



Cambridge IGCSE™

CANDIDATE
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MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2024

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.



- 1 A concert starts at 19 50 and finishes 2 hours 42 minutes later.

Work out the time the concert finishes.

..... [1]

- 2 Find the reciprocal of $1\frac{1}{4}$.

..... [1]

- 3 Use one of the symbols $<$, $>$ or $=$ to make each statement true.

$$\begin{array}{l} \frac{2}{7} \dots\dots\dots 0.2861 \\ \frac{99}{900} \dots\dots\dots 11\% \\ 1^3 \dots\dots\dots 4^0 \end{array}$$

[2]

- 4 Safia has a piece of fabric of length 5.6 m.
She cuts the fabric into two parts, with lengths in the ratio 3 : 4.

Calculate the length of the longer part.

..... m [2]





5 Work out.

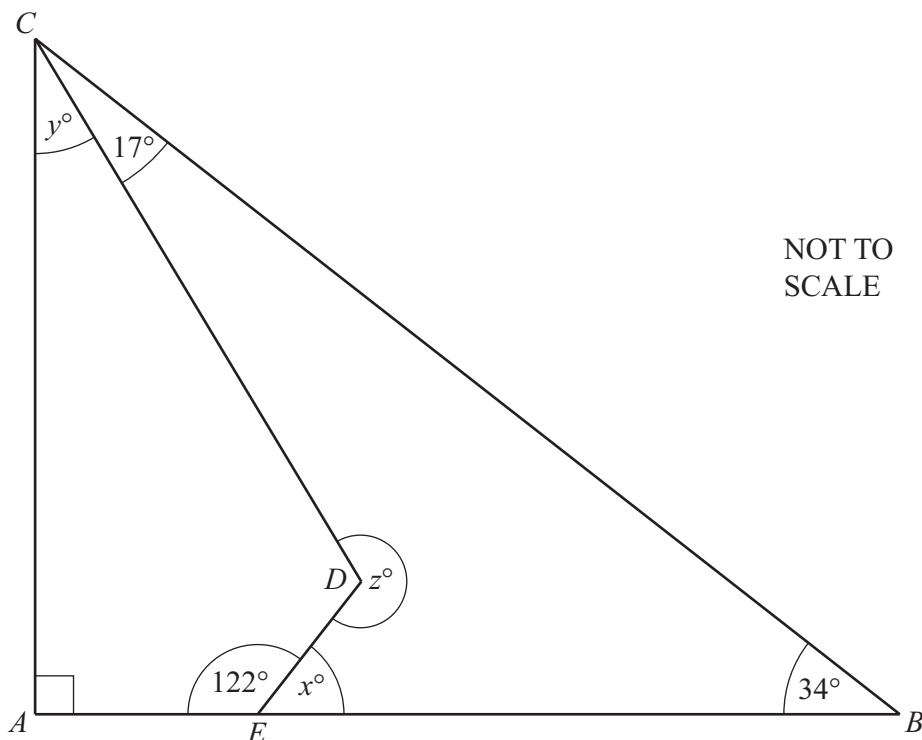
(a) $3 \begin{pmatrix} 6 \\ -4 \end{pmatrix}$

$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) $\begin{pmatrix} 4 \\ -1 \end{pmatrix} + \begin{pmatrix} -7 \\ 5 \end{pmatrix}$

$\begin{pmatrix} \\ \end{pmatrix}$ [1]

6 The diagram shows a right-angled triangle ABC and a quadrilateral $AEDC$.



Find the value of

(a) x

$x = \dots\dots\dots$ [1]

(b) y

$y = \dots\dots\dots$ [1]

(c) z .

$z = \dots\dots\dots$ [1]





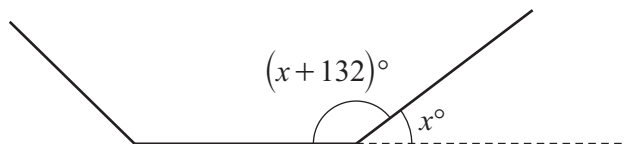
- 7 Factorise.
 $28x - 35$

..... [1]

- 8 Edith invests \$3000 in a savings account.
The account pays simple interest at a rate of 2.6% per year.
Calculate the total interest earned at the end of 3 years.

\$ [2]

9



NOT TO
SCALE

The diagram shows part of a regular polygon.
The interior angle of the polygon is 132° larger than the exterior angle.

Calculate the number of sides of this polygon.

..... [3]





- 10 Jacinda plays a game with her friend.
She can win, lose or draw the game.
The probability that she wins the game is 0.28 .

(a) Jacinda is twice as likely to draw the game as to lose the game.

Work out the probability that she loses the game.

..... [2]

(b) Jacinda plays the game 150 times.

Find the expected number of times that **she wins**.

..... [1]

- 11 **Without using a calculator**, work out $5\frac{1}{3} - 3\frac{4}{7}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]





- 12 Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned} 5x + 6y &= 9 \\ 3x - 2y &= -17 \end{aligned}$$

$$\begin{aligned} x &= \\ y &= \end{aligned} \quad [3]$$

- 13 (a) A sequence has n th term $3n^2 - 1$.

Find the second term in this sequence.

$$..... \quad [1]$$

- (b) The table shows the first five terms of sequences A and B .

	1st term	2nd term	3rd term	4th term	5th term	n th term
Sequence A	-6	-2	2	6	10	
Sequence B	3	17	55	129	251	

Complete the table to show the n th term of each sequence.

[4]





- 14 Two solid steel statues are mathematically similar.
 The smaller statue has height 12 cm and the larger statue has height 15 cm.
 The larger statue has a mass 2.5 kg.
 The density of steel is 8 g/cm^3 .

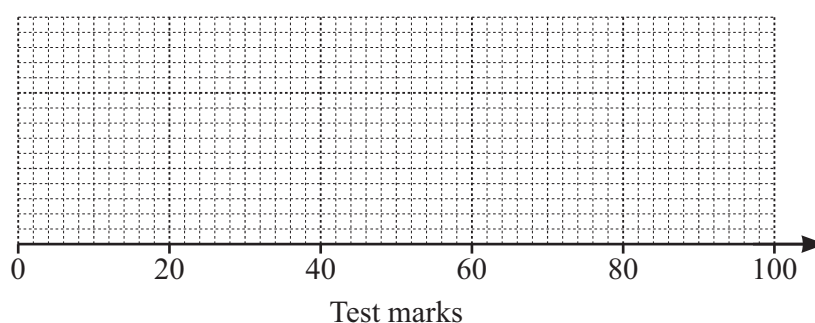
Calculate the volume of the smaller statue.
 [Density = mass $\div$ volume.]

..... cm^3 [4]

- 15 Students in class P take a test.
 These statistics show information about their marks.

- lower quartile = 38
- median = 53
- interquartile range = 28
- range = 81
- highest mark = 96

- (a) Draw a box-and-whisker plot to represent this information.



[3]

- (b) Students in class Q take the same test.
 For class Q , the median is 49 and the interquartile range is 35.

Make two comments comparing the distribution of marks for class P with that of class Q .

1.

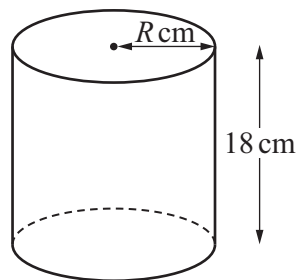
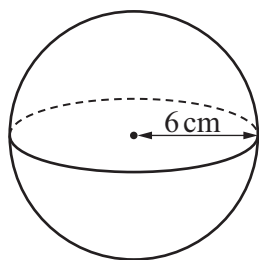
 2.

[2]





16



NOT TO
SCALE

The diagram shows a sphere of radius 6 cm and a cylinder of height 18 cm and radius R cm. The volume of the sphere is equal to the volume of the cylinder.

Calculate the curved surface area of the cylinder.

Give your answer in terms of π .

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$]

..... cm^2 [4]

17 Solve.

$$3x^2 - 7x - 16 = 0$$

You must show all your working and give your answers correct to 2 decimal places.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]





18 $g(x) = 4^{x+3}$

(a) Find x when $g(x) = 1$.

..... [1]

(b) Find $g^{-1}\left(\frac{1}{16}\right)$.

..... [2]

- 19 $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
 $P = \{\text{odd numbers}\}$
 $Q = \{\text{multiples of 3}\}$
 $R = \{\text{square numbers}\}$

(a) Find $P \cap Q \cap R$.

{ } [1]

(b) (i) Find $Q \cup R$.

{ } [1]

(ii) Find $n(P \cap (Q \cup R)')$.

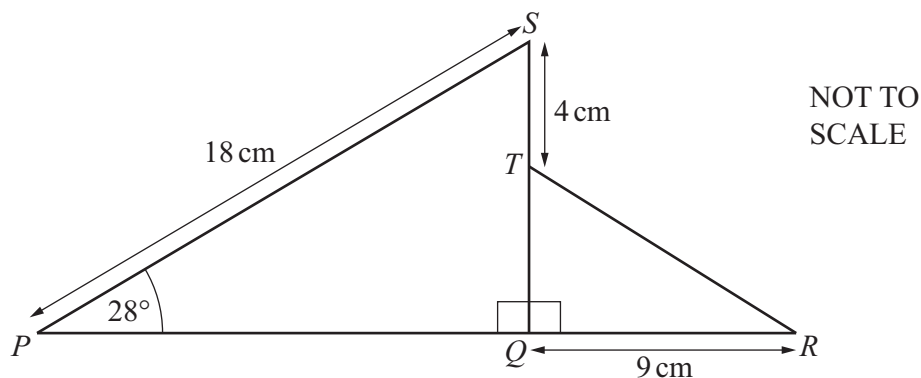
..... [1]





20

10



The diagram shows two right-angled triangles PQS and RQT .
 PQR and QTS are straight lines.

Calculate angle QTR .

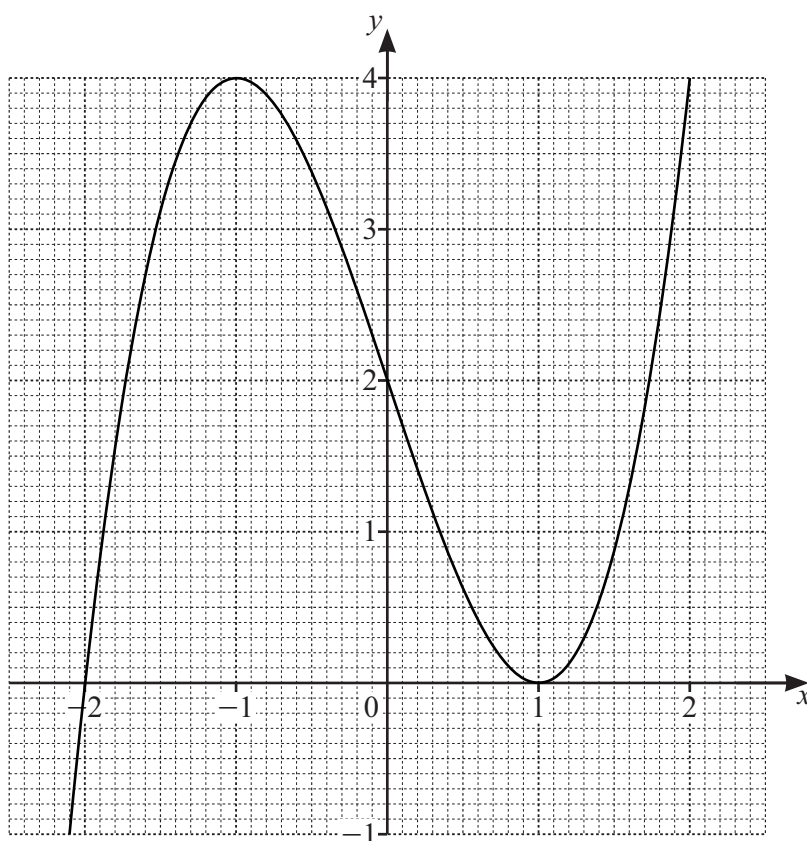
Angle $QTR = \dots\dots\dots$ [5]

21 Solve the equation $3 \tan x + 5 = 1$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]



- 22 The graph of $y = (x+2)(x-1)^2$ is shown on the grid.



- (a) Show that $y = (x+2)(x-1)^2$ can be written as $y = x^3 - 3x + 2$.

[2]

- (b) By drawing a suitable straight line, solve the equation $2x^3 - 5x = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

Question 23 is printed on the next page.





23

$$(x-5)^2 + k = x^2 - px - 21$$

Find the value of p and the value of k .

$$p = \dots\dots\dots$$

$$k = \dots\dots\dots$$

[2]

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MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2024

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao – correct answer only

dep – dependent

FT – follow through after error

isw – ignore subsequent working

oe – or equivalent

SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1	22 32 or 10 32 pm	1	
2	$\frac{4}{5}$ or 0.8	1	
3	< = =	2	B1 for two correct
4	3.2	2	M1 for $\frac{5.6}{3+4}[\times k]$ where $k = 1, 3$ or 4
5(a)	$\begin{pmatrix} 18 \\ -12 \end{pmatrix}$	1	
5(b)	$\begin{pmatrix} -3 \\ 4 \end{pmatrix}$	1	
6(a)	58	1	
6(b)	39	1	
6(c)	251	1	
7	$7(4x - 5)$ final answer	1	
8	234	2	M1 for $\frac{3000 \times 2.6[\times 3]}{100}$
9	15	3	B2 for $[x =] 24$ OR M1 for $x + x + 132 = 180$ oe soi M1 for $\frac{360}{their\ x}$ oe provided this gives an integer answer
10(a)	0.24 oe	2	M1 for $1 - 0.28$ oe
10(b)	42	1	

Question	Answer	Marks	Partial Marks
11	$\frac{16}{3}$ or $\frac{25}{7}$ $2\frac{1}{3} - \frac{4}{7}$	B1	Correct step for dealing with mixed numbers Allow $\frac{16k}{3k}$ or $\frac{25k}{7k}$
	$\frac{112}{21}$ and $\frac{75}{21}$ $[2]\frac{7}{21}$ and $\frac{12}{21}$	M1	Correct method to find common denominator e.g. $5\frac{7}{21}$ and $3\frac{12}{21}$
	$1\frac{16}{21}$ cao	A1	
12	Correctly eliminating one variable	M1	
	$x = -3$	A1	If A0 scored SC1 for 2 values satisfying one of the original equations.
	$y = 4$	A1	
13(a)	11	1	
13(b)	$4n - 10$ oe final answer and $2n^3 + 1$ oe final answer	4	B2 for $4n - 10$ oe final answer or B1 for $4n + j$ or $kn - 10$ ($k \neq 0$) or $4n - 10$ seen then spoilt B2 for $2n^3 + 1$ oe final answer or B1 for any cubic expression in n or 3rd difference = 12 or for correct answer seen then spoilt
14	160	4	M3 for $V \div \frac{2500}{8} = \frac{12^3}{15^3}$ oe or for answer figs 16 from $\frac{\text{figs}25}{8} \times \frac{12^3}{15^3}$ or B2 for 1.28 [kg] OR M1 for $2500 \div 8$ oe or 312.5 seen M1 for $\left(\frac{12}{15}\right)^3$ or $\left(\frac{15}{12}\right)^3$ oe
15(a)	Correct box-and-whisker plot L = 15 LQ = 38 Median = 53 UQ = 66 H = 96	3	B1 for UQ = 66 or Lowest = 15 soi M1 for at least 3 values correct within box and whisker plot

Question	Answer	Marks	Partial Marks
15(b)	Class Q scored fewer marks on average [as median is lower] oe Class Q have a larger spread of marks [as IQR is higher] oe	2	B1 for each
16	144π cao	4	M2 for $[R^2 =] \frac{\frac{4}{3} \times \pi \times 6^3}{18 \times \pi}$ oe or M1 for $\frac{4}{3} \times \pi \times 6^3 = \pi \times R^2 \times 18$ oe M1 for $2 \times \pi \times their R \times 18$ oe
17	$\frac{[-]7 \pm \sqrt{([-]7)^2 - 4(3)(-16)}}{2 \times 3}$ oe	B2	B1 for $\sqrt{([-]7)^2 - 4(3)(-16)}$ or better and if in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ then B1 for $p = -(-7)$ and $r = 2(3)$
	3.75 and -1.42	B2	B1 for each or SC1 for answers 3.8 or 3.754... and -1.4 or -1.42... or -1.421 or 3.75 and -1.42 seen in working or -3.75 and 1.42 as final answers
18(a)	-3	1	
18(b)	-5	2	M1 for $\frac{1}{4^2}$ or 4^{-2}
19(a)	9	1	
19(b)(i)	1, 3, 4, 6, 9	1	
19(b)(ii)	2	1	FT 5 – numbers of odds in (b)(i)
20	63.7 or 63.68 to 63.69	5	M4 for $\tan [QTR] = \frac{9}{18\sin 28 - 4}$ oe OR M3 for $18\sin 28 - 4$ or M2 for $18\sin 28$ or M1 for $\frac{QS}{18} = \sin 28$ oe and M1 for $\tan [QTR] = \frac{9}{their QT}$ oe

Question	Answer	Marks	Partial Marks
21	126.9 and 306.9	3	B2 for one correct answer or M1 for $\tan x = -\frac{4}{3}$ oe If M1 or 0 scored, SC1 for two angles with a difference of 180
22(a)	$x^2 - x - x + 1$ or $x^2 + 2x - x - 2$	M1	
	A correct unsimplified expansion e.g. $x^3 + 2x^2 - x^2 - 2x - x^2 - 2x + x + 2$ oe leading to [y =] $x^3 - 3x + 2$	A1	
22(b)	$y = 2 - 0.5x$ ruled	B2	B1 for [y =] $2 - 0.5x$ soi or for $y = 2 - kx$ drawn or for $y = k - 0.5x$ drawn
	-1.5 to -1.6 0 1.5 to 1.6	B2	B1 for two correct values
23	[p =] 10 [k =] -46	2	B1 for each



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This document has **16** pages.



- 1 These are the first eight terms of a sequence.

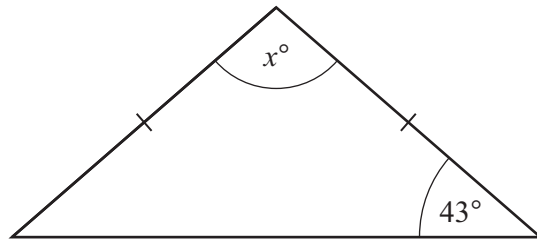
c -3 -9 -15 -21 -27 -33 k

Find the value of c and the value of k .

$c = \dots\dots\dots$

$k = \dots\dots\dots$ [2]

- 2 The diagram shows an isosceles triangle.



NOT TO
SCALE

Find the value of x .

$x = \dots\dots\dots$ [2]

- 3

0.25	3.142	$\sqrt{3}$	-3	24	-0.4	1.2	$-\frac{1}{4}$

Complete each statement with a number from the list.

$\dots\dots\dots$ is a natural number.

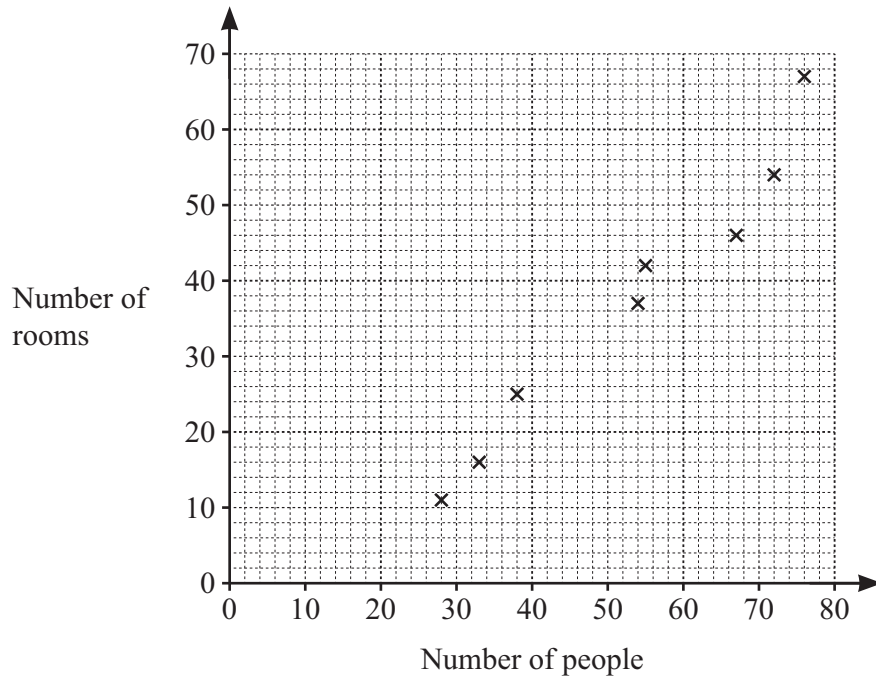
$\dots\dots\dots$ is an irrational number.

$\dots\dots\dots$ is the reciprocal of 4.

[3]



- 4 The scatter diagram shows the number of rooms and the number of people in each of eight buildings.



- (a) One of the buildings has 67 rooms.

Write down the number of people in this building.

..... [1]

- (b) In another building there are 42 people and 33 rooms.

On the scatter diagram, plot this point.

[1]

- (c) (i) On the scatter diagram, draw a line of best fit.

[1]

- (ii) There are 45 people in a different building.

Find an estimate for the number of rooms in this building.

..... [1]

- (d) What type of correlation is shown in the scatter diagram?

..... [1]

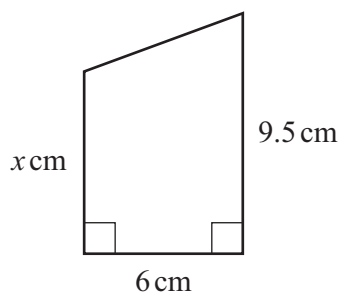




5 Convert 7.51 m^2 into cm^2 .

..... cm^2 [1]

6 The diagram shows a trapezium.



NOT TO
SCALE

The area of the trapezium is 42 cm^2 .

Calculate the value of x .

$x =$ [2]



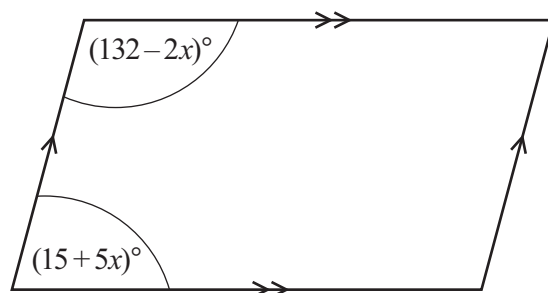


- 7 Without using a calculator, work out $\frac{2}{7} \div \frac{6}{11}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

- 8 The diagram shows a parallelogram.



NOT TO
SCALE

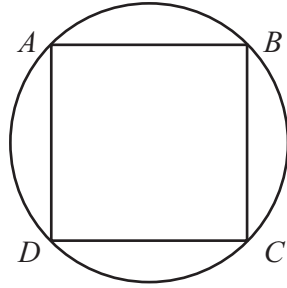
Work out the size of the smallest interior angle of the parallelogram.

..... [4]





9



NOT TO
SCALE

Points A , B , C and D lie on a circle.
 $ABCD$ is a square with area 72 cm^2 .

Calculate the area of the circle.
Give your answer as a multiple of π .

..... cm^2 [3]

10 Calculate $\sqrt[3]{1 + 10.9 \times 0.4^2}$.

..... [1]





11 Factorise fully.

(a) $24x^2 - 9xy$

..... [2]

(b) $63x^2 - 28y^2$

..... [3]

12 y is directly proportional to the square root of $x + 1$.
 $y = 10.5$ when $x = 8$.

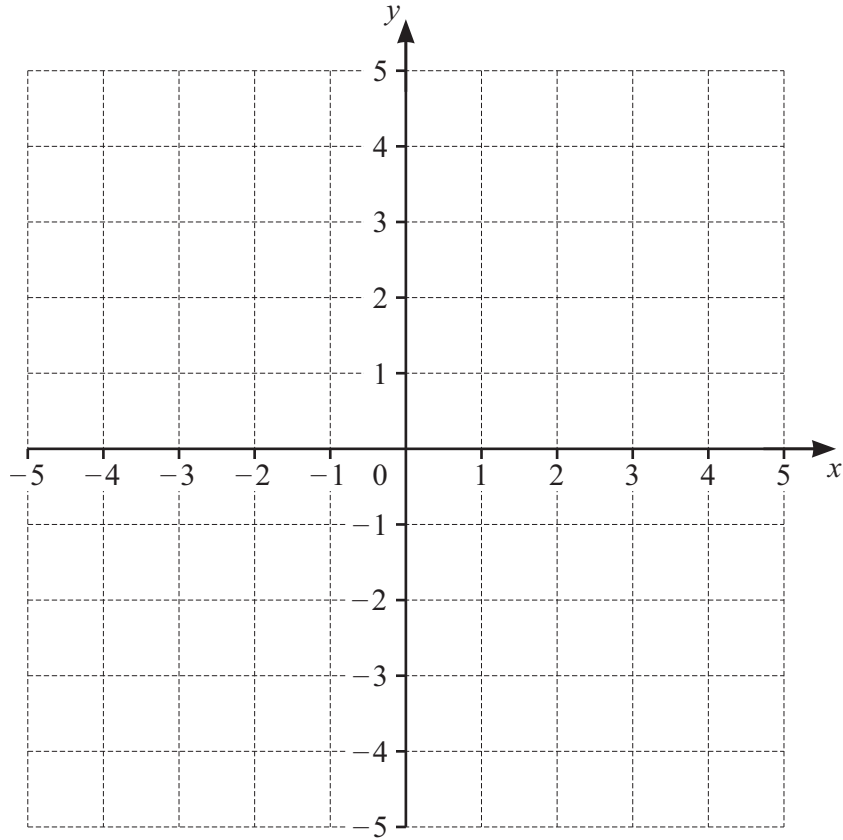
Find y when $x = 1.56$.

$y =$ [3]





13



The region R satisfies these inequalities.

$$-3 < y \leq 2 \quad y \leq x - 1$$

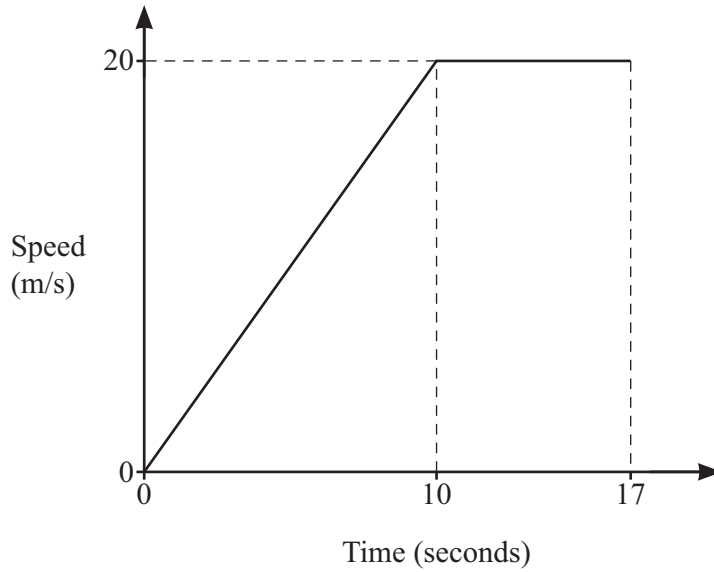
By drawing suitable straight lines and shading **unwanted** regions, find and label the region R .

[4]





14



NOT TO
SCALE

The diagram shows the speed–time graph for 17 seconds of a car journey.

(a) Find the acceleration of the car during the first 10 seconds.

..... m/s^2 [1]

(b) Calculate the total distance travelled by the car during the 17 seconds.

..... m [3]



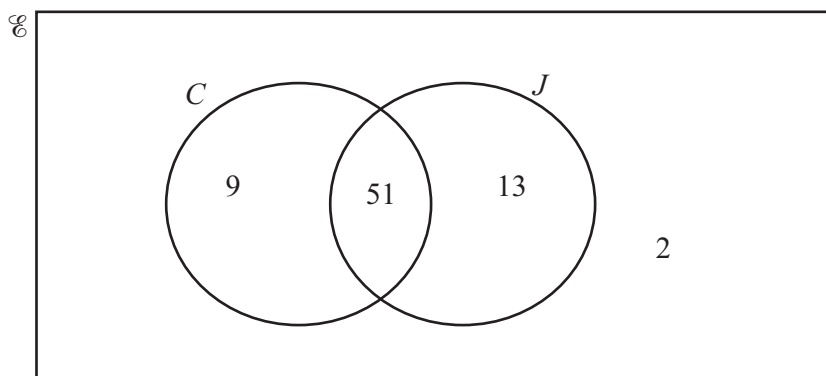


- 15 At the start of an experiment there are 40 000 bacteria.
The number of bacteria increases at a rate of 15% per hour.

Calculate the number of bacteria after 3 hours.

..... [2]

- 16 75 people are asked if they have a car, C , and if they have a job, J .
The Venn diagram shows the results.



A person is chosen at random from those who have a car.

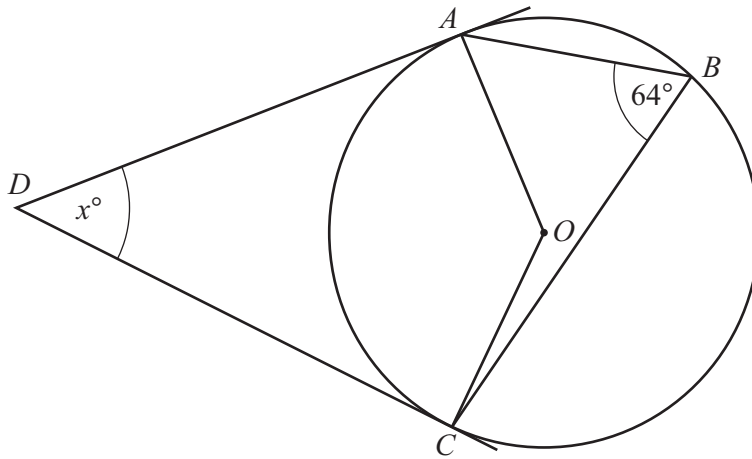
Find the probability that this person also has a job.

..... [1]





17



NOT TO
SCALE

A , B and C are points on the circumference of a circle with centre O .
 DA and DC are tangents to the circle.
 Angle $ABC = 64^\circ$.

Work out the value of x .

$x = \dots\dots\dots [2]$

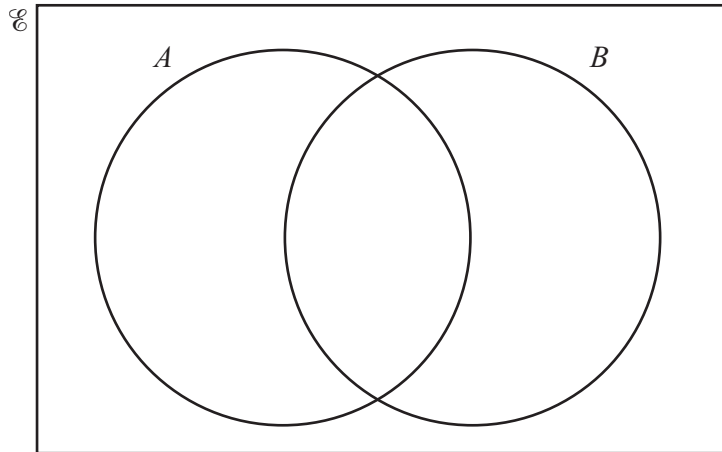




18 (a) $\mathcal{E} = \{8 \times 10^{-1}, 0.\dot{8}, 8\%, \sqrt{0.08}\}$

$$A = \{a: 0.08 < a \leq 0.8\}$$

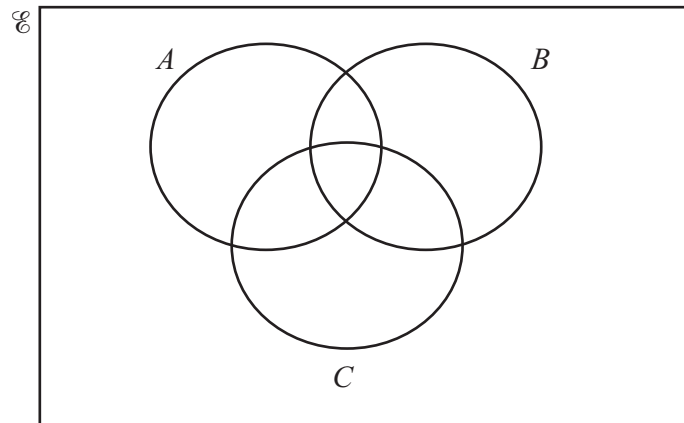
$$B = \{b: b \geq 0.8\}$$



Complete the Venn diagram.

[3]

(b) Shade the region $(A \cup C) \cap B'$ in the Venn diagram.

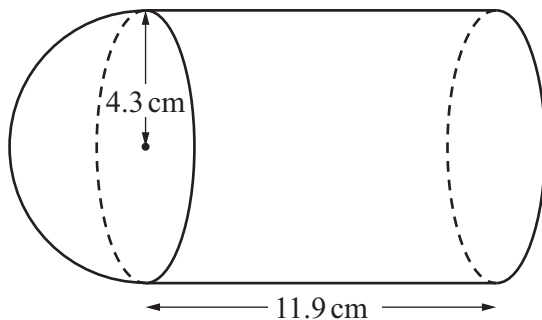


[1]





19



NOT TO
SCALE

A solid is made from a cylinder and a hemisphere, both of radius 4.3 cm.
The cylinder has length 11.9 cm.

- (a) Calculate the volume of the solid.
[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm^3 [3]

- (b) Calculate the total surface area of the solid.
[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

..... cm^2 [4]





20 Find an expression for the n th term of this sequence.

$$\frac{1}{7}, \quad 1, \quad 7, \quad 49, \quad 343, \quad 2401, \quad \dots$$

..... [2]

21 Expand and simplify.

$$(x + 3)(x + 5)(2x + 1)$$

..... [3]





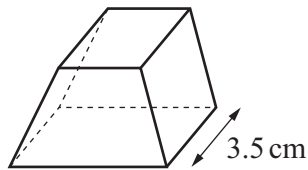
22 A is the point $(17, 9)$ and B is the point $(23, 39)$.

Find the equation of the perpendicular bisector of line AB .
Give your answer in the form $y = mx + c$.

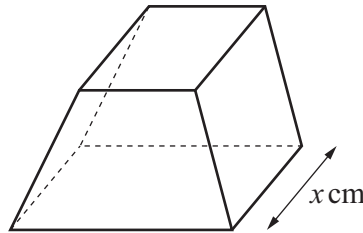
$y = \dots\dots\dots$ [5]

Question 23 is printed on the next page.





Small box



Large box

NOT TO
SCALE

The small box is mathematically similar to the large box.
The volume of the large box is 72.8% greater than the volume of the small box.
The small box has length 3.5 cm and the large box has length x cm.

Calculate the value of x .

$x = \dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

October/November 2024

MARK SCHEME

Maximum Mark: 70

Published

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Mathematics-Specific Marking Principles

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- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
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- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao – correct answer only

dep – dependent

FT – follow through after error

isw – ignore subsequent working

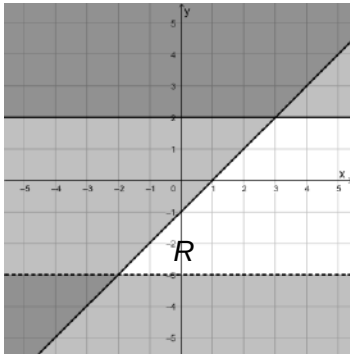
oe – or equivalent

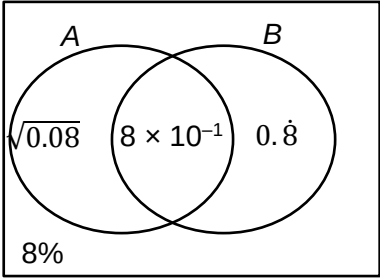
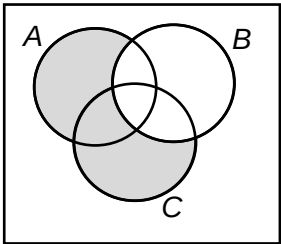
SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1	$[c =] 3$ $[k =] -39$	2	B1 for each or SC1 for $c = -39$ and $k = 3$
2	94	2	M1 for $x + 2 \times 43 = 180$ oe
3	24 $\sqrt{3}$ 0.25	3	B1 for each
4(a)	76	1	
4(b)	Point correctly plotted at (42, 33)	1	
4(c)(i)	Correct ruled line of best fit	1	
4(c)(ii)	An integer in the range 27 to 33	1	FT <i>their</i> line of best fit provided line shows positive correlation and answer is an integer
4(d)	Positive	1	
5	75 100	1	
6	4.5 oe	2	M1 for $\frac{1}{2} \times 6 \times (x + 9.5) = 42$ oe or $42 \times \frac{2}{6} - 9.5$ oe
7	$\frac{2}{7} \times \frac{11}{6}$ or $\frac{22}{77} \div \frac{42}{77}$ oe with common denominator	M1	
	$\frac{11}{21}$ cao	A1	
8	70	4	B3 for $x = 11$ OR M1 for $132 - 2x + 15 + 5x = 180$ oe M1 for collecting x terms on one side and number terms on the other for <i>their</i> equation. M1 for $15 + 5 \times \text{their } x$ oe where $-3 < \text{their } x < 15$ or for $132 - 2 \times \text{their } x$ oe where $21 < \text{their } x < 66$

Question	Answer	Marks	Partial Marks
9	36π ao	3	B2 for answer 113 or 113.0 to 113.1... or an answer in terms of π which rounds to 113 or M1 for correct first step for finding d or r e.g. $72 + 72 = d^2$ oe $72 = r^2 + r^2$ oe or $\left(\frac{\sqrt{72}}{2}\right)^2 + \left(\frac{\sqrt{72}}{2}\right)^2 = r^2$ oe $\sqrt{72} = \frac{r}{\sin 45}$ oe $\frac{1}{2} \times r \times r = \frac{72}{4}$ oe
10	1.4 oe	1	
11(a)	$3x(8x - 3y)$ final answer	2	B1 for $3(8x^2 - 3xy)$ or $x(24x - 9y)$ or $3x(8x - 3y)$ seen then spoilt
11(b)	$7(3x + 2y)(3x - 2y)$ final answer	3	B2 for $(21x + 14y)(3x - 2y)$ or $(3x + 2y)(21x - 14y)$ or $7(3x + 2y)(3x - 2y)$ seen then spoilt or M1 for $7(9x^2 - 4y^2)$ or [...] $(3x + 2y)(3x - 2y)$
12	5.6 oe	3	M1 for $y = k\sqrt{x+1}$ oe M1 for $y = \text{their } k\sqrt{1.56+1}$ oe
13		4	B1 for $y = 2$ solid line B1 for $y = x - 1$ solid line B1 for $y = -3$ dashed line B1 for correct region identified satisfying the given inequalities
14(a)	2	1	
14(b)	240	3	M2 for correct complete area statement e.g. $\frac{1}{2} \times 20 \times 10 + 7 \times 20$ oe or M1 for one correct area

Question	Answer	Marks	Partial Marks
15	60835	2	M1 for $40000 \times \left(1 + \frac{15}{100}\right)^3$ oe
16	$\frac{17}{20}$ oe	1	
17	52	2	M1 for $360 - 90 - 90 - 128$ oe or B1 for [obtuse angle] $AOC = 128$ or AOD or $COD = 64$ or DAO or $DCO = 90$
18(a)		3	B2 for three correctly placed or B1 for two correctly placed or correct conversion of 8×10^{-1} , 8% and $\sqrt{0.08}$ to 0.8, 0.08, 0.2[8...] or 0.3
18(b)		1	
19(a)	858 or 857.7 to 857.9	3	M2 for $\left[\frac{1}{2} \times \frac{4}{3}\right] \times \pi \times 4.3^3 + \pi \times 4.3^2 \times 11.9$ oe or M1 for $\left[\frac{1}{2} \times \frac{4}{3}\right] \times \pi \times 4.3^3$ or $\pi \times 4.3^2 \times 11.9$
19(b)	496 or 495.7 to 495.8...	4	M3 for $\frac{1}{2} \times 4 \times \pi \times 4.3^2 + \pi \times 4.3^2 + 2 \times \pi \times 4.3 \times 11.9$ oe OR M1 for $\pi \times 4.3^2 \times k$ where k is a whole number M1 for $2 \times \pi \times 4.3 \times 11.9$
20	7^{n-2} oe final answer	2	M1 for recognition of terms being powers of 7

Question	Answer	Marks	Partial Marks
21	$2x^3 + 17x^2 + 38x + 15$ final answer	3	B2 for correct expansion of the three brackets unsimplified or for simplified four-term expression of correct form with three terms correct or B1 for correct expansion of two of the given brackets with at least three terms out of four correct
22	$[y =] -\frac{1}{5}x + 28$ final answer	5	B1 for midpoint (20, 24) soi M1 for $[\text{gradient} =] \frac{39-9}{23-17}$ oe M1 for $\frac{-1}{\text{their gradient}}$ M1 for substitution of <i>their</i> midpoint into <i>their</i> $y = mx + c$ oe
23	4.2 oe	3	M2 for $\sqrt[3]{1 + \frac{72.8}{100}} \times 3.5$ oe or M1 for $\frac{\sqrt[3]{172.8}}{\sqrt[3]{100}}$ oe or $\frac{\sqrt[3]{100}}{\sqrt[3]{172.8}}$ oe or $\frac{x^3}{3.5^3} = \frac{172.8}{100}$ oe



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MATHEMATICS

0580/23

Paper 2 (Extended)

October/November 2024

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.



1

61	62	63	64	65	66	67	68	69

From the list of numbers, write down

(a) a cube number

..... [1]

(b) a prime number.

..... [1]

2 A train journey starts at 23 30 and finishes at 07 15 the next day.

Find the time taken for this journey.

..... h min [1]

3 Simplify.

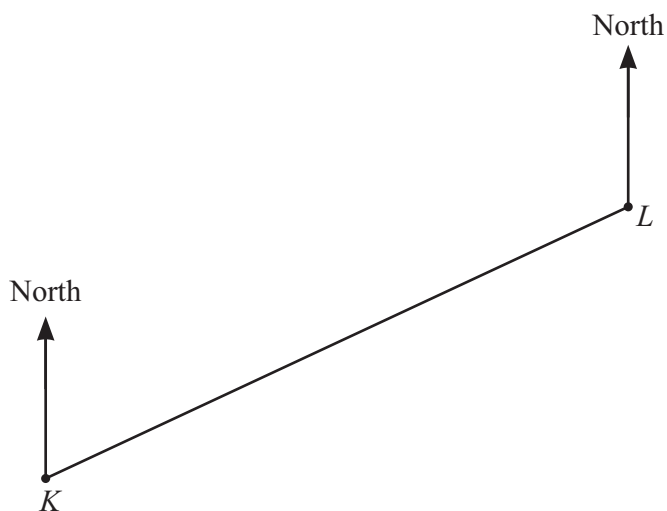
$$3p - t - p - 4t$$

..... [2]





- 4 The scale drawing shows the positions of town K and town L .
The scale is 1 cm represents 10 km.



Scale : 1 cm to 10 km

- (a) Find the actual distance between town K and town L .

..... km [2]

- (b) Measure the bearing of town L from town K .

..... [1]





- 5 Each student in a class of 20 students records the number of coins in their pockets. The table shows the results.

Number of coins	0	1	2	3	4	5	6
Frequency	3	1	7	8	0	0	1

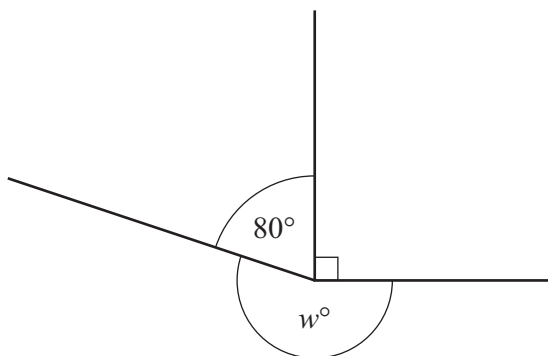
(a) Find the median.

..... [1]

(b) Calculate the mean.

..... [3]

6



NOT TO SCALE

The diagram shows three lines meeting at a point.

Find the value of w .

$w =$ [1]

7 Solve the equation.

$$7 - h = 3 - 5h$$

$h =$ [2]





- 8 Sacha buys b books and m magazines.
The cost of each book is \$12 and the cost of each magazine is \$5.

Write an expression, in terms of b and m , for the total cost of the books and the magazines.

\$ [2]

- 9 Find the size of an interior angle of a regular 15-sided polygon.

..... [2]

- 10 **Without using a calculator**, work out $2\frac{1}{4} - 1\frac{11}{12}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]





11 Solve the simultaneous equations.

$$3p - 2q = 7$$

$$p + 2q = 1$$

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [2]$$

12 $V = \sqrt[3]{\frac{x}{y}}$

Rearrange the formula to write x in terms of V and y .

$$x = \dots\dots\dots [2]$$

13 Find the n th term of each sequence.

(a) 21, 13, 5, -3, -11, ...

$$\dots\dots\dots [2]$$

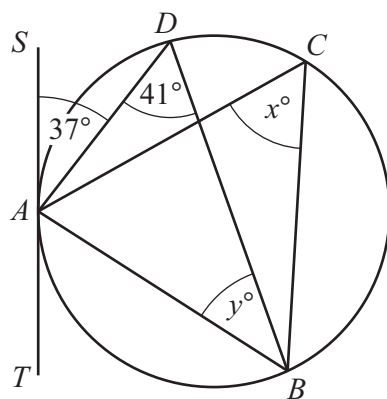
(b) 2.5, 5, 10, 20, 40, ...

$$\dots\dots\dots [2]$$





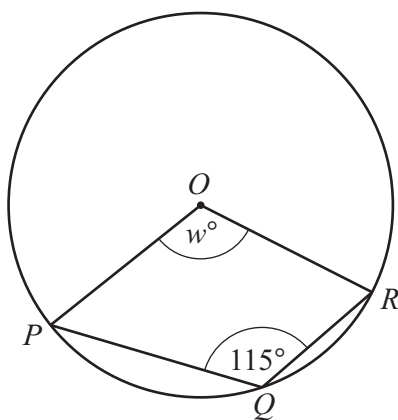
14 (a)

NOT TO
SCALE

A, B, C and D lie on the circle.
 TAS is a tangent to the circle at A .

(i) Find the value of x . $x = \dots\dots\dots$ [1](ii) Find the value of y . $y = \dots\dots\dots$ [1]

(b)

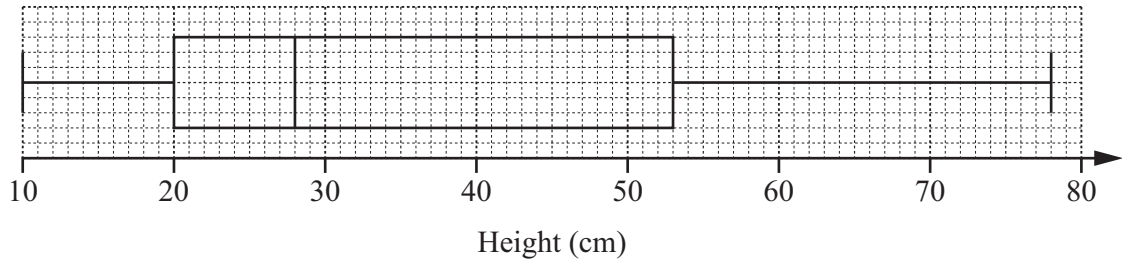
NOT TO
SCALE

P, Q and R lie on the circle, centre O .

Find the value of w . $w = \dots\dots\dots$ [2]



15



The box-and-whisker diagram shows information about the heights of some plants.

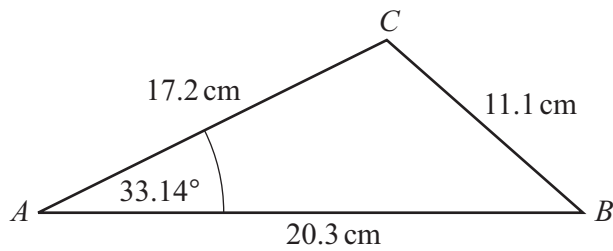
(a) Find the median height.

..... cm [1]

(b) Find the interquartile range of the heights.

..... cm [1]

16



NOT TO SCALE

Calculate the shortest distance from C to AB .

..... cm [3]

17 Simplify.

(a) $18x^{18} \div 3x^3$

..... [2]

(b) $(125y^{75})^{\frac{2}{3}}$

..... [2]





- 18 Two mathematically similar solids have volumes 81 cm^3 and 24 cm^3 .
The height of the smaller solid is 4.8 cm .

Calculate the height of the larger solid.

..... cm [3]

- 19 y is inversely proportional to $\sqrt{x+2}$.
When $x = 2$, $y = 3$.

Find y in terms of x .

$y =$ [2]

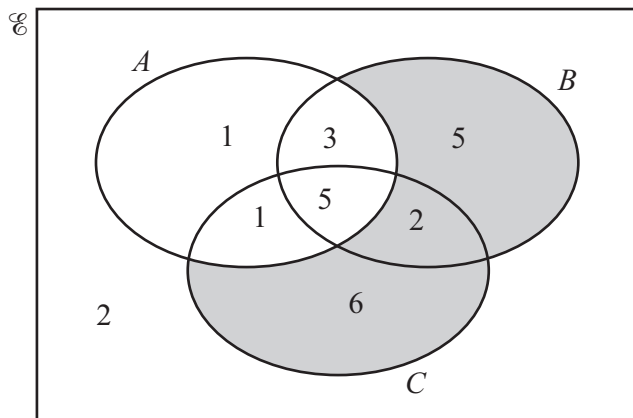
- 20 Solve the equation $\tan x + 2 = 0$ for $0^\circ \leq x \leq 360^\circ$.

$x =$ or $x =$ [3]





21



The Venn diagram shows the number of elements in each region.

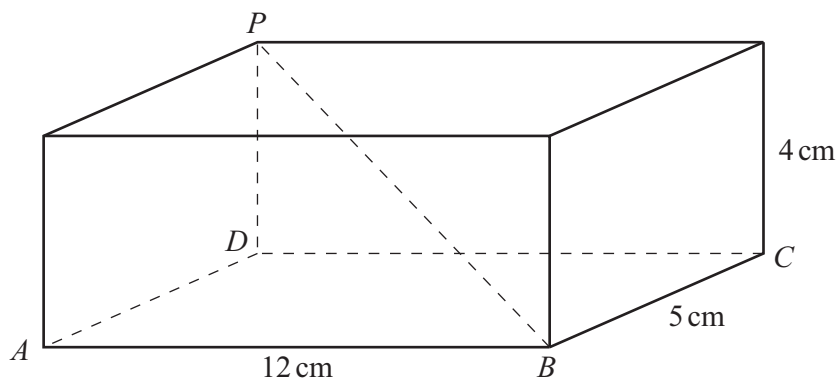
(a) Use set notation to describe the shaded region.

..... [1]

(b) Find $n(A \cap B \cap C)$.

..... [1]

22



NOT TO
SCALE

The diagram shows a cuboid with a diagonal PB .

Calculate the angle between the diagonal PB and the base $ABCD$.

..... [4]





23 Write $x^2 + 8x - 7$ in the form $(x + a)^2 + b$.

..... [2]

24 A rectangle has an area of 150 m^2 , correct to the nearest square metre.
The length of the rectangle is 22 m, correct to the nearest metre.

Calculate the upper bound of the width of the rectangle.

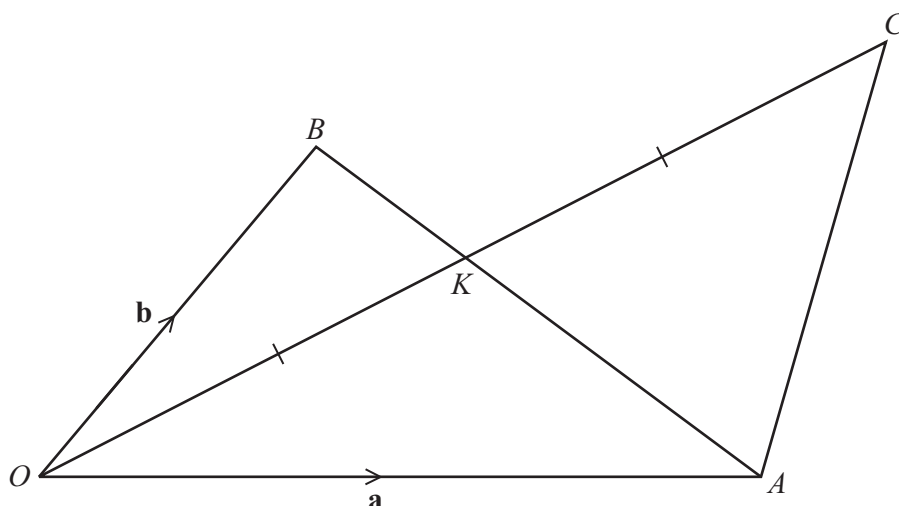
..... m [3]

25 Simplify.

$$\frac{3x - 2 - 3xy + 2y}{1 - y^2}$$

..... [4]



NOT TO
SCALE

In the diagram, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

$AK : KB = 2 : 1$.

$OK = KC$.

Find $\overrightarrow{AC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

Give your answer in its simplest form.

$\overrightarrow{AC} = \dots\dots\dots$ [4]

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MATHEMATICS

0580/23

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MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M** Method marks, awarded for a valid method applied to the problem.
- A** Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.
- B** Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more ‘method’ steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation ‘dep’ is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfww	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	64	1	
1(b)	61 or 67 or both	1	
2	7[h] 45 [min]	1	
3	$2p - 5t$ final answer	2	B1 for $2p$ or $-5t$ in final answer or for $2p - 5t$ seen then spoilt
4(a)	85	2	B1 for 8.5 or M1 for <i>their</i> 8.5×10
4(b)	065	1	
5(a)	2	1	

Question	Answer	Marks	Partial Marks
5(b)	2.25	3	M1 for $[3 \times 0] + 1 \times 1 + 7 \times 2 + 8 \times 3 + [0 \times 4] + [0 \times 5]$ $+ 1 \times 6$ oe or for 45 M1 dep for $\frac{\text{their } \Sigma fx}{20}$ dep on first M1
6	190	1	
7	-1	2	M1 for $5h - h = 3 - 7$ or $7 - 3 = h - 5h$ or better
8	$12b + 5m$	2	B1 for $12b + km$ or $kb + 5m$ or correct answer seen and spoilt
9	156	2	M1 for $180 - 360 \div 15$ oe or $\frac{180 \times (15 - 2)}{15}$ oe
10	$\frac{9}{4}$ oe or $\frac{23}{12}$ oe $1\frac{1}{4} - \frac{11}{12}$	B1	Correct step for dealing with mixed numbers Allow $\frac{9k}{4k}$ or $\frac{23k}{12k}$
	$\frac{27}{12}$ and $\frac{23}{12}$ $[1]\frac{3}{12}$ and $\frac{11}{12}$	M1	Correct method to find common denominator e.g. $2\frac{3}{12}$ and $1\frac{11}{12}$
	$\frac{1}{3}$ cao	A1	
11	$[p =] 2$ $[q =] -\frac{1}{2}$ oe	2	B1 for each
12	V^3y final answer	2	M1 for $V^3 = \frac{x}{y}$
13(a)	$29 - 8n$ oe final answer	2	B1 for $k - 8n$ or $29 - cn$ $c \neq 0$, or $29 - 8n$ seen then spoilt
13(b)	$5 \times 2^{n-2}$ oe final answer	2	B1 for 2^k or correct answer seen and spoilt
14(a)(i)	41	1	
14(a)(ii)	37	1	

Question	Answer	Marks	Partial Marks
14(b)	130	2	M1 for $2(180 - 115)$ or $360 - 2 \times 115$ or for reflex $POR = 230$ or for an opposite angle in cyclic quad drawn in and labelled 65
15(a)	28	1	
15(b)	33	1	
16	9.4[0] or 9.403...	3	M2 for $\sin 33.14 = \frac{\text{dist}}{17.2}$ oe or M1 for recognition that the line from C is perpendicular to AB
17(a)	$6x^{15}$ final answer	2	B1 for kx^{15} or $6x^c$ as final answer or correct answer seen and spoilt
17(b)	$25y^{50}$ final answer	2	B1 for ky^{50} or $25y^c$ as final answer or correct answer seen and spoilt
18	7.2	3	M2 for $4.8 \times \sqrt[3]{\frac{81}{24}}$ oe or M1 for $\sqrt[3]{\frac{81}{24}}$ oe or for $\left(\frac{4.8}{h}\right)^3 = \frac{24}{81}$ oe
19	$[y =] \frac{6}{\sqrt{x+2}}$ oe final answer	2	M1 for $y = \frac{k}{\sqrt{x+2}}$ oe
20	116.6 and 296.6	3	B2 for one correct answer or M1 for $\tan x = -2$ If 0 or M1 scored, SC1 for two angles with a difference of 180 in range from 0 to 360
21(a)	$(B \cup C) \cap A'$ oe	1	
21(b)	5	1	

Question	Answer	Marks	Partial Marks
22	17.1 or 17.10...	4	M3 for $\tan = \frac{4}{\sqrt{12^2 + 5^2}}$ oe or M2 for $12^2 + 5^2$ oe or $12^2 + 5^2 + 4^2$ oe or M1 for recognising angle PBD
23	$(x+4)^2 - 23$ final answer	2	B1 for $(x+4)^2$
24	7 nfww	3	M2 for $\frac{150 \text{ to } 151}{22 - 0.5}$ or for $\frac{150 + 0.5}{21 \text{ to } 22}$ oe or M1 for $150 + 0.5$ or $150 - 0.5$ or $22 + 0.5$ or $22 - 0.5$ oe seen
25	$\frac{3x-2}{1+y}$ final answer	4	B2 for $(3x-2)(1-y)$ or $(2-3x)(y-1)$ or B1 for $3x-2-y(3x-2)$ or for $3x(1-y)-2(1-y)$ B1 for $(1-y)(1+y)$ or $(y-1)(-1-y)$ or $-(y-1)(1+y)$
26	$-\frac{1}{3}\mathbf{a} + \frac{4}{3}\mathbf{b}$ oe final simplified answer	4	B3 for correct unsimplified answer or B2 for $\overrightarrow{OK}$ or $\overrightarrow{KC} = \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$ oe or M1 for $\overrightarrow{AK} = \frac{2}{3}(-\mathbf{a} + \mathbf{b})$ oe or $\overrightarrow{BK} = \frac{1}{3}(-\mathbf{b} + \mathbf{a})$ oe or a correct vector route for $\overrightarrow{AC}$ along lines in diagram



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MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2024

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.



1 (a) (i) Write 70 as a product of its prime factors.

..... [2]

(ii) Find the highest common factor (HCF) of 70 and 112.

..... [2]

(iii) Find the lowest common multiple (LCM) of $70x^4y^2$ and $112x^3y^5$.

..... [2]

(b) Simplify.

(i) $a^{12} \div a^4$

..... [1]

(ii) $\frac{5}{2b} \times \frac{bc}{20}$

..... [2]

(c) Solve.

$$4 + 2x = 15$$

$x =$ [2]





(d) Solve. $\frac{34+2x}{5} = 4-x$

$x = \dots\dots\dots$ [3]

(e) $P = d + \sqrt[3]{m^2}$

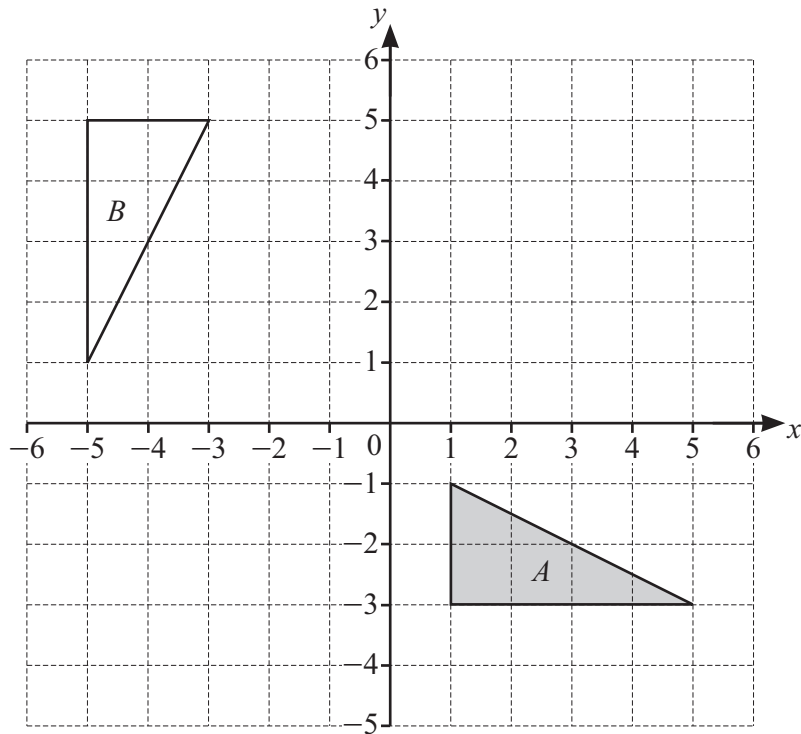
(i) Find P when $d = 7$ and $m = -8$.

$P = \dots\dots\dots$ [2]

(ii) Rearrange the formula to make m the subject.

$m = \dots\dots\dots$ [3]





- (a) On the grid, draw
- the image of triangle A after a reflection in the line $x = 1$ [2]
 - the image of triangle A after an enlargement by scale factor $\frac{1}{2}$ with centre $(5, 1)$. [2]
- (b) Describe fully the **single** transformation that maps triangle A onto triangle B .
- [3]
- (c) The point (a, b) is reflected in the line $y = k$ where k is an integer and $b < k$.
- Write the coordinates of the image of point (a, b) in terms of a , b and k .

(....., ...) [2]





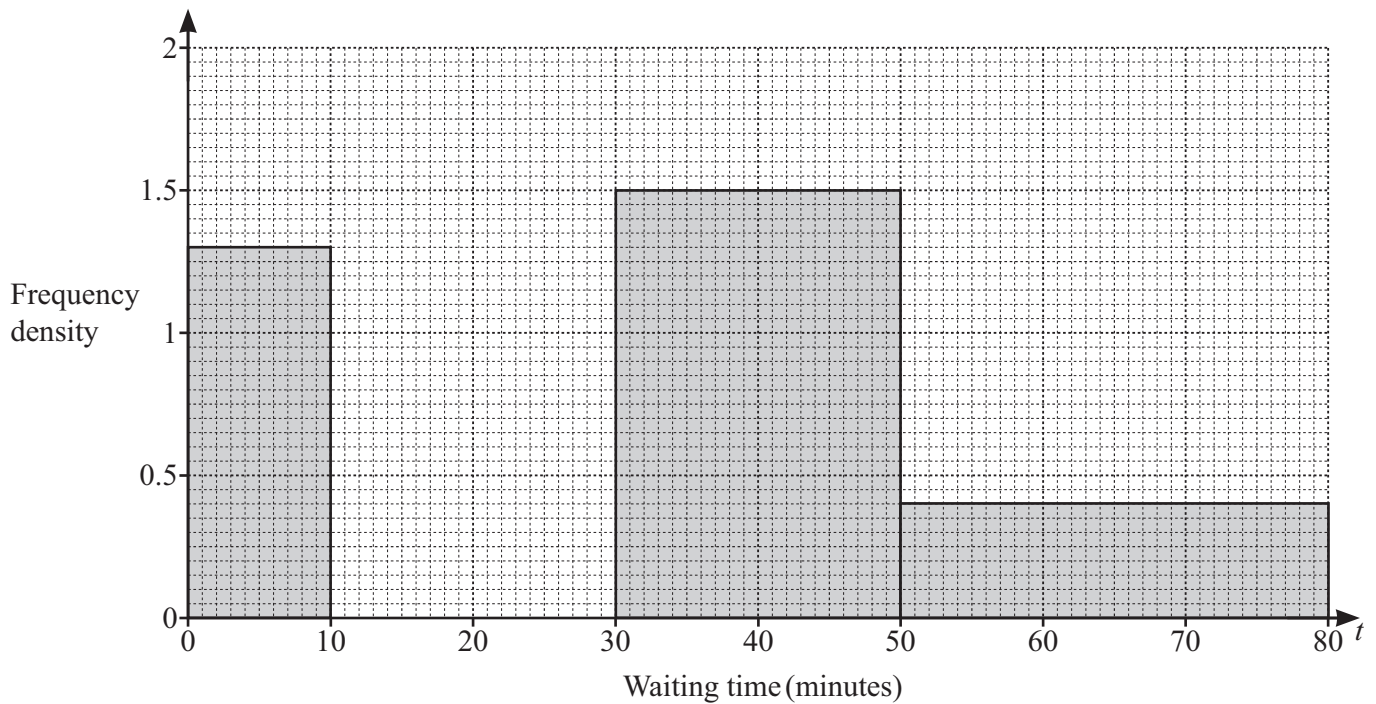
- 3 (a) The table shows the waiting times for 120 patients at a medical centre.

Waiting time (t minutes)	$0 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 50$	$50 < t \leq 80$
Frequency	2	46	33	26	13

Calculate an estimate of the mean waiting time.

..... min [4]

- (b) The histogram shows some information about the waiting times at a different medical centre.



The total number of patients is 90 and no patient waits for more than 80 minutes.

Complete the histogram for the patients that have a waiting time between 10 and 30 minutes.

[4]





- 4 (a) Enzo, Rashid and Blessy each swim as many lengths of a swimming pool as they can in 15 minutes. The results are shown in the table.

Name	Number of lengths
Enzo	11.25
Rashid	18.75
Blessy	20

- (i) Find the number of lengths Enzo swims **as a percentage** of the total number of lengths all three people swim.

..... % [2]

- (ii) Write the ratio of the number of lengths each person swims in the form

Enzo : Rashid : Blessy.

Give your answer in its simplest form.

..... : : [2]





(iii) Each length of the pool is 25 m.

- (a) Work out Blessy's average swimming speed for the 15 minutes.
Give your answer in metres per second.

..... m/s [3]

- (b) Rashid continues to swim at the same rate.

Calculate the time it takes Rashid to swim a total distance of 5 km.
Give your answer in hours and minutes.

..... h min [4]

- (iv) Blessy swims for one hour.
The number of lengths she swims decreases by 5% every 15 minutes.

Calculate the number of lengths she swims in the final 15 minutes.

..... [3]

- (b) Another swimmer, Adam, swims 450 m, correct to the nearest 25 metres.
This takes 10 minutes, correct to the nearest minute.

Calculate the minimum distance Adam swims in one hour at this rate.

..... m [3]





5 A box contains 3 blue pens and 5 red pens.

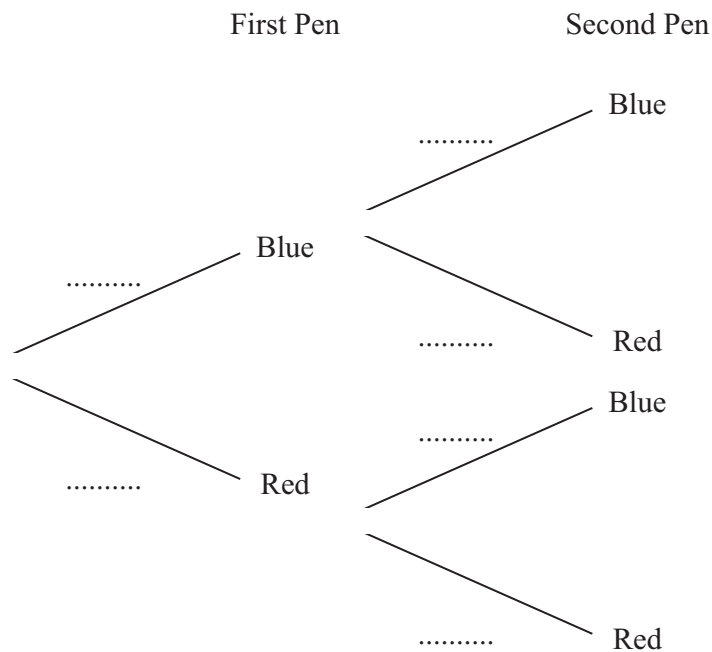
(a) Mia picks a pen from the box at random.

Find the probability that she picks a red pen.

..... [1]

(b) Mia puts the pen back into the box.
She then picks a pen at random and replaces it.
She then picks a second pen at random.

(i) Complete the tree diagram.



[2]

(ii) Find the probability that Mia picks two pens that have the same colour.

..... [3]





(c) Mia now picks 3 of the 8 pens in the box at random **without** replacement.

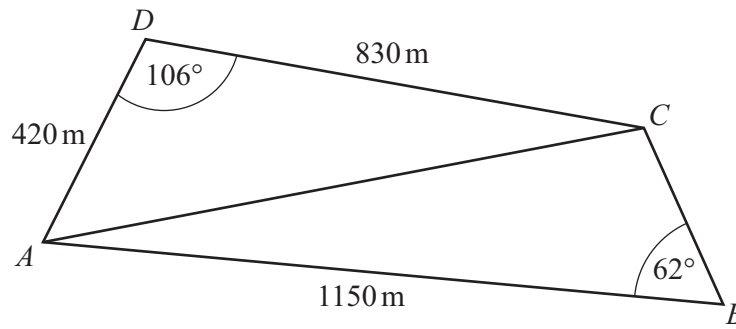
Find the probability that she picks 2 blue pens and 1 red pen.

..... [3]





- 6 The diagram shows a field $ABCD$.
A straight path AC goes across the field.



NOT TO
SCALE

- (a) Show that $AC = 1028$ m, correct to the nearest metre.

[3]

- (b) Angle ACB is obtuse.

Calculate angle ACB .

Angle $ACB = \dots\dots\dots$ [4]





(c) Part of the field, triangle ACD , is sold for \$41 500.

Calculate the cost of 1 hectare of this part of the field.
Give your answer correct to the nearest dollar.
[1 hectare = 10 000 m²]

\$ [4]





- 7 A company makes scientific calculators and graphic calculators.
Each day they make x scientific calculators and y graphic calculators.

These inequalities describe the number of scientific and graphic calculators they make each day.

$$x < 180 \qquad y \leq 90 \qquad x + y \leq 240$$

- (a) Complete these two statements.

The company makes fewer than scientific calculators each day.

The company can make a maximum of calculators each day. [2]

- (b) Scientific calculators cost \$12 to make.
Graphic calculators cost \$18 to make.
Each day the company spends at least \$2700 making calculators.

Show that $2x + 3y \geq 450$.

[1]





(c) The region R satisfies these four inequalities.

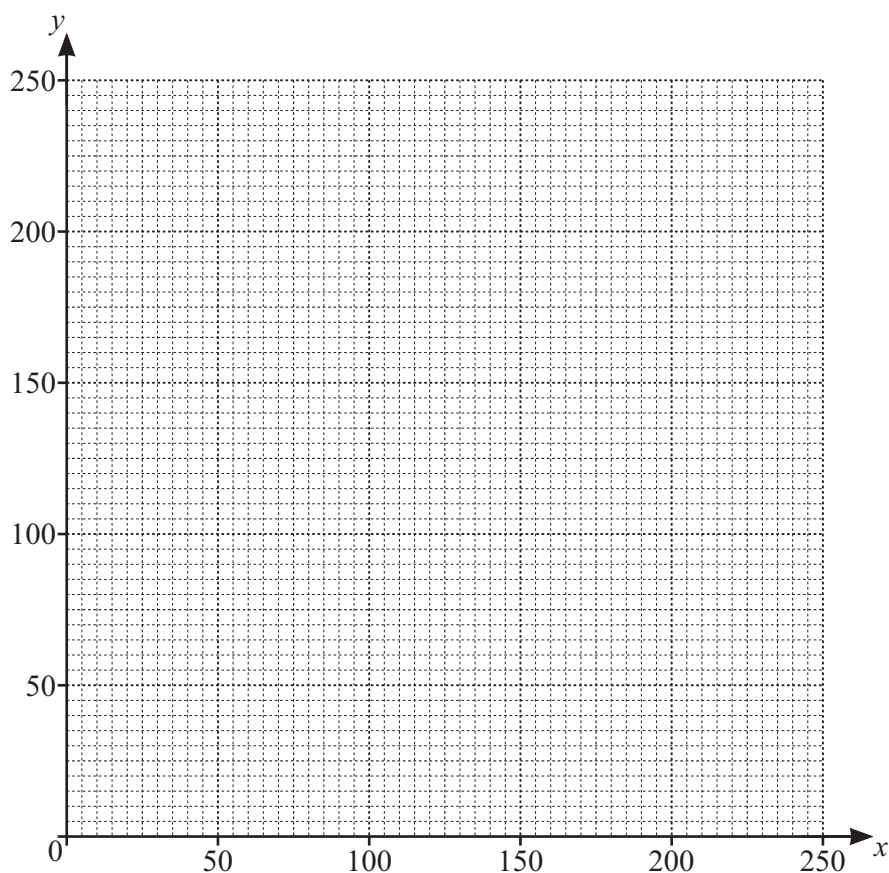
$$x < 180$$

$$y \leq 90$$

$$x + y \leq 240$$

$$2x + 3y \geq 450$$

By drawing four suitable lines and shading unwanted regions, find and label the region R .



[7]

- (d) Scientific calculators are sold for a profit of \$10.
Graphic calculators are sold for a profit of \$30.

Calculate the maximum profit made by the company in one day.

\$ [2]





8 (a) $f(x) = 7 - 3x$ $g(x) = x^2 - 16$

(i) Find the values of x when $g(x) = 20$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

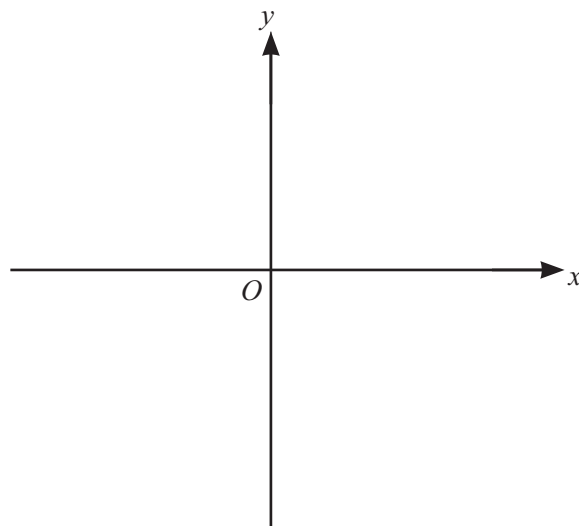
(ii) Find $f^{-1}(x)$.

$f^{-1}(x) = \dots\dots\dots$ [2]

(iii) Find $gf(x) + 1$, giving your answer in its simplest form.

$\dots\dots\dots$ [3]

(iv) On the axes, sketch the graph of $y = g(x)$.
On your sketch, indicate the values where the graph crosses the axes.



[4]



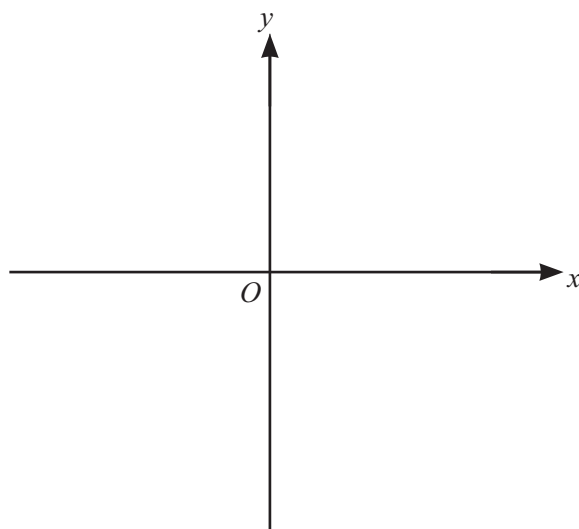


- (v) Find the equation of the tangent to the graph of $y = g(x)$ when $x = -3$.
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [5]

(b) $h(x) = 3^x$

- (i) On the axes, sketch the graph of $y = h(x)$.



[2]

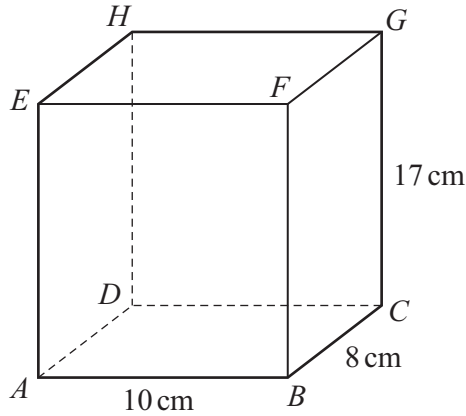
- (ii) Write down the equation of the asymptote to the graph of $y = h(x)$.

$\dots\dots\dots$ [1]





9



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$ABCDEFGH$ is a solid cuboid.
 $AB = 10$ cm, $BC = 8$ cm and $CG = 17$ cm.

(a) Work out the volume of the cuboid.

..... cm^3 [1]

(b) Work out the total surface area of the cuboid.

..... cm^2 [3]

(c) Calculate the angle between GA and the base $ABCD$.

..... [4]

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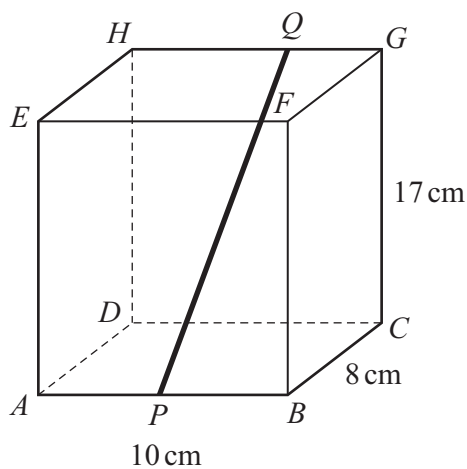
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- (d) A straight rod PQ is placed inside the cuboid.
One end of the rod, P , is placed at the midpoint of AB .
The other end of the rod, Q , rests on GH .
 $HQ : QG = 4 : 1$.



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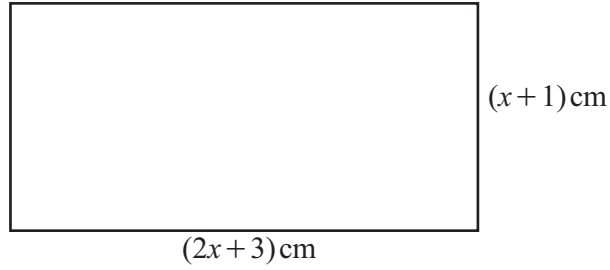
Calculate the length of the rod PQ .

..... cm [4]





10 (a)



NOT TO
SCALE

This rectangle has area 190 cm^2 .

(i) By forming and solving an equation, show that $x = 8.5$.

[4]

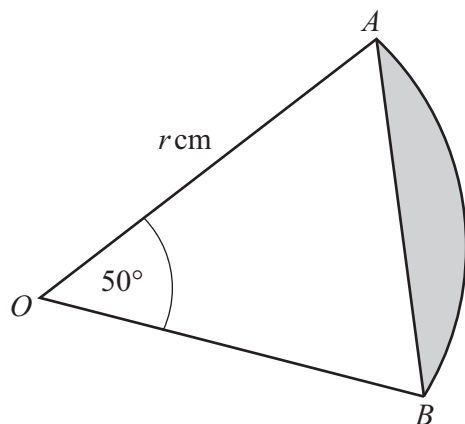
(ii) Work out the perimeter of the rectangle.

..... cm [2]





(b)



NOT TO
SCALE

The diagram shows a sector OAB of a circle, with centre O , and a chord AB .
The shaded segment has area 30 cm^2 .

(i) Show that $r = 23.7 \text{ cm}$, correct to 1 decimal place.

[4]

(ii) Calculate the perimeter of the shaded segment.

..... cm [4]





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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2024

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

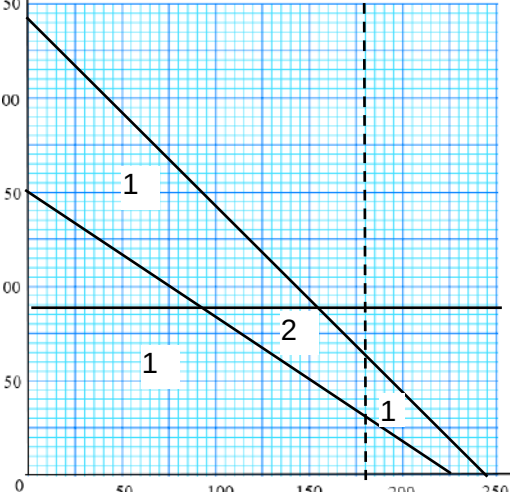
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

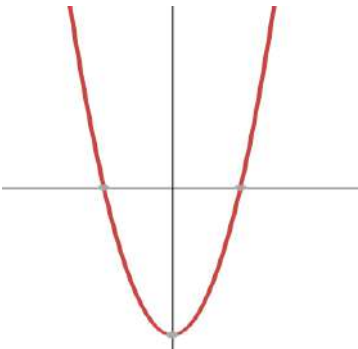
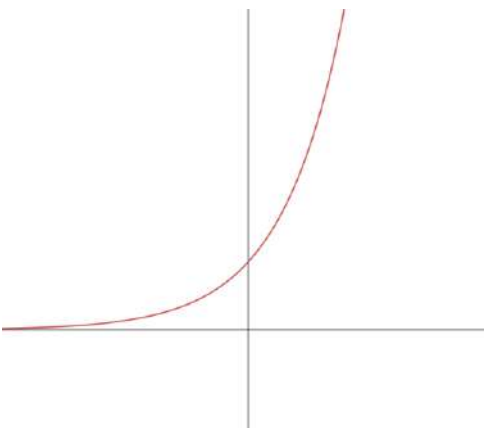
Question	Answer	Marks	Partial Marks
1(a)(i)	$2 \times 5 \times 7 [=70]$	2	B1 for 2, 5, 7
1(a)(ii)	14	2	M1 for $[112 =] 2^4 \times 7$ oe or for answer 2×7
1(a)(iii)	$560x^4y^5$	2	B1 for answer kx^4y^5 or for answer $560x^ay^b$ or for correct answer seen then spoiled
1(b)(i)	d^8	1	
1(b)(ii)	$\frac{c}{8}$ final answer	2	M1 for $\frac{5bc}{40b}$ or better
1(c)	5.5 or $\frac{11}{2}$ or $5\frac{1}{2}$	2	M1 for $2x = 15 - 4$ oe or $2 + x = \frac{15}{2}$ oe
1(d)	-2	3	M1 for $34 + 2x = 5(4 - x)$ oe or better M1 dep for reaching $ax = b$ FT <i>their</i> first step
1(e)(i)	11	2	M1 for $7 + \sqrt[3]{(-8)^2}$ oe
1(e)(ii)	$[\pm]\sqrt{(P-d)^3}$ oe final answer	3	B1 for $P - d = \sqrt[3]{m^2}$ oe M1 for cube both sides M1 for square root leading to final answer
2(a)(i)	Triangle at (1, -1) (1, -3) (-3, -3)	2	B1 for reflection in $x = k$ or for reflection in $y = 1$
2(a)(ii)	Triangle at (3, -1) (5, -1) (3, 0)	2	B1 for correct size and orientation but wrong position
2(b)	Rotation 90 clockwise oe [centre] (2, 4) oe	3	B1 for each
2(c)	$(a, 2k - b)$ oe isw	2	B1 for each coordinate
3(a)	30.875	4	M1 for 5, 15, 30, 45, 65 soi M1 for Σfx M1 dep for <i>their</i> $\Sigma fx \div 120$ dep on 2 nd M1

Question	Answer	Marks	Partial Marks
3(b)	Draws correct bar to height 1.75	4	B3 for [height =] 1.75 OR M2 for $[90 -](10 \times 1.3 + 20 \times 1.5 + 30 \times 0.4)$ oe or M1 for 10×1.3 or 20×1.5 or 30×0.4 M1dep for <i>their</i> frequency $\div 20$ dep on at least M1 After 0 scored SC1 for bar of correct width and height between 1.7 and 1.8
4(a)(i)	22.5	2	M1 for $\frac{11.25}{11.25 + 18.75 + 20} [\times 100]$ oe
4(a)(ii)	9 : 15 : 16	2	M1 for 1125 : 1850 : 2000 or better
4(a)(iii)(a)	$\frac{5}{9}$ or 0.556 or 0.5555 to 0.5556	3	M2 for $\frac{20 \times 25}{15[\times 60]}$ oe or M1 for 20×25 or for <i>their</i> distance $\div (15 [\times 60])$ oe

Question	Answer	Marks	Partial Marks
4(a)(iii)(b)	2 h 40 mins	4	Approach 1 B3 for $\frac{8}{3}$ [h] oe or 160 [mins] or 9600[s] Or M3 for $5000 \div (18.75 \times 25 \times 4)$ [h] oe or $5000 \div (18.75 \times 25 \div 15)$ [mins] oe or $5000 \div ((18.75 \times 25 \times 4) \div (60 \times 60))$ [secs] oe Or M2 for $(18.75 \times 25 \times 4)$ [m/h] oe or $(18.75 \times 25 \div 15)$ [m/min] oe or $(18.75 \times 25 \times 4) \div (60 \times 60)$ [m/sec] oe Or B1 for 200 or 1 km = 1000m soi After 0 scored SC1 for time <i>Figs</i> 267 or <i>figs</i> 2666 to 2667 or <i>figs</i> 16 or <i>figs</i> 96 Approach 2 B3 for 160 [mins] Or M3 for $15 \times 5000 \div (18.75 \times 25)$ [mins] oe Or M2 for $5000 \div (18.75 \times 25)$ oe Or B1 for 200 or 1 km = 1000m soi After 0 scored SC1 for time <i>figs</i> 16
4(a)(iv)	17.1 or 17.14 to 17.15	3	M2 for $20 \times \left(\frac{100-5}{100}\right)^3$ oe or M1 for $20 \times \left(\frac{100-5}{100}\right)^k$ where <i>k</i> is 2, or 4 or for $20 \times \left(\frac{100-5}{100}\right)^3$ oe seen and spoiled
4(b)	2500	3	M2 for $\frac{425 \text{ to } 450}{10 + 0.5}$ or $\frac{450 - 12.5}{10 \text{ to } 11}$ or $\frac{425 \text{ to } 450}{630}$ or $\frac{450 - 12.5}{600 \text{ to } 660}$ or M1 for 10.5 or 9.5 or 437.5 or 462.5 or 630[s] or 570[s]

Question	Answer	Marks	Partial Marks
5(a)	$\frac{5}{8}$ oe	1	
5(b)(i)	Tree diagram correct probabilities on 3 pairs of branches $\frac{3}{8}$ $\frac{5}{8}$	2	B1FT for one pair of branches of first stage or second stage correct
5(b)(ii)	$\frac{17}{32}$ oe	3	M2FT for <i>their</i> $\left(\frac{3}{8} \times \frac{3}{8}\right) + \left(\frac{5}{8} \times \frac{5}{8}\right)$ oe or M1FT for one correct product seen
5(c)	$\frac{15}{56}$ oe	3	M2 FT for $\frac{3}{8} \times \frac{2}{7} \times \frac{5}{6} \times k$ where k is 1, 2 or 3 or M1FT for $\frac{3}{8}$ and $\frac{2}{7}$ and $\frac{5}{6}$ seen oe or for showing the 3 possible combinations If 0 scored, SC1 for answer $\frac{135}{512}$ oe
6(a)	$\sqrt{420^2 + 830^2 - 2 \times 420 \times 830 \times \cos 106}$ oe	M2	or M1 for $420^2 + 830^2 - 2 \times 420 \times 830 \times \cos 106$ oe A1 for 1 057 474
	1028.3...	A1	
6(b)	99[.0] or 98.98 to 99.1[0...]	4	B3 for 80.89 to 81.02 or M2 for $\sin[ACB] = \frac{1150 \sin 62}{1028}$ oe or M1 for $\frac{1028}{\sin 62} = \frac{1150}{\sin ACB}$ oe

Question	Answer	Marks	Partial Marks
6(c)	2477 cao nfw	4	B3 for answer 2476.9... or M2 for $\frac{1}{2} \times 420 \times 830 \times \sin 106 \times \frac{P}{10000} = 41\,500$ oe or M1 for $\frac{1}{2} \times 420 \times 830 \times \sin 106$ oe
7(a)	180 and 240	2	B1 for 180 or for 240
7(b)	$12x + 18y \geq 2700$ and completion to $2x + 3y \geq 450$	1	with no errors seen
7(c)	$x = 180$ broken straight line and $y = 90$ solid ruled line and $x + y = 240$ solid ruled line and $2x + 3y = 450$ solid ruled line	B5	B1 for $x = 180$ broken straight line B1 for $y = 90$ solid ruled line B1 for $x + y = 240$ solid ruled line B2 for $2x + 3y = 450$ solid ruled line or B1 for line with a negative gradient passing through (0, 150) or (225, 0)
	Correct region indicated 	B2	B1 for region satisfying 3 of the inequalities
7(d)	4200	2	B1 for 150 and 90 or M1 for <i>their</i> $150 \times 10 + \text{their } 90 \times 30$
8(a)(i)	6 and -6	2	M1 for $x^2 = 20 + 16$ or better Or B1 for 6 or -6

Question	Answer	Marks	Partial Marks
8(a)(ii)	$\frac{7-x}{3}$ oe final answer	2	M1 for $x = 7 - 3y$ or $\frac{y}{3} = \frac{7}{3} - x$ or $y - 7 = -3x$ oe or better
8(a)(iii)	$9x^2 - 42x + 34$ final answer	3	M1 for $(7 - 3x)^2 - 16 [+ 1]$ oe B1 for $49 - 21x - 21x + 9x^2 + k$
8(a)(iv)	Correct sketch with roots marked at -4 and 4 and y – intercept and turning point at $y = -16$ 	4	B1 for correct parabola shape B2 for roots at -4 and 4 on graph and no extras or B1 for $(x - 4)(x + 4) [= 0]$ or for one correct root on graph or for -4 and 4 seen B1 for turning point at $(0, -16)$
8(a)(v)	$[y =] -6x - 25$	5	M1 for derivative $= 2x$ M1 for $x = -3$ substituted into <i>their</i> derivative B1 for $(-3, -7)$ soi M1 substitution of $(-3, \text{their } -7)$ into $y = \text{their } -6x + c$ oe dep on 2 nd M1
8(b)(i)	Correct sketch with y – intercept above x – axis 	2	B1 for correct shape
8(b)(ii)	$y = 0$	1	
9(a)	1360	1	

Question	Answer	Marks	Partial Marks
9(b)	772	3	M2 for $[2 \times] (10 \times 8 + 10 \times 17 + 8 \times 17)$ oe or M1 for 10×8 oe or 10×17 oe or 8×17 oe
9(c)	53 or 53.0 to 53.01	4	M3 for $\tan [GAC] = \frac{17}{\sqrt{10^2 + 8^2}}$ oe or M2 for $10^2 + 8^2$ oe or for $10^2 + 8^2 + 17^2$ oe or M1 for recognising angle GAC is required
9(d)	19[.0] or 19.02 to 19.03	4	M3 for $3^2 + 8^2 + 17^2$ oe OR B1 for $QG = 2$ soi or $HQ = 8$ M1 for $(5 - 2)^2 + 8^2$ or $(5 - 2)^2 + 17^2$
10(a)(i)	$2x^2 + 5x - 187 [= 0]$	M2	M1 for $(2x + 3)(x + 1) = 190$
	$(2x - 17)(x + 11) [= 0]$ oe	M1	
	Leading to $x = 8.5$ with no errors	A1	
10(a)(ii)	59	2	M1 for $6 \times 8.5 + 8$ oe or $6x + 8$ oe or B1 for 9.5 and 20
10(b)(i)	$\frac{50}{360} \pi \times r^2 - \frac{1}{2} r^2 \times \sin 50 = 30$ oe	M3	M1 for $\frac{50}{360} \pi \times r^2$ M1 for $\frac{1}{2} r^2 \times \sin 50$ oe
	23.70[9] to 23.72...	A1	must see at least 4 sig figs

Question	Answer	Marks	Partial Marks
10(b)(ii)	40.7 or 40.8 or 40.71 to 40.75...	4	M2 for $2 \times 23.7 \times \sin 25$ oe or $\sqrt{23.7^2 + 23.7^2 - 2 \times 23.7 \times 23.7 \cos 50}$ oe or $\frac{23.7 \sin 50}{\sin\left(\frac{180-50}{2}\right)}$ oe or M1 for $\frac{x}{23.7} = \sin 25$ oe or for $23.7^2 + 23.7^2 - 2 \times 23.7 \times 23.7 \cos 50$ oe or $\frac{AB}{\sin 50} = \frac{23.7}{\sin\left(\frac{180-50}{2}\right)}$ oe AND M1 for $\frac{50}{360} \times 2 \times \pi \times 23.7$ oe

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MATHEMATICS**0580/42**

Paper 4 (Extended)

October/November 2024**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.



1 (a) Anvi buys a new car.

- (i) The price of the car is \$28 240.
She is given a 7.5% discount.

Calculate the amount she pays.

\$ [2]

- (ii) The fuel tank in the new car has a capacity of 45 litres.
This is 72% of the capacity of the fuel tank in her old car.

Calculate the capacity of the fuel tank in her old car.

..... litres [2]

- (b) Aadi buys a new car costing \$28 000.
He pays for the car using a finance plan.
The finance plan is

- a deposit
- 47 equal monthly payments of \$330
- a final payment of \$11 490.

Using this finance plan, Aadi pays a total of \$31 900 for the car.

Calculate the deposit paid as a percentage of \$28 000.

..... % [4]





- (c) A car travels 64 km and uses 2.5 litres of fuel.
It then travels 128 km and uses 6 litres of fuel.

Calculate the rate at which the car uses fuel during the whole journey.
Give your answer in litres per 100 km.

..... litres per 100 km [2]

- (d) At the start of 2021 the value of a car was \$46 500.
At the end of 2021 the value of the car was 20% less.
At the end of 2022 the value of the car was 15% less than its value at the end of 2021.

Calculate the value of the car at the end of 2022.

\$ [2]



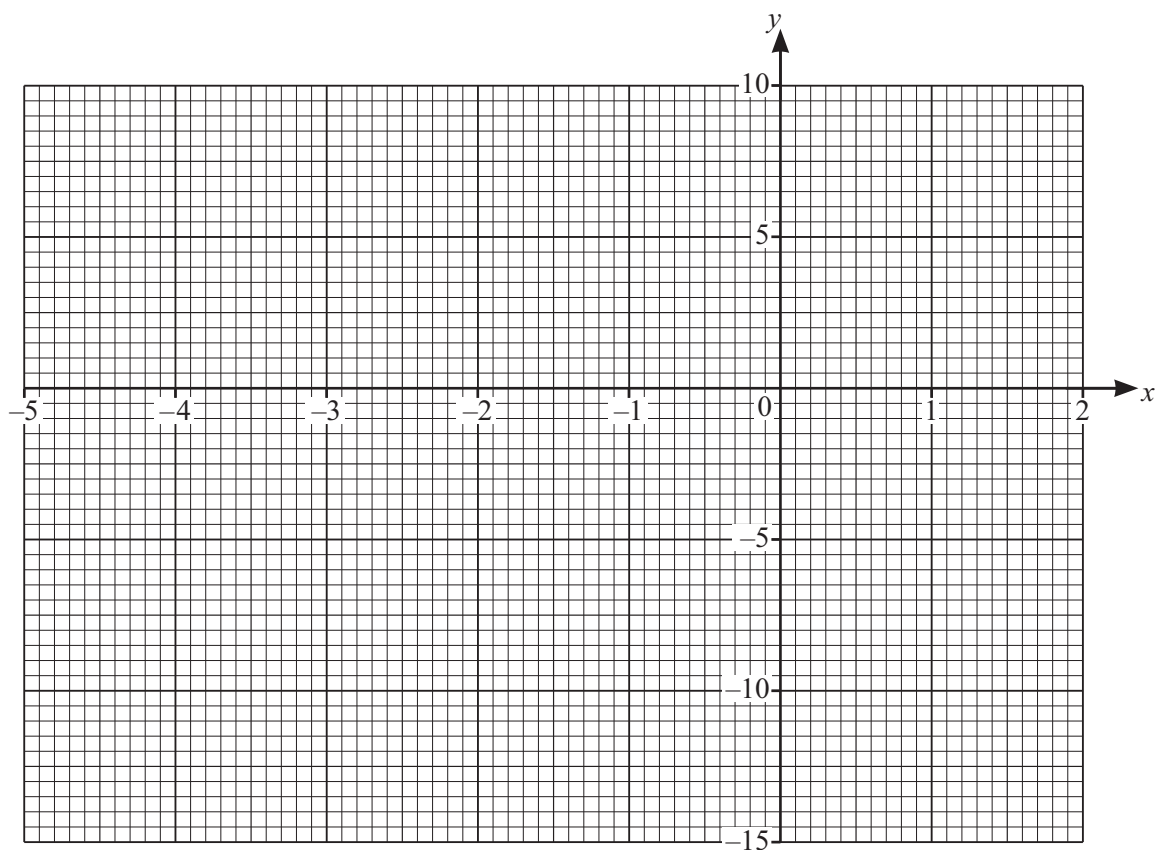


2 The table shows some values for $y = x^3 + 4x^2 - 4$.

x	-4.5	-4	-3	-2	-1	0	1	1.5
y	-14.1		5	4		-4	1	8.4

(a) Complete the table. [2]

(b) On the grid, draw the graph of $y = x^3 + 4x^2 - 4$ for $-4.5 \leq x \leq 1.5$.



(c) (i) Draw the tangent to the graph at the point (1, 1). [1]

(ii) Use your tangent to estimate the gradient of the curve at the point (1, 1).

..... [2]





(d) By drawing a suitable straight line on the grid, solve the equation $x^3 + 4x^2 - x - 6 = 0$.

$x = \dots\dots\dots$ Or $x = \dots\dots\dots$ Or $x = \dots\dots\dots$ [4]





3 (a) Simplify.

(i) $3m - 5n - 4m + 8n$

..... [2]

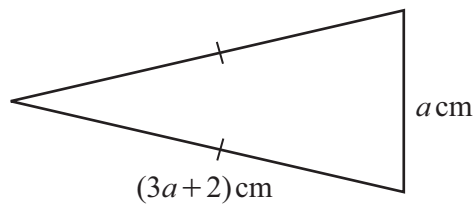
(ii) $(3a^2c^3)^4$

..... [2]

(iii) $\frac{4x}{5} - \frac{3x}{10} + \frac{2x}{15}$

..... [2]

(b) This isosceles triangle has a perimeter of 35.5 cm.



NOT TO
SCALE

Find the value of a .

$a =$ [3]





- (c) Using the quadratic formula, solve $5x^2 - 4x - 3 = 0$.
You must show all your working.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (d) Solve these simultaneous equations.

$$\begin{aligned} y &= x^2 - 4x + 5 \\ y &= 2x - 3 \end{aligned}$$

You must show all your working.

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [5]$$



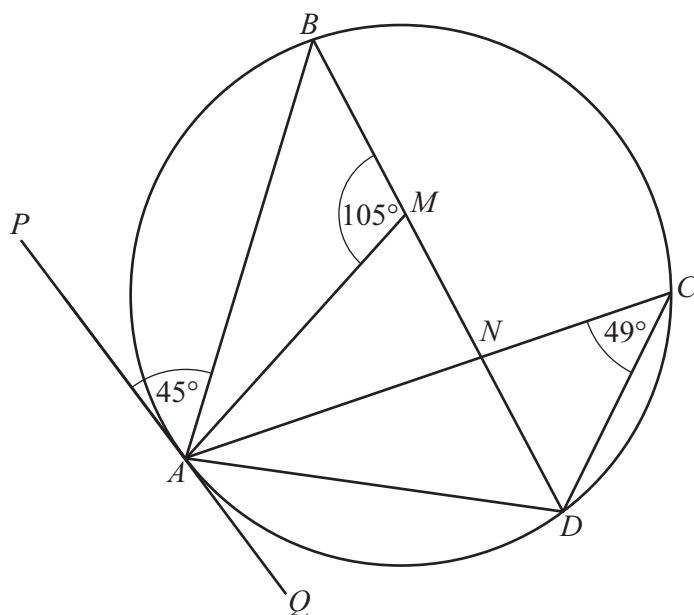


- 4 (a) The angles of a quadrilateral are w° , x° , y° and z° .
The ratio $w : (x + y + z) = 3 : 5$.

Find the value of w .

$w = \dots\dots\dots$ [2]

(b)



NOT TO
SCALE

A, B, C and D are points on a circle.
 PQ is the tangent to the circle at A .
 $BMND$ is a straight line.
Angle $ACD = 49^\circ$, angle $AMB = 105^\circ$ and angle $PAB = 45^\circ$.

- (i) Find angle BAM .

Angle $BAM = \dots\dots\dots$ [2]

- (ii) (a) Find angle BAD .

Angle $BAD = \dots\dots\dots$ [2]

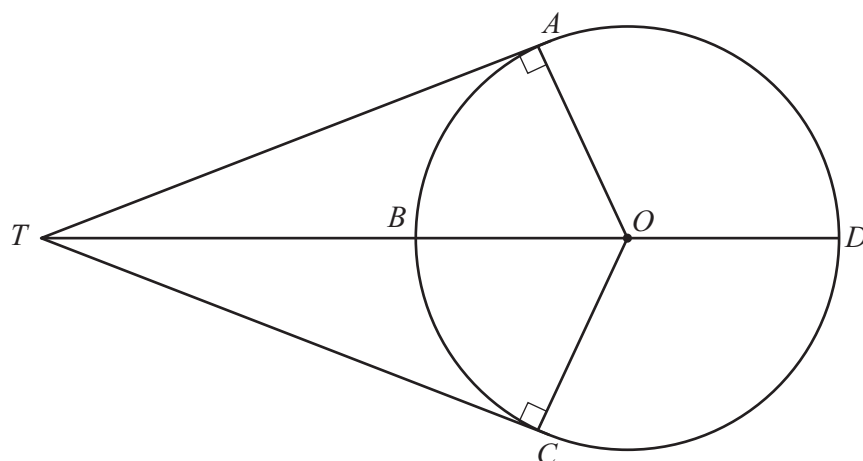
- (b) Give a geometrical reason why BD is **not** the diameter of the circle.

$\dots\dots\dots$
 $\dots\dots\dots$ [1]





(c)

NOT TO
SCALE

A, B, C and D are points on a circle, centre O .

TA and TC are tangents to the circle.

$OA = 6.75$ cm and $OT = 11.5$ cm.

(i) Show that angle $AOC = 108.12^\circ$, correct to 2 decimal places.

[3]

(ii) Calculate the length of the **minor** arc ABC .

..... cm [2]

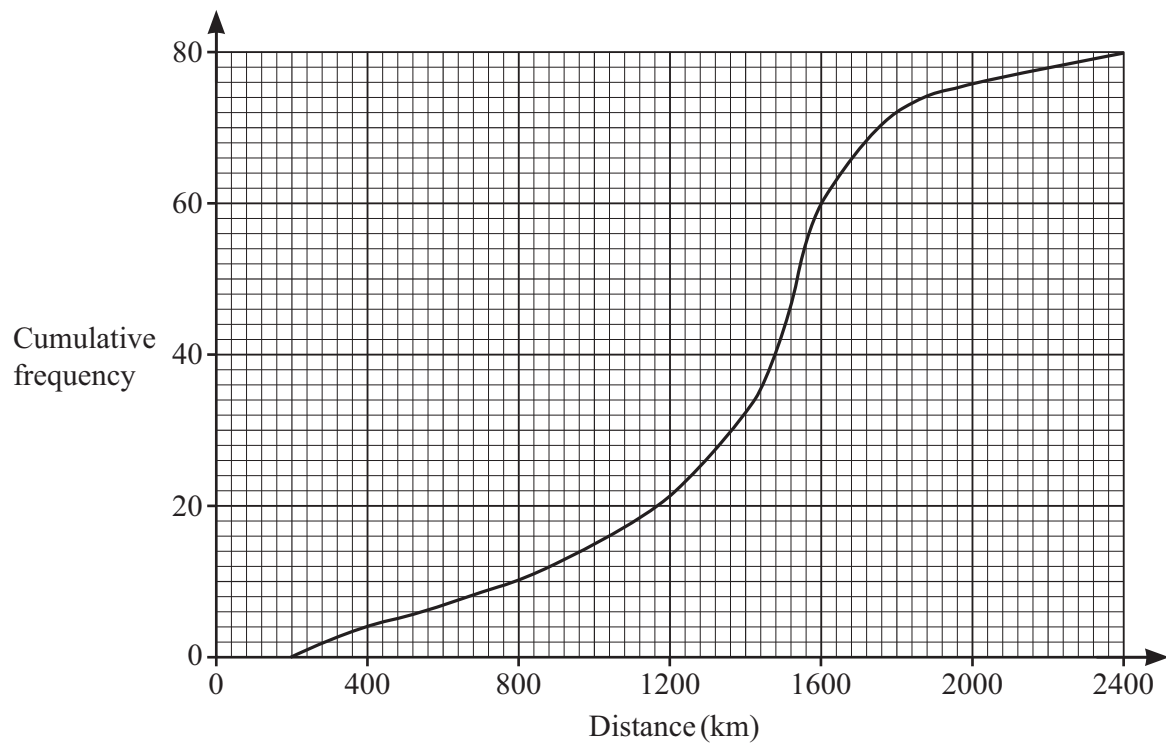
(iii) Calculate the area of the **major** sector $OCDA$.

..... cm^2 [3]





- 5 (a) The cumulative frequency diagram shows information about the distance travelled by each of 80 motorists in a month.



- (i) Use the cumulative frequency diagram to find an estimate for

(a) the median

..... km [1]

(b) the interquartile range

..... km [2]

- (ii) One of these motorists is picked at random.

Find the probability that this motorist travels more than 1800 km.

..... [2]

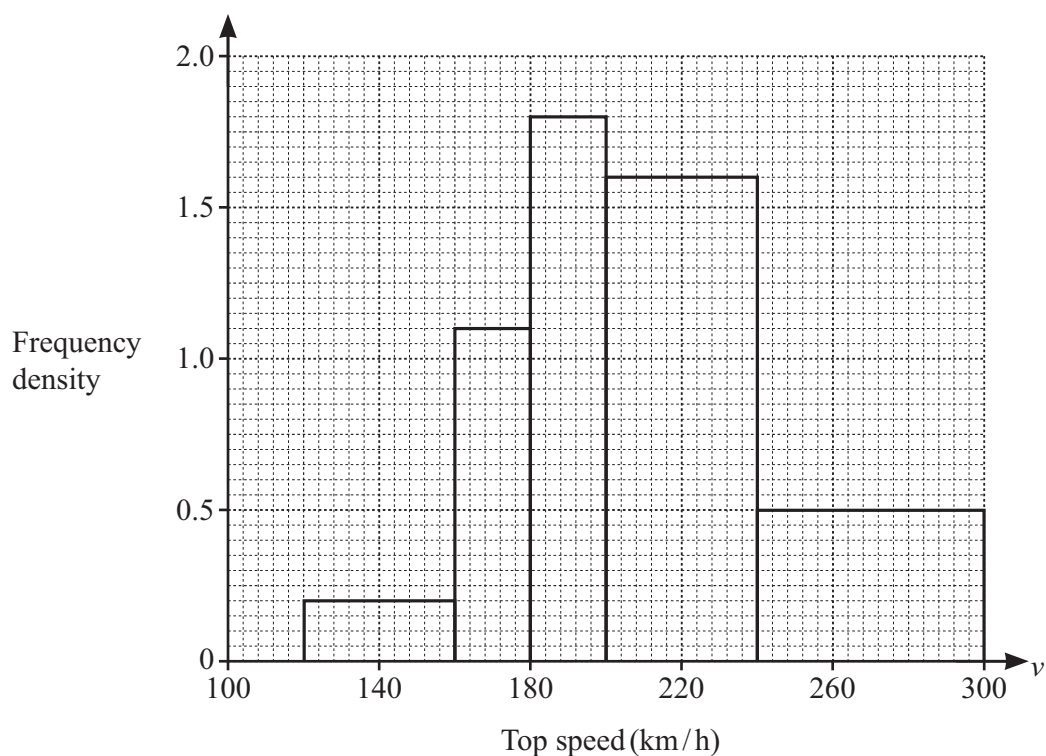
- (b) The distance around a racing track is 5.104 km.
The time taken by a car to complete one lap of the track is 1 min 18 s.

Calculate the average speed of the car.
Give your answer in km/h.

..... km/h [3]



- (c) The top speed, v km/h, of each of 160 cars is recorded.
The histogram shows this information.



- (i) Show that there are 8 cars with a top speed in the interval $120 < v \leq 160$.

[1]

- (ii) Calculate an estimate of the mean top speed.
You must show all your working.

..... km/h [6]



6 (a) Work out $2\begin{pmatrix} 3 \\ -5 \end{pmatrix} - \begin{pmatrix} 2 \\ -7 \end{pmatrix}$.

(b) $\overrightarrow{MN} = \begin{pmatrix} -6 \\ 4 \end{pmatrix}$.

(i) M is the point $(2, -5)$.

Find the coordinates of N .

(..... , ...) [1]

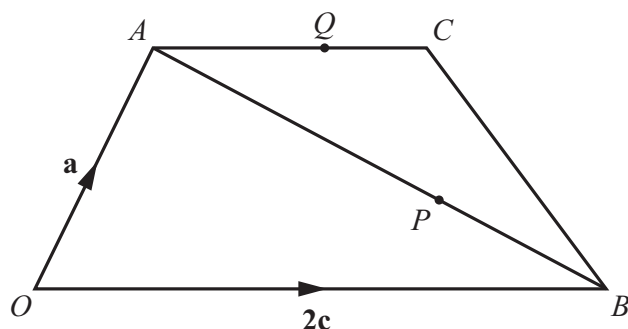
(ii) Find $|\overrightarrow{MN}|$.

..... [2]





(c)

NOT TO
SCALE

$OACB$ is a trapezium with $OB = 2AC$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = 2\mathbf{c}$.

$AP : PB = 4 : 1$ and $AQ = \frac{4}{5}AC$.

- (i) Write each of the following in terms of $\mathbf{a}$ and $\mathbf{c}$.
Give each answer in its simplest form.

(a) $\overrightarrow{AB}$

..... [1]

(b) $\overrightarrow{CB}$

..... [1]

(c) $\overrightarrow{OP}$

..... [2]

(d) $\overrightarrow{QP}$

..... [2]

- (ii) Use your answers to make **two** statements about the relationship between lines QP and CB .

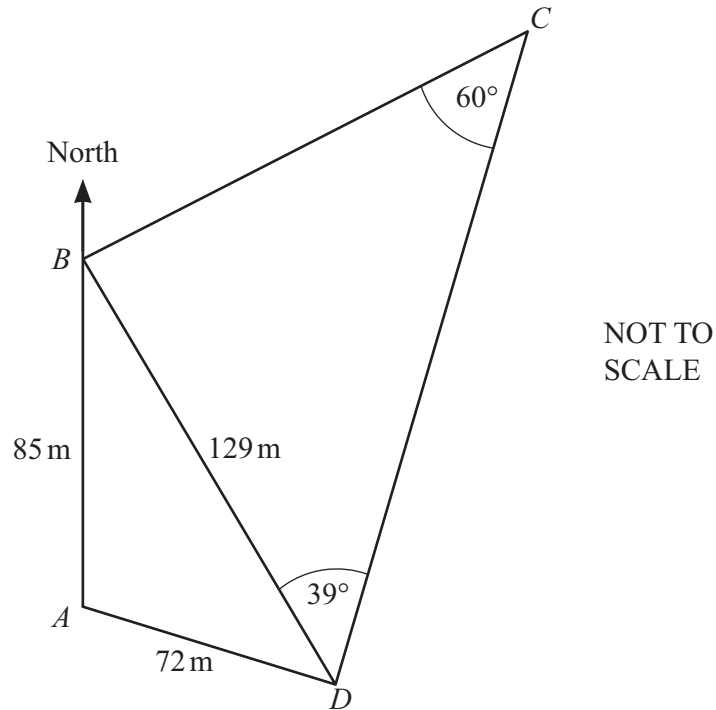
.....

..... [2]





7 (a)



The diagram shows a field, $ABCD$ with B north of A .

BD is a path across the field.

$AB = 85$ m, $AD = 72$ m, $BD = 129$ m, angle $BDC = 39^\circ$ and angle $BCD = 60^\circ$.

(i) Show that angle $CBD = 81^\circ$.

[1]

(ii) Calculate CD .

..... m [3]

(iii) Show that angle $ABD = 31.6^\circ$, correct to 1 decimal place.

[4]





(iv) Find the shortest distance from A to BD .

..... m [3]

(v) Find the bearing of B from C .

..... [2]

(vi) Trees are planted in the field.
The number of trees planted is 1100 per hectare.

Calculate the total number of trees planted in the field.
[1 hectare = 10 000 m²]

..... [4]

(b) A rectangle has an area of 9400 cm², correct to the nearest 100 cm².
The length of the rectangle is 80 cm, correct to the nearest 10 cm.

Calculate the upper bound of the width of the rectangle.

..... cm [3]





- 8 (a) A bag contains 24 coloured beads.
Some are red, some are blue and 10 are yellow.
One bead is picked at random from the bag.

Find the probability that

- (i) the bead is yellow

..... [1]

- (ii) the bead is not yellow.

..... [1]

- (b) Another bag contains 5 green marbles, 6 white marbles and 4 black marbles.
Meera picks 2 marbles at random from the bag, without replacement.

Find the probability that

- (i) the first marble is black and the second marble is white

..... [2]

- (ii) both marbles have different colours.

..... [4]





9 $f(x) = 2x - 5$ $g(x) = x^2 - 2x$

(a) Find

(i) $f(7)$

..... [1]

(ii) $gf(7)$

..... [1]

(iii) $f^{-1}(x)$.

$f^{-1}(x) =$ [2]

(b) Find $gf(x) - 3g(x)$.

Give your answer in the form $ax^2 + bx + c$.

..... [4]





10 A curve has the equation $y = x^3 - 9x^2 - 48x$.

(a) Differentiate $x^3 - 9x^2 - 48x$.

..... [2]

(b) Find the coordinates of the turning points of the graph of $y = x^3 - 9x^2 - 48x$.
You must show all your working.

(..... , ...) and (..... , ...)
[4]

(c) Determine whether each of the turning points is a maximum or a minimum.
Give reasons for your answers.

[3]





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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2024

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	26 122 cao	2	M1 for $28\,240 \times \left(1 - \frac{7.5}{100}\right)$ oe or B1 for answer 2118
1(a)(ii)	62.5	2	M1 for $C \times \frac{72}{100} = 45$ oe or better
1(b)	17.5	4	M3 for $\frac{31900 - 11490 - (47 \times 330)}{28000} [\times 100]$ or M2 for $31\,900 - 11\,490 - (47 \times 330)$ or M1 for 47×330 or for $31\,900 - 11\,490$
1(c)	4.43 or 4.427...	2	M1 for $\frac{2.5 + 6}{64 + 128} [\times 100]$ oe
1(d)	31 620	2	M1 for $46\,500 \times \left(1 - \frac{20}{100}\right) \left[\times \left(1 - \frac{15}{100}\right)\right]$ or $46\,500 \times \left(1 - \frac{15}{100}\right) \left[\times \left(1 - \frac{20}{100}\right)\right]$ or for $\left(1 - \frac{20}{100}\right) \times \left(1 - \frac{15}{100}\right)$
2(a)	−4, −1	2	B1 for each correct value
2(b)	Correct graph	4	B3FT for 7 or 8 correct points or B2FT for 5 or 6 correct points or B1FT for 3 or 4 correct points
2(c)(i)	Ruled tangent at $x = 1$	1	
2(c)(ii)	6 to 14 nfw	2	dep on correct tangent or a close attempt at the tangent at $x = 1$ M1 for rise/run for <i>their</i> tangent, or close attempt at tangent at any point. Must see correct or implied calculation from a drawn tangent.
2(d)	$y = x + 2$ ruled	M2	M1 for $[y =] x + 2$ soi or $y = x + k$ ruled or $y = kx + 2$ ruled, but not $y = 2$
	$x = -3.95$ to -3.75 $x = -1.4$ to -1.25 $x = 1.1$ to 1.25	A2	A1 for any two values If A0, SC1 for three correct values

Question	Answer	Marks	Partial Marks
3(a)(i)	$-m + 3n$ final answer	2	B1 for $-m$ or $[+]$ $3n$ in final answer or for $-m + 3n$ seen and then spoiled
3(a)(ii)	$81a^8c^{12}$ final answer	2	B1 for final answer in correct form with any two of $81, a^8, c^{12}$ correct or for $81a^8c^{12}$ seen and then spoiled
3(a)(iii)	$\frac{19x}{30}$ final answer	2	M1 for $\frac{6 \times 4x - 3 \times 3x + 2 \times 2x}{30}$ oe
3(b)	4.5 oe	3	M1 for $a + 2(3a + 2) = 35.5$ oe M1 for correct $ka = b$ for <i>their</i> linear equation
3(c)	$\frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times 5 \times (-3)}}{2 \times 5}$ oe	M2	M1 for $\sqrt{(-4)^2 - 4 \times 5 \times (-3)}$ or better or for $\frac{-(-4) + \sqrt{q}}{2 \times 5}$ or $\frac{-(-4) - \sqrt{q}}{2 \times 5}$ or better
	-0.472 or -0.4718 to -0.4717 and 1.27 or 1.271 to 1.272	B1	
3(d)	$x^2 - 6x + 8 [= 0]$ or $y^2 - 6y + 5 [= 0]$	M2	M1 for $x^2 - 4x + 5 = 2x - 3$ or $y = \left(\frac{y+3}{2}\right)^2 - 4\left(\frac{y+3}{2}\right) + 5$
	$(x - 4)(x - 2) [= 0]$ or $(y - 1)(y - 5) [= 0]$ OR $[x =] \frac{-(-6) \pm \sqrt{(-6)^2 - 4[\times 1] \times 8}}{2[\times 1]}$ or $[y =] \frac{-(-6) \pm \sqrt{(-6)^2 - 4[\times 1] \times 5}}{2[\times 1]}$ OR $[x =] 3 \pm \sqrt{-8+9}$ or $[y =] 3 \pm \sqrt{-5+9}$	M1	FT <i>their</i> 3-term quadratic but not if $x^2 - 4x + 5 [= 0]$

Question	Answer	Marks	Partial Marks
	$[x =] 2, [y =] 1$ $[x =] 4, [y =] 5$	B2	B1 for one correct pair or two correct x-values or two correct y-values If B0 scored and at least 2 method marks scored, SC1 for correct substitution of both of <i>their</i> x values or <i>their</i> y values into $y = x^2 - 4x + 5$ or $y = 2x - 3$
4(a)	135	2	M1 for $\frac{360}{5+3} \times k$, where $k = 1, 3$ or 5 oe
4(b)(i)	26	2	B1 for $\angle ABD = 49$
4(b)(ii)(a)	86	2	B1 for $\angle QAD = 49$ or for $\angle BDA = 45$ or for $\angle BCA = 45$
4(b)(ii)(b)	Angle in a semicircle = 90	1	
4(c)(i)	$[2 \times] \cos^{-1} \left(\frac{6.75}{11.5} \right)$ oe	M2	M1 for $\cos(\dots) = \frac{6.75}{11.5}$ oe
	108.117...	A1	
4(c)(ii)	12.7 or 12.73 to 12.74	2	M1 for $\frac{108.12}{360} \times 2 \times \pi \times 6.75$
4(c)(iii)	100 or 100.1 to 100.2	3	M2 for $\frac{360 - 108.12}{360} \times \pi \times 6.75^2$ oe or M1 for $\frac{108.12}{360} \times \pi \times 6.75^2$ If 0 scored, SC1 for $\frac{360 - 108.12}{360} \times \pi \times k$
5(a)(i)(a)	1480	1	
5(a)(i)(b)	440	2	M1 for $[UQ =] 1600$ soi or $[LQ =] 1160$ soi
5(a)(ii)	$\frac{8}{80}$ oe	2	M1 for 72 or 8 written
5(b)	236 or 235.5 to 235.6	3	M2 for $\frac{5.104}{1.3} \times 60$ oe or M1 for $\frac{5.104}{\text{their time}}$

Question	Answer	Marks	Partial Marks
5(c)(i)	$(160 - 120) \times 0.2 [= 8]$	1	with no errors seen
5(c)(ii)	22, 36, 64, 30 seen	B2	B1 for 2 or 3 correct frequencies or M1 for three of $1.1 \times (180 - 160)$, $1.8 \times (200 - 180)$, $1.6 \times (240 - 200)$ and $0.5 \times (300 - 240)$ oe
	$(8 \times 140 + \text{their } 22 \times 170 + \text{their } 36 \times 190 + \text{their } 64 \times 220 + \text{their } 30 \times 270) \div 160$	M3	M1 for midpoints soi M1 for Σfx , x in interval or boundary of interval M1 dep on second M1 for $\Sigma fx \div 160$
	211.75	B1	
6(a)	$\begin{pmatrix} 4 \\ -3 \end{pmatrix}$	2	B1 for $\begin{pmatrix} 6 \\ -10 \end{pmatrix}$ or answer $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -3 \end{pmatrix}$
6(b)(i)	$(-4, -1)$	1	
6(b)(ii)	7.21 or 7.211...	2	M1 for $(-6)^2 + 4^2$
6(c)(i)(a)	$2\mathbf{c} - \mathbf{a}$	1	
6(c)(i)(b)	$\mathbf{c} - \mathbf{a}$	1	
6(c)(i)(c)	$\frac{1}{5}(\mathbf{a} + 8\mathbf{c})$ final answer	2	M1 for $[\overrightarrow{AP} =] \frac{4}{5} \times \text{their}(2\mathbf{c} - \mathbf{a})$ or $[\overrightarrow{BP} =] \frac{1}{5} \times -\text{their}(2\mathbf{c} - \mathbf{a})$ or for a correct vector route using the lines on the diagram
6(c)(i)(d)	$\frac{4}{5}(-\mathbf{a} + \mathbf{c})$ final answer	2	M1 for $[\overrightarrow{QP} =] -\frac{4}{5}\mathbf{c} + \frac{4}{5} \times \text{their}(2\mathbf{c} - \mathbf{a})$ or for a correct vector route
6(c)(ii)	$[QP \text{ is}] \text{ parallel } [\text{to } CB]$ $QP = \frac{4}{5}CB$ oe	2	Dep both statements consistent with <i>their (c)(i)(b)</i> and <i>their (c)(i)(d)</i> and both vectors in terms of $\mathbf{a}$ and $\mathbf{c}$ B1 for each dep on statement consistent with <i>their (c)(i)(b)</i> and <i>their (c)(i)(d)</i> and both vectors in terms of $\mathbf{a}$ and $\mathbf{c}$
7(a)(i)	$180 - 60 - 39 [= 81]$	1	
7(a)(ii)	147 or 147.1...	3	M2 for $\frac{129 \sin(81)}{\sin 60}$ oe or M1 for $\frac{\sin(81)}{CD} = \frac{\sin 60}{129}$ oe

Question	Answer	Marks	Partial Marks
7(a)(iii)	$[\cos =] \frac{85^2 + 129^2 - 72^2}{2 \times 85 \times 129}$	M2	M1 for $72^2 = 85^2 + 129^2 - 2 \times 85 \times 129 \cos ABD$
	31.58...	A2	A1 for 0.851 to 0.852 or $\frac{9341}{10965}$ or equivalent fraction
7(a)(iv)	44.5 or 44.51 to 44.54	3	M2 for implicit correct method e.g. $\frac{d}{85} = \sin 31.6$ oe or M1 for recognition that the line from A is perpendicular to BD
7(a)(v)	247 or 247.4...	2	M1 for $180 + (180 - 81 - 31.6)$ oe or for $\angle NBC = 180 - 81 - 31.6$ oe or for $\angle NCB = 81 + 31.6$ oe
7(a)(vi)	972 or 973	4	M1 for $[\triangle ABD] \frac{1}{2} \times 85 \times 129 \sin 31.6$ oe or $\frac{1}{2} \times 129 \times \text{their } 44.5$ oe M1 for $[\triangle BCD] \frac{1}{2} \times 129 \times \text{their } 147 \times \sin 39$ oe M1 for $\frac{\text{their total area}}{10000} \times 1100$
7(b)	126 nfw	3	M2 for $\frac{9400 + 50}{70 \text{ to } 80}$ or $\frac{9400 \text{ to } 9500}{80 - 5}$ or M1 for 9350 or 9450 or 75 or 85 seen
8(a)(i)	$\frac{5}{12}$ oe	1	
8(a)(ii)	$\frac{7}{12}$ oe	1	FT 1 – <i>their (a)(i)</i>
8(b)(i)	$\frac{4}{35}$ oe	2	M1 for $\frac{4}{15} \times \frac{6}{14}$

Question	Answer	Marks	Partial Marks
8(b)(ii)	$\frac{74}{105}$ oe	4	M3 for $1 - \left(\frac{5}{15} \times \frac{4}{14} + \frac{6}{15} \times \frac{5}{14} + \frac{4}{15} \times \frac{3}{14} \right)$ oe or M2 for $\frac{5}{15} \times \frac{4}{14} + \frac{6}{15} \times \frac{5}{14} + \frac{4}{15} \times \frac{3}{14}$ oe or M1 for $\frac{k}{15} \times \frac{k-1}{14}$ where k is 4, 5 or 6 oe If 0 scored, SC1 for $\frac{148}{225}$ ALTERNATIVE 1 M3 for $\frac{5}{15} \times \frac{10}{14} + \frac{6}{15} \times \frac{9}{14} + \frac{4}{15} \times \frac{11}{14}$ oe or M2 for two of these products added oe or M1 for $\frac{k}{15} \times \frac{15-k}{14}$ where k is 4, 5 or 6 oe If 0 scored, SC1 for $\frac{148}{225}$ ALTERNATIVE 2 M3 for $\frac{5}{15} \times \frac{6}{14} \times 2 + \frac{5}{15} \times \frac{4}{14} \times 2 + \frac{6}{15} \times \frac{4}{14} \times 2$ oe or M2 for at least two of these different products added oe or M1 for one correct product If 0 scored, SC1 for $\frac{148}{225}$
9(a)(i)	9	1	
9(a)(ii)	63	1	FT $(their\ (a)(i))^2 - 2 \times their\ (a)(i)$
9(a)(iii)	$\frac{x+5}{2}$ oe final answer	2	M1 for $x = 2y - 5$ or $y + 5 = 2x$ or $\frac{y}{2} = x - \frac{5}{2}$
9(b)	$x^2 - 18x + 35$ final answer	4	M1 for $(2x - 5)^2 - 2(2x - 5) - 3(x^2 - 2x)$ B1 for $4x^2 - 10x - 10x + 25$ B1 for $-4x + 10 - 3x^2 + 6x$
10(a)	$3x^2 - 18x - 48$ final answer	2	B1 for two correct terms or for correct answer seen then spoiled

Question	Answer	Marks	Partial Marks
10(b)	$their \frac{dy}{dx} = 0$ soi	M1	
	$[3](x - 8)(x + 2)$ oe or $\frac{-(-18) \pm \sqrt{(-18)^2 - 4(3)(-48)}}{2 \times 3}$ oe or $3 \pm \sqrt{16 + 3^2}$	M1	oe $\frac{18 \pm \sqrt{900}}{6}$
	(-2, 52) (8, -448)	B2	B1 for one correct pair of coordinates or for two correct values of x
10(c)	(-2, 52) maximum with reason and (8, -448) minimum with reason and no incorrect statement	3	Reasons could be e.g. 1. A reasonable sketch of a positive cubic 2. Correct evaluation and use of 2nd derivative $6x - 18 = -30, -30 < 0$, so (-2, 52) is a maximum oe. $6x - 18 = 30, 30 > 0$, so (8, -448) is a minimum oe. 3. Evaluates correctly values of y on both sides of both correct stationary points 4. Finds gradient on each side of both correct stationary points. Any incorrect statement MAX B2 B2 for 1 correct with correct reason for that stationary point or for both x -values correct and reasonable sketch of a positive cubic or for correct substitution and evaluation of both of <i>their</i> x -values into <i>their</i> second derivative or substitution and evaluation for one x -value on both sides of both of <i>their</i> stationary points to find the gradients soi or M1 for showing [2nd derivative =] $6x - 18$ or correct FT <i>their</i> 2nd derivative from part (a) or substitution and evaluation shown for one x -value on both sides of one of <i>their</i> stationary points to find the gradients soi or for sketch of any positive cubic.



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MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2024

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.



1 Dinari sells fruit and vegetables.

- (a) One day the mass of fruit and vegetables he sells is in the ratio fruit : vegetables = 9 : 8.
He sells 48 kg of vegetables.

Find the mass of the fruit he sells.

..... kg [2]

- (b) On another day he receives \$280 for the fruit and vegetables he sells.
The \$280 is in the ratio fruit : vegetables = $(c + 3) : (c - 1)$.

Find the amount he receives from selling the fruit.

\$ [3]

- (c) In one week Dinari buys fruit and vegetables for \$1620.
He sells the fruit and vegetables for \$1750.

Calculate his percentage profit.

..... % [2]

- (d) In another week Dinari sells fruit and vegetables for \$1738.
He makes a profit of 10%.

Calculate the amount he paid for the fruit and vegetables in that week.

\$ [2]





2 (a) A is the point $(3, 7)$ and B is the point $(-1, 5)$.

(i) Find the coordinates of the midpoint of the line AB .

(..... , ...) [2]

(ii) Write $\overrightarrow{AB}$ as a column vector.

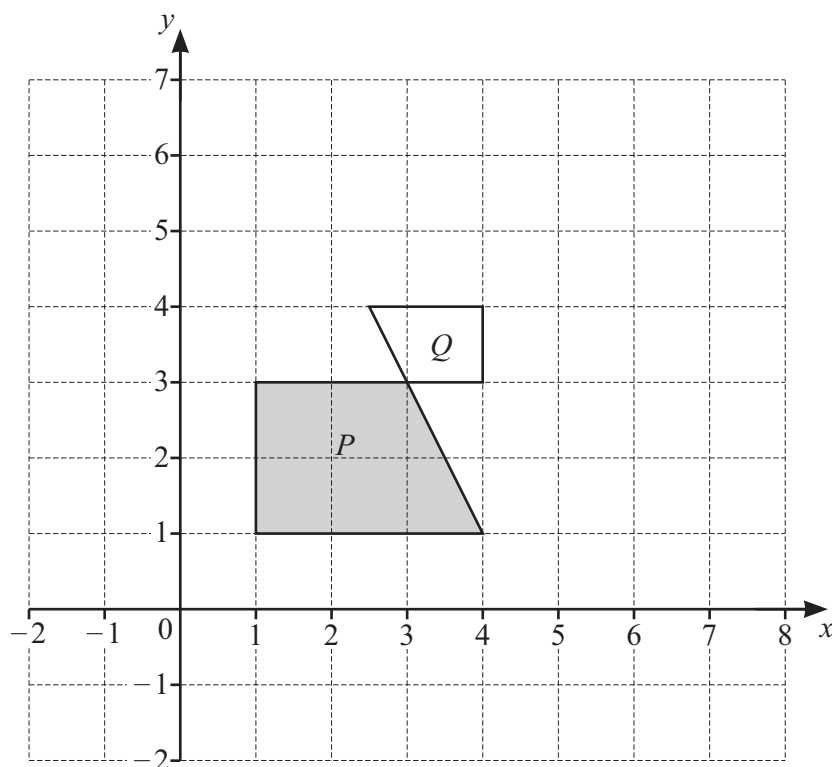
$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(iii) $\overrightarrow{AC} = 3\overrightarrow{BA}$

Find the coordinates of C .

(..... , ...) [2]

(b)



(i) Rotate shape P through 180° about the point $(4, 1)$. [2]

(ii) Reflect shape P in the line $y = x + 2$. [2]

(iii) Describe fully the **single** transformation that maps shape P onto shape Q .

.....

..... [3]





- 3 (a) Ed invests \$500 in an account paying $r\%$ per year simple interest.
At the end of 14 years the total amount in Ed's account is \$675.

Find the value of r .

$r = \dots\dots\dots$ [3]

- (b) Eva invests \$400 at a rate of 2.2% per year compound interest.

Calculate the total interest earned at the end of 11 years.

\$ \dots\dots\dots\$ [3]

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- (c) Erin invests \$700 at a rate of $p\%$ per **month** compound interest.
At the end of 21 years the value of Erin's investment is \$1074, correct to the nearest dollar.

Calculate the value of p .

$p = \dots\dots\dots [3]$





- 4 (a) A box contains 50 cuboids.
Each cuboid has a mass of 135 g.
The total mass of the cuboids and the box is 7 kg.

Calculate the mass of the box.
Give your answer in grams.

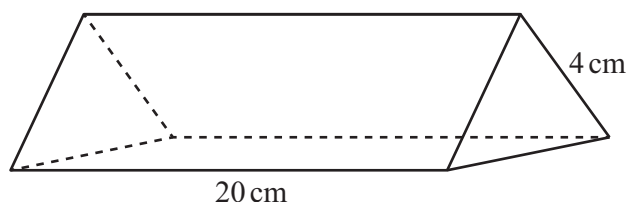
..... g [2]

- (b) A solid cube of side 4 cm is fixed to the base inside an empty cube of side 6 cm.
Water is poured into the larger cube until it reaches the top of the smaller cube.

Calculate the amount of water poured into the larger cube.

..... cm³ [2]

(c)



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The diagram shows a solid triangular prism of length 20 cm.
The cross-section is an equilateral triangle with side length 4 cm.
The prism is made of wood with a density of 0.85 g/cm³.

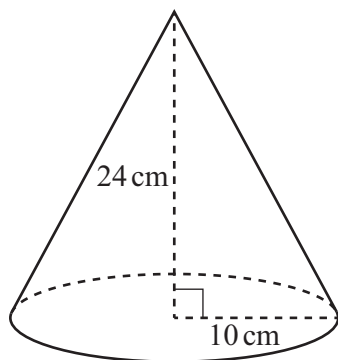
Calculate the mass of the prism.
[Density = mass ÷ volume]

..... g [4]





(d)

NOT TO
SCALE

The diagram shows a solid cone with base radius 10 cm and height 24 cm.

- (i) Show that the **total** surface area of the cone is 1131 cm^2 , correct to the nearest cm^2 .
[The curved surface area of a cone with base radius r and slant height l is $A = \pi r l$.]

[4]

- (ii) The total surface area of the cone is painted.

- (a) The cost to paint the cone is \$1.71 .

Calculate the cost to paint 1 cm^2 of the cone.
Give your answer in cents.

..... cents [1]

- (b) One tin of paint has enough paint to cover 2.5 m^2 .

Calculate the number of these cones that can be painted completely using one tin of paint.

..... [2]





- 5 (a) Naomi runs 100 m in 15 seconds.

Calculate Naomi's average speed in kilometres per hour.

..... km/h [2]

- (b) Olav runs for 45 minutes at a speed of 9.5 km/h.
He then runs 8.1 km at a speed of 7.5 km/h.

Calculate Olav's average speed for the whole run.

..... km/h [3]

- (c) A train has length p metres.
The train passes through a station of length q metres.
The speed of the train is v kilometres per hour.

Find an expression for the time the train takes to completely pass through the station.
Give your answer in seconds, in terms of p , q and v .

..... s [3]





6 (a) Simplify $\frac{24u}{5y} \times \frac{10}{3u}$.

..... [2]

(b) Expand and simplify $(x-1)(x+2)(x+3)$.

..... [3]

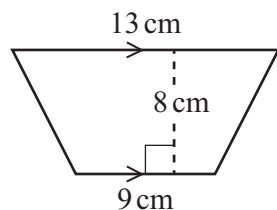
(c) Solve the equation $2x^2 + x - 5 = 0$.
You must show all your working and give your answers correct to 2 decimal places.

$x =$ or $x =$ [4]





7 (a) (i)

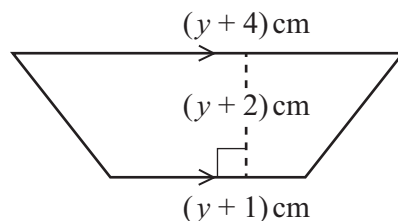


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Calculate the area of the trapezium.

..... cm^2 [2]

(ii)



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The area of this trapezium is 264 cm^2 .

(a) Show that $2y^2 + 9y - 518 = 0$.

[3]

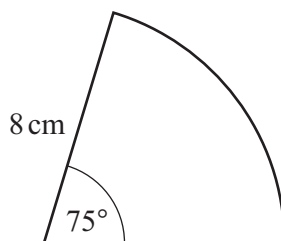
(b) Solve $2y^2 + 9y - 518 = 0$ by factorisation to find the value of y .

$y =$ [3]





(b)

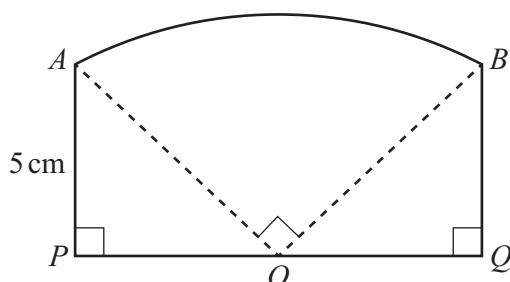
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The diagram shows a sector of a circle with radius 8 cm and angle 75° .

Find the perimeter of the sector.

..... cm [3]

(c)

NOT TO
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The diagram shows a shape $ABQP$ made from three straight lines and an arc of a sector of a circle. The sector has centre O and angle 90° .

POQ is a straight line and $AP = PO = OQ = QB = 5$ cm.

Find the area of $ABQP$.

Give your answer in the form $a + k\pi$.

..... cm^2 [4]





- 8 Guillaume measures the speed of each of 100 cars.
The results are shown in the table.

Speed (v km/h)	$30 < v \leq 40$	$40 < v \leq 45$	$45 < v \leq 50$	$50 < v \leq 70$
Frequency	15	20	35	30

- (a) Guillaume draws a pie chart for this data.

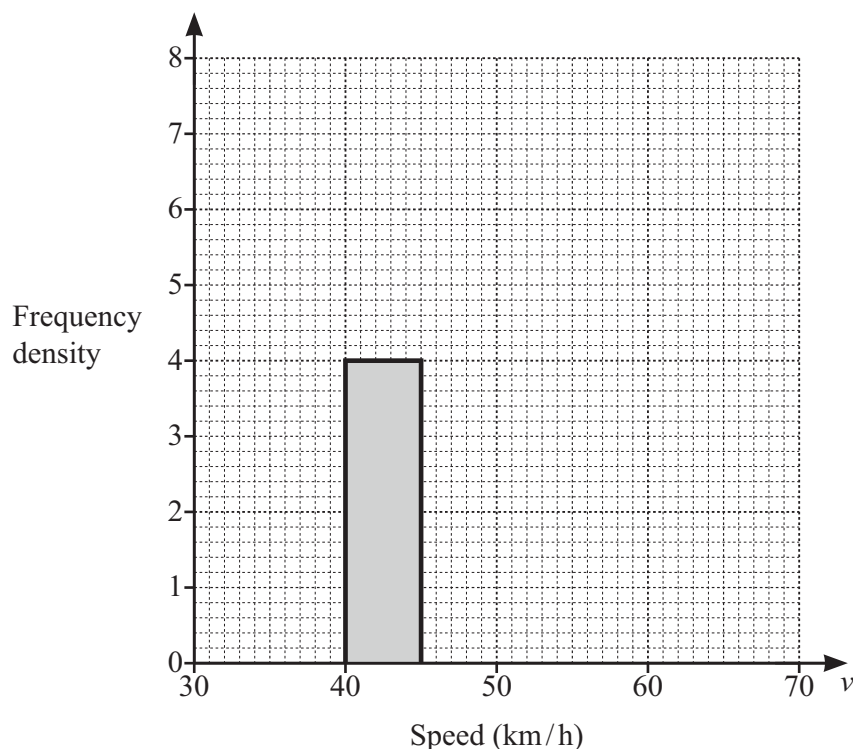
Calculate the angle for the interval $45 < v \leq 50$.

..... [2]

- (b) Calculate an estimate of the mean speed.

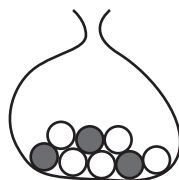
..... km/h [4]

- (c) Complete the histogram to show the data in the table.



[3]





A bag contains 5 white balls and 3 black balls.

- (a) (i) Marwan picks a ball from the bag at random and then replaces it.

Find the probability that the ball is white.

..... [1]

- (ii) Naomi picks a ball from the bag at random and then replaces it.
She repeats this 120 times.

Find the number of times the ball is expected to be white.

..... [1]

- (b) Oscar picks a ball from the bag at random.
He replaces it and then picks a second ball from the bag at random.

- (i) Find the probability that the balls are the same colour.

..... [3]

- (ii) Find the probability that the balls are not the same colour.

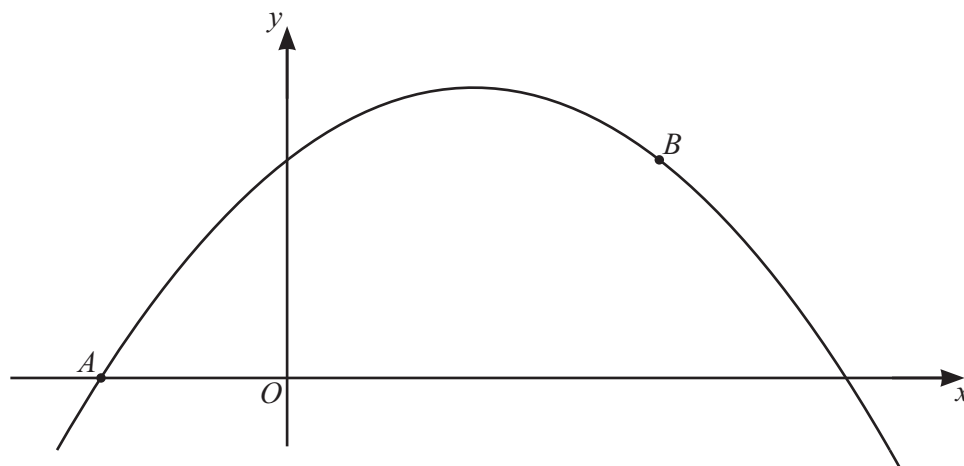
..... [1]

- (c) Priya picks 3 of the 8 balls from the bag at random without replacement.

Find the probability that she picks two white balls and one black ball.

..... [3]





The diagram shows a sketch of the graph of $y = 3 + 2x - x^2$.
 A is the point $(-1, 0)$ and B is the point $(2, 3)$.

(a) Find the derivative of $3 + 2x - x^2$.

..... [2]

(b) (i) Show that the equation of the tangent at A is $y = 4x + 4$.

[3]

(ii) The line L is perpendicular to the line $y = 4x + 4$.
 The line L passes through the point B .

Find the equation of the line L .

Give your answer in the form $y = mx + c$.

$y =$ [3]





(c) Find the coordinates of the maximum point on the graph of $y = 3 + 2x - x^2$.

(..... , ...) [3]





11 $f(x) = 2x + 5$ $g(x) = 1 - 2x$ $h(x) = \frac{1}{x+1}, x \neq -1$ $j(x) = 2^x$

(a) Find $g(-3)$.

..... [1]

(b) Find $f(x)g(x) + fg(x) + 1$.
Give your answer in its simplest form.

..... [4]

(c) Find $g^{-1}(x)$.

$g^{-1}(x) =$ [2]

(d) Find $hh(1)$.

..... [2]

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(e) Simplify $\frac{1}{f(x)} - h(x)$.

Give your answer as a single fraction in its simplest form.

..... [3]

(f) Find x when $j(x) = \frac{1}{32}$.

$x =$ [1]

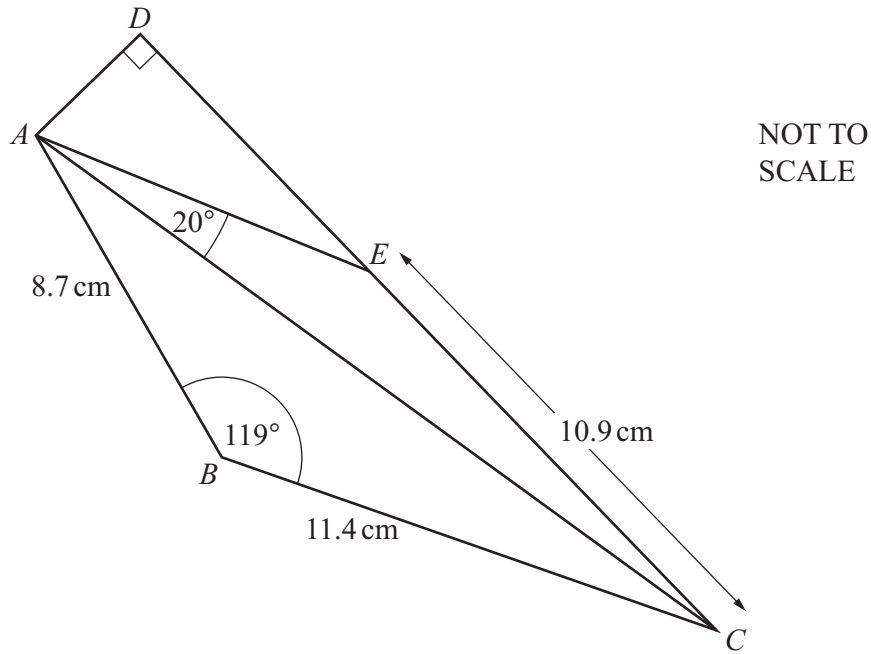
(g) Find x when $j^{-1}(x) = 0$.

$x =$ [1]





12



$ABCD$ is a quadrilateral and E is a point on CD .
 $AB = 8.7 \text{ cm}$, $BC = 11.4 \text{ cm}$ and $CE = 10.9 \text{ cm}$.
 Angle $ADE = 90^\circ$, angle $ABC = 119^\circ$ and angle $CAE = 20^\circ$.

(a) Show that $AC = 17.37 \text{ cm}$, correct to 2 decimal places.

[3]





(b) Angle AEC is obtuse.

Calculate angle ACE .

Angle $ACE = \dots\dots\dots$ [4]

(c) Calculate the perimeter of quadrilateral $ABCD$.

$\dots\dots\dots$ cm [3]



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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2024

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfwf	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	54	2	M1 for $\frac{48}{8}$
1(b)	142	3	B2 for $2c = 278$ or better or M1 for $c + 3 + c - 1 = 280$ OR B2 for $2x = 276$ or better or M1 for $c + 3 - (c - 1) = 4$
1(c)	8.02 or 8.024 to 8.025	2	M1 for $\frac{1750 - 1620}{1620} [\times 100]$ or for $\frac{1750}{1620} \times 100 [-100]$
1(d)	1580	2	M1 for $[...] \times \frac{100 + 10}{100} = 1738$ oe or better
2(a)(i)	(1, 6)	2	B1 for each
2(a)(ii)	$\begin{pmatrix} -4 \\ -2 \end{pmatrix}$	1	
2(a)(iii)	(15, 13)	2	FT <i>their</i> (a)(ii) M1 for $\begin{pmatrix} 12 \\ 6 \end{pmatrix}$ or $\begin{pmatrix} -12 \\ -6 \end{pmatrix}$ seen or for $-1 + 16$ and $5 + 8$ seen
2(b)(i)	Image at (4, 1), (5, -1), (7, -1), (7, 1)	2	B1 for rotation 180° but incorrect position
2(b)(ii)	Image at (1, 3), (-1, 3), (-1, 6), (1, 5)	2	B1 for correct orientation but incorrect position or for drawing line $y = x + 2$

Question	Answer	Marks	Partial Marks
2(b)(iii)	Enlargement [centre] (3, 3) [factor] $-\frac{1}{2}$	3	B1 for each
3(a)	2.5	3	M2 for $\frac{500 \times r \times 14}{100} = 675 - 500$ oe or M1 for $\frac{500 \times r \times 14}{100}$ or for $675 - 500$
3(b)	108.18	3	B2 for 508.18... or 508.2 or 508 or M1 for $400 \times \left(\frac{100 + 2.2}{100}\right)^{11}$ oe or better
3(c)	0.17[0] or 0.1700...	3	M2 for either $^{(12 \times 21)}\sqrt{\frac{1074}{700}}$ or $^{252}\sqrt{\frac{1074}{700}}$ or better or M1 for $700 \times [\dots]^{(12 \times 21)} = 1074$ oe If 0 scored SC1 answer 2.06 or 2.059...
4(a)	250	2	B1 for 6750 or M1 for $7000 - 50 \times 135$ or for $7 - 50 \times 0.135$
4(b)	80	2	M1 for $6 \times 6 \times 4$ or for 4^3 oe OR M1 for $(6 \times 6) - (4 \times 4)$ oe
4(c)	118 or 117.7 to 117.8	4	M3 for $\frac{1}{2} \times 4 \times 4 \times \sin 60 \times 20 \times 0.85$ oe OR M1 for $\frac{1}{2} \times 4 \times 4 \times \sin 60$ or $\frac{1}{2} \times 4 \times \sqrt{4^2 - 2^2}$ oe M1 for $20 \times$ <i>their</i> area of triangle M1 dep for $0.85 \times$ <i>their</i> volume, dependent on previous M1 If 0 scored SC1 for height = 3.46...

Question	Answer	Marks	Partial Marks
4(d)(i)	$\pi \times \sqrt{24^2 + 10^2} \times 10 + \pi \times 10^2$ or $\pi \times \left(\sqrt{24^2 + 10^2} \right)^2 \times \frac{2 \times \pi \times 10}{2 \times \pi \times 26} + \pi \times 10^2$	M3	M2 for $\pi \times \sqrt{24^2 + 10^2} \times 10$ or $\pi \times \left(\sqrt{24^2 + 10^2} \right)^2 \times \frac{2 \times \pi \times 10}{2 \times \pi \times 26}$ or M1 for $24^2 + 10^2$ or $\pi \times 10^2$
	1130.9 to 1131.1...	A1	Must see at least 5 sf
4(d)(ii)(a)	0.151 or 0.1511 to 0.1512...	1	
4(d)(ii)(b)	22	2	B1 for figs 22[1...] or M1 for $\frac{2.5 \times 100^2}{1131}$
5(a)	24	2	M1 for $\frac{100 \text{ or } 0.1}{\text{time}}$ or B1 for figs 24
5(b)	8.32 or 8.319 to 8.320	3	M1 for $9.5 \times \frac{45}{60}$ oe M1 for $\frac{8.1}{7.5}$
5(c)	$\frac{18(p+q)}{5v}$ oe final answer	3	M1 for $[k \times] \frac{(p+q)}{v}$ for some $k \neq 0$ M1 for $v \times \frac{1000}{3600}$ oe soi
6(a)	$\frac{16}{y}$ final answer	2	M1 for $\frac{240u}{15uy}$ or better
6(b)	$x^3 + 4x^2 + x - 6$ final answer	3	B2 for correct unsimplified expansion of three brackets or for simplified four-term expression of correct form with 3 terms correct in final answer or B1 for correct expansion of two given brackets with at least 3 terms out of 4 correct

Question	Answer	Marks	Partial Marks
6(c)	$\frac{-1 \pm \sqrt{1^2 - 4(2)(-5)}}{2(2)}$	M2	M1 for $\sqrt{1^2 - 4(2)(-5)}$ or better or for $\frac{-1 + \sqrt{p}}{2(2)}$ or $\frac{-1 - \sqrt{p}}{2(2)}$
	-1.85, 1.35	A2	A1 for each or -1.851 to -1.850 and 1.350 to 1.351 or -1.9 and 1.4 or -1.35 and 1.85
7(a)(i)	88	2	M1 for $\frac{1}{2}(9+13) \times 8$ oe
7(a)(ii)(a)	$\frac{1}{2}(y+4+y+1) \times (y+2) [=264]$ or $\frac{1}{2} \times 3 \times (y+2) + (y+1) \times (y+2) [=264]$	M1	
	$2y^2 + 5y + 4y + 10$	B1	
	Leading to $2y^2 + 9y - 518 = 0$	A1	No errors or omissions
7(a)(ii)(b)	$(2y+37)(y-14)$	B2	B1 for $(2y+a)(y+b)$ where $ab = -518$ or $a + 2b = 9$ or $2y(y-14) + 37(y-14)$ or $y(2y+37) - 14(2y+37)$
	14	B1	
7(b)	26.5 or 26.47...	3	B2 for 10.5 or 10.47... or $\frac{10\pi}{3}$ OR M2 for $8 + 8 + \frac{75}{360} \times 2\pi 8$ or M1 for $\frac{75}{360} \times 2\pi 8$
7(c)	$25 + \frac{25}{2}\pi$	4	M2 for $\frac{90}{360} \times \pi \times (\sqrt{5^2 + 5^2})^2$ or M1 for [radius $^2 = $] $5^2 + 5^2$ M1 for [triangle area =] [2×] $\frac{1}{2} \times 5 \times 5$ oe

Question	Answer	Marks	Partial Marks
8(a)	126	2	M1 for $\frac{35}{100} \times 360$
8(b)	48.375	4	M1 for mid-values 35, 42.5, 47.5, 60 soi M1 for $15 \times 35 + 20 \times 42.5 + 35 \times 47.5 + 30 \times 60$ M1 dep $\frac{\Sigma fx}{100}$ dep on second M1
8(c)	Correct histogram with correct widths and heights 1.5, ... 7, 1.5	3	B1 for each column If 0 scored, SC1 for freq. densities 1.5, ...7, 1.5 seen or $\frac{15}{10}, \frac{35}{5}, \frac{30}{20}$
9(a)(i)	$\frac{5}{8}$ oe	1	
9(a)(ii)	75	1	FT <i>their (a)(i)</i>
9(b)(i)	$\frac{17}{32}$ oe	3	M2 for $\frac{5}{8} \times \frac{5}{8} + \frac{3}{8} \times \frac{3}{8}$ or M1 for $\frac{5}{8} \times \frac{5}{8}$ or $\frac{3}{8} \times \frac{3}{8}$
9(b)(ii)	$\frac{15}{32}$ oe	1	FT <i>their (b)(i)</i>
9(c)	$\frac{15}{28}$ oe	3	M2 for $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} \times k, k = 1 \text{ or } 2 \text{ or } 3$ oe M1 for $\frac{5}{8}$ and $\frac{4}{7}$ and $\frac{3}{6}$ or showing the three possible combinations oe If 0 scored SC1 for $\frac{225}{512}$ oe
10(a)	$2 - 2x$	2	B1 for $k - 2x$ or $2 - kx$ or $3 + 2 - 2x$
10(b)(i)	Gradient (m) = correct substitution of -1 into <i>their</i> (a) $2 - 2(-1)$	M1	
	$0 = \text{their } m \times -1 + c$ or $y [-0] = \text{their } m(x - -1)$ oe	M1	Dep on previous M1
	$c = 4$ and leading to $y = 4x + 4$	A1	

Question	Answer	Marks	Partial Marks
10(b)(ii)	$-\frac{1}{4}x + \frac{7}{2}$ oe	3	M1 for $-\frac{1}{4}$ M1 for $3 = \text{their } m \times 2 + c$ or better or $y - 3 = \text{their } m(x - 2)$ or better
10(c)	(1, 4)	3	B2 for $x = 1$ or M1 for <i>their</i> (a) = 0 M1 for substituting <i>their</i> 1 into $y = 3 + 2x - x^2$ OR B2 for $x = 1$ or M2 for $4 - (x - 1)^2$ or M1 for $(x - 1)^2$
11(a)	7	1	
11(b)	$-4x^2 - 12x + 13$ final answer	4	B1 for $(2x + 5)(1 - 2x)$ B1 for $2x - 4x^2 + 5 - 10x$ oe B1 for $2(1 - 2x) + 5$
11(c)	$\frac{1-x}{2}$ oe final answer	2	M1 for $x = 1 - 2y$ or $2x = 1 - y$ or $\frac{y}{2} = \frac{1}{2} - x$
11(d)	$\frac{2}{3}$ oe	2	M1 for $h\left(\frac{1}{2}\right)$ or $\frac{1}{\frac{1}{x+1} + 1}$ oe
11(e)	$\frac{-x-4}{(2x+5)(x+1)}$ or $\frac{-x-4}{2x^2+7x+5}$ or $-\frac{x+4}{2x^2+7x+5}$ final answer	3	M1 for $x+1 - (2x+5)$ oe M1 for common denominator $(2x+5)(x+1)$ seen
11(f)	-5	1	
11(g)	1	1	
12(a)	$\sqrt{8.7^2 + 11.4^2 - 2 \times 8.7 \times 11.4 \cos 119}$	M2	M1 for $8.7^2 + 11.4^2 - 2 \times 8.7 \times 11.4 \cos 119$ A1 for 301.8...
	17.372 to 17.373	A1	

Question	Answer	Marks	Partial Marks
12(b)	13.[0] or 13.02 to 13.03	4	M2 for $\sin E = \frac{17.37 \sin 20}{10.9}$ or M1 for $\frac{10.9}{\sin 20} = \frac{17.37}{\sin E}$ oe M1 for $\angle ACE = 180 - 20 - \text{their obtuse } AEC$ oe
12(c)	40.9 or 40.91 to 40.94	3	M1 for a correct implicit trig statement for AD e.g. $\sin(\text{their acute } ACE) = \frac{AD}{17.37}$ oe M1 for a correct implicit statement for CD e.g. $\cos(\text{their acute } ACE) = \frac{CD}{17.37}$ oe or $CD^2 = 17.37^2 - (\text{their } AD)^2$ or for a correct statement for ED eg $\tan(180 - \text{their obtuse } \angle AEC) = \frac{\text{their } AD}{ED}$



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MATHEMATICS

0580/21

Paper 2 (Extended)

May/June 2024

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

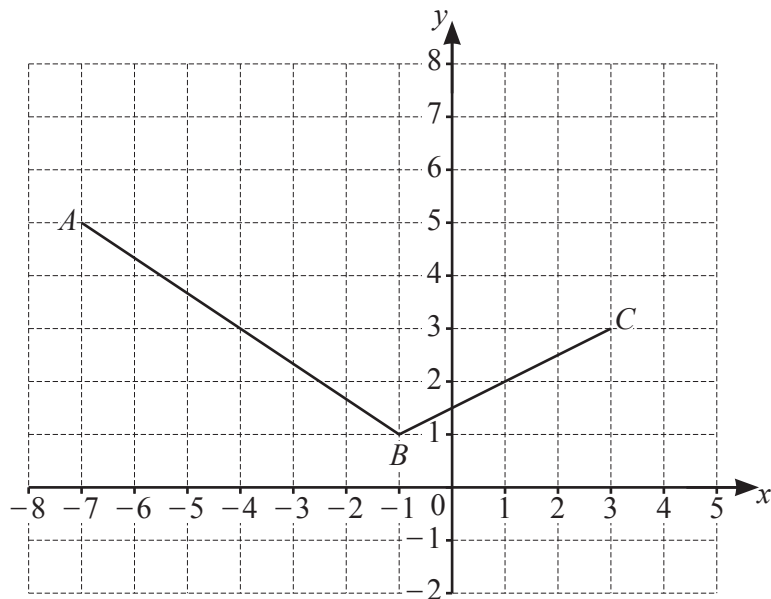
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

1



The diagram shows two sides of a parallelogram $ABCD$.

Find the coordinates of point D .

(..... , ...) [2]

- 2 Geetha has a box of toys.
She picks a toy at random from the box.
The probability that she picks a wooden toy is 0.6 .

(a) Work out the probability that she does not pick a wooden toy.

..... [1]

(b) The box contains three types of toys, wooden, plastic or metal.

Type of toy	Wooden	Plastic	Metal
Number of toys		14	14
Probability	0.6		

Complete the table.

[2]

- 3 The table shows some information about two sequences.

	n th term	5th term
Sequence A	$60 - 4n$	
Sequence B	$n^2 - 300$	

- (a) Complete the table.

[2]

- (b) Find the smallest **positive** number in sequence B .

..... [2]

- 4 Find the greatest **odd** number that is a factor of 140 and a factor of 210.

..... [2]

- 5 Calculate.

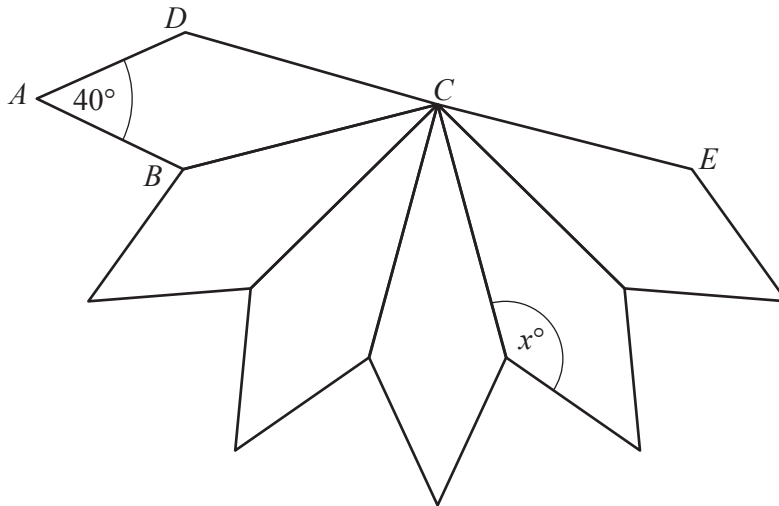
(a) $\sqrt[3]{343} - \sqrt{40.96}$

..... [1]

(b) $(192 + 4 \times 16)^{1.25}$

..... [1]

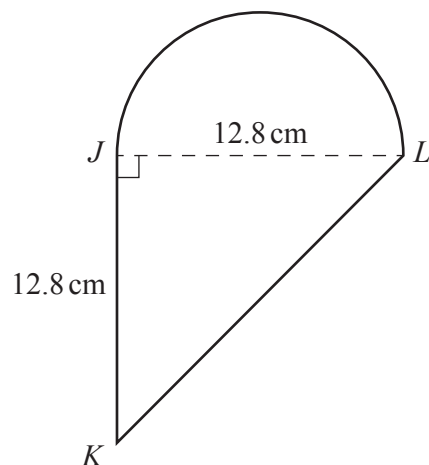
6

NOT TO
SCALE

The diagram shows 5 kites that are congruent to kite $ABCD$.
 Each kite is joined to the next kite along one edge.
 Angle $DAB = 40^\circ$ and DCE is a straight line.

Find the value of x .

$x = \dots\dots\dots$ [3]



NOT TO
SCALE

The diagram shows a shape made from a triangle JKL and a semicircle with diameter JL . JKL is an isosceles right-angled triangle with $JK = JL = 12.8$ cm.

(a) Calculate the area of this shape.

..... cm^2 [3]

(b) Calculate the perimeter of this shape.

..... cm [4]

6

- 8 These are the first five terms of a sequence.

11 18 25 32 39

Find an expression for the n th term of the sequence.

..... [2]

- 9 The value of a car is \$8000.
Each year the value of the car decreases exponentially by 25%.

Calculate the value of this car after 3 years.

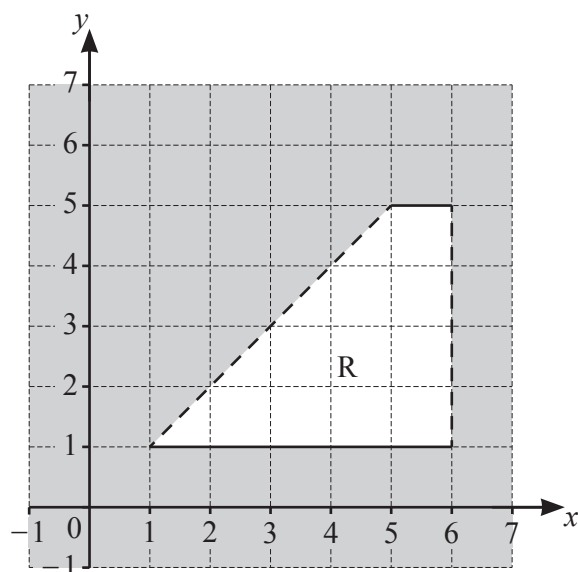
\$ [2]

- 10 Amir invests \$1500 in an account.
The account pays compound interest at a rate of r % per year.
At the end of 8 years the value of his investment is \$1656.73 .

Find the value of r .

$r =$ [3]

11



Find the inequalities that define the unshaded region, R.

..... [4]

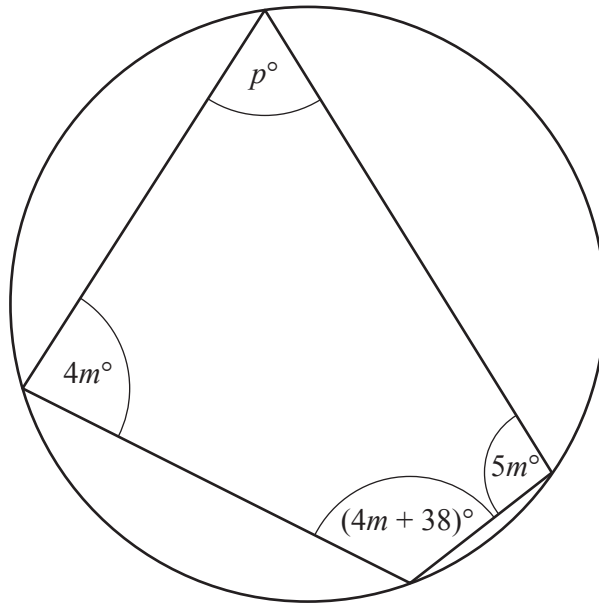
- 12 Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}\frac{3x}{2} + 5y &= 5 \\ 4x - 3y &= 46\end{aligned}$$

$x =$

$y =$ [4]

13

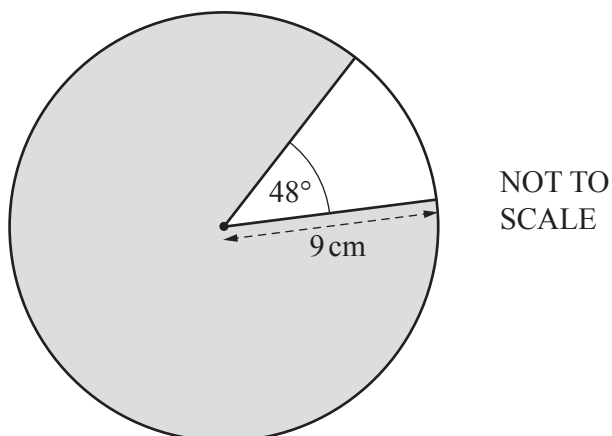
NOT TO
SCALE

The diagram shows a cyclic quadrilateral.

Find the value of p .

$p = \dots\dots\dots$ [3]

14



The diagram shows a circle with radius 9 cm.

Calculate the area of the shaded major sector.

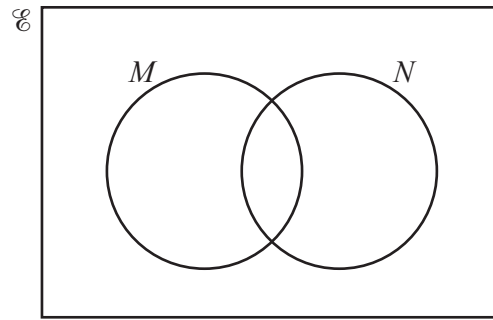
..... cm² [3]

- 15 Write $0.1\dot{4}\dot{6}$ as a fraction in its simplest form.
You must show all your working.

..... [3]

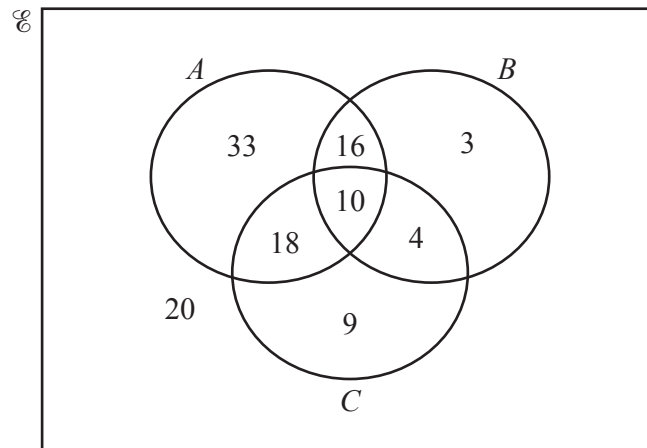
10

- 16 (a) In the Venn diagram, shade the region $M' \cap N'$.



[1]

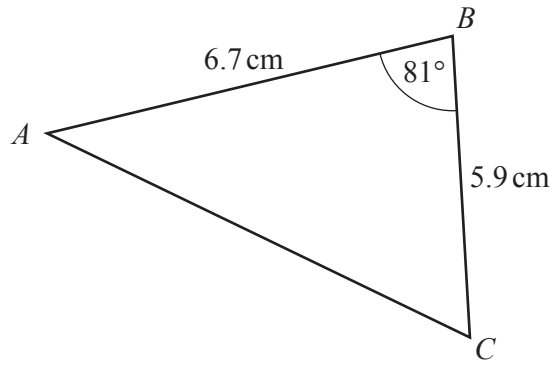
- (b) Find $n(B \cap (A' \cup C))$.



..... [1]

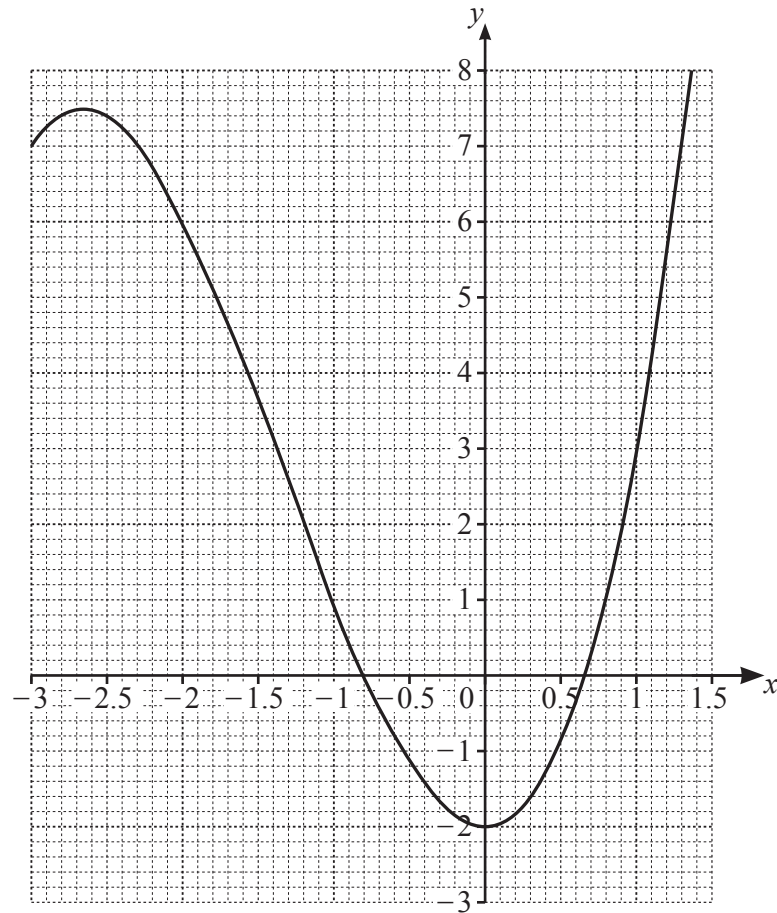
11

17

NOT TO
SCALE

Calculate the area of triangle ABC .

..... cm^2 [2]



The diagram shows the graph of $y = x^3 + 4x^2 - 2$ for $-3 \leq x \leq 1.5$.

By drawing a suitable straight line, solve the equation $x^3 + 4x^2 - 2 = 2x$ for $-3 \leq x \leq 1.5$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

19 Factorise completely.

(a) $12m^2 - 75t^2$

..... [3]

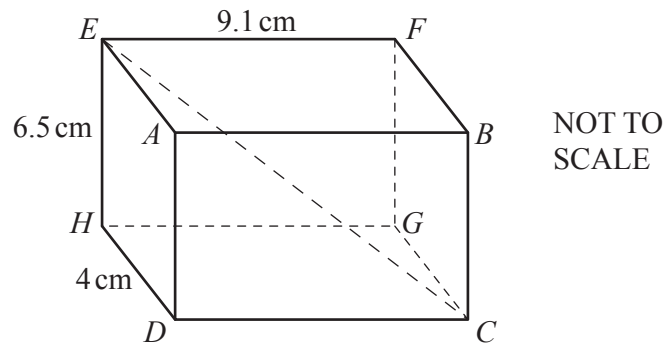
(b) $xy + 15 + 3y + 5x$

..... [2]

20 Solve the equation $8 \sin x + 6 = 1$ for $0^\circ \leq x \leq 360^\circ$.

$x =$ or $x =$ [3]

21



The diagram shows a cuboid.

$HD = 4\text{ cm}$, $EH = 6.5\text{ cm}$ and $EF = 9.1\text{ cm}$.

Calculate the angle between CE and the base $CDHG$.

..... [4]

- 22 Bag A and bag B each contain red counters and blue counters only.
Stephan picks a counter at random from bag A and Jen picks a counter at random from bag B .

The probability that Stephan picks a red counter is 0.4 .

The probability that Stephan and Jen both pick a red counter is 0.25 .

Find the probability that Stephan and Jen both pick a blue counter.

..... [4]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

May/June 2024

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

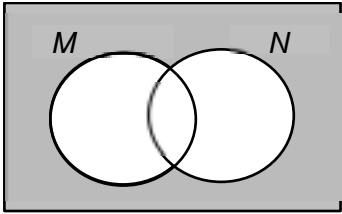
- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	$(-3, 7)$	2	B1 for correct diagram or correct coordinates for <i>their</i> point <i>D</i> or for $(-3, k)$ or $(k, 7)$
2(a)	0.4 oe	1	
2(b)	42 0.2 0.2	2	B1 for 42 B1 for 0.2 and 0.2 If B0 scored SC1 for <i>their</i> two probabilities being half <i>their</i> (a)
3(a)	40 -275	2	B1 for each
3(b)	24	2	B1 for 324 or 289 or $\sqrt{300}$ or 17.3...
4	35	2	B1 for answer 5, 7 or 70 or M1 for $2 \times 2 \times 5 \times 7$ and $2 \times 3 \times 5 \times 7$ or two correct factor trees or tables or $5 \times 7 \times k$ seen
5(a)	0.6 or $\frac{3}{5}$	1	
5(b)	1024	1	
6	145	3	M1 for $180 \div 6$ or any angle congruent to $BCD = 30$ M1 for $(360 - 40 - \text{their } 30) \div 2$ oe
7(a)	146 or 146.2 to 146.3	3	M1 for $\frac{1}{2} \times 12.8 \times 12.8$ M1 for $\left[\frac{1}{2} \times \right] \pi \times \left(\frac{12.8}{2} \right)^2$

Question	Answer	Marks	Partial Marks
7(b)	51[.0] or 51.00 to 51.01...	4	M1 for $\frac{1}{2} \times \pi \times 12.8$ M2 for $\sqrt{12.8^2 + 12.8^2}$ or $\frac{12.8}{\sin 45}$ oe or M1 for $12.8^2 + 12.8^2$ oe or $\sin 45 = \frac{12.8}{KL}$ oe
8	$7n + 4$ oe final answer	2	B1 for $7n + j$ or $kn + 4$ $k \neq 0$, or $7n + 4$ seen then spoilt
9	3375	2	M1 for $8000 \times \left(1 - \frac{25}{100}\right)^3$ oe
10	1.25 or 1.250...	3	M2 for $\sqrt[8]{\frac{1656.73}{1500}}$ oe or M1 for $1656.73 = 1500(k)^8$ oe for any k
11	$y < x$ $x < 6$ $1 \leq y \leq 5$ oe	4	B1 for $y < x$ B1 for $x < 6$ B2 for $1 \leq y \leq 5$ or B1 for $y \geq 1$ or $y \leq 5$ If B0 scored, SC2 for $y \leq x$, $x \leq 6$ and $1 < y < 5$ oe or SC1 for three correct from $y = x$, $x = 6$, $y = 1$ and $y = 5$
12	Correctly equating one set of coefficients	M1	
	Correct method to eliminate one variable	M1	
	$x = 10$, $y = -2$	A2	A1 for $x = 10$ A1 for $y = -2$ If M0 scored SC1 for 2 values satisfying one of the original equations.
13	62	3	B2 for $m = 20$ or M1 for $5m + 4m = 180$ soi or $p + 4m + 38 = 180$ soi

Question	Answer	Marks	Partial Marks
14	221 or 220.5 to 220.6	3	M2 for $\frac{360-48}{360} \times \pi \times 9^2$ or M1 for $\frac{k}{360} \times \pi \times 9^2$ where $k < 360$ or B1 for 312
15	$146.\dot{4}\dot{6} - 1.\dot{4}\dot{6}$ oe	M1	
	$\frac{29}{198}$ cao	A2	A1 for $\frac{145}{990}$ oe If M0 scored SC1 for $\frac{k}{990}$ with insufficient working.
16(a)		1	
16(b)	17	1	
17	19.5 or 19.52...	2	M1 for $\frac{1}{2} \times 6.7 \times 5.9 \times \sin 81$ oe
18	$y = 2x$ ruled	B1	
	$x = -0.5$ to -0.55 $x = 0.85$ to 0.9	B2	B1 for -0.5 to -0.55 B1 for 0.85 to 0.9
19(a)	$3(2m + 5t)(2m - 5t)$ final answer	3	B2 for $(6m + 15t)(2m - 5t)$ or $(2m + 5t)(6m - 15t)$ or B1 for $3(4m^2 - 25t^2)$ or $(2m + 5t)(2m - 5t)$
19(b)	$(x + 3)(y + 5)$ final answer	2	B1 for $x(y + 5) + 3(y + 5)$ or $y(x + 3) + 5(x + 3)$
20	218.7, 321.3	3	B2 for one correct or M1 for $\sin x = -\frac{5}{8}$ oe If M1 or 0 scored, SC1 for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180

Question	Answer	Marks	Partial Marks
21	33.2 or 33.18...	4	M3 for $\tan = \frac{6.5}{\sqrt{4^2 + 9.1^2}}$ oe or M2 for $4^2 + 9.1^2$ oe or $4^2 + 9.1^2 + 6.5^2$ oe or M1 for recognising the angle ECH
22	0.225 oe	4	M3 for $\left(1 - \frac{0.25}{0.4}\right) \times (1 - 0.4)$ oe OR M2 for $\frac{0.25}{0.4}$ or M1 for $0.4 \times p = 0.25$ oe M1 for $(1 - \text{their } P(\text{Jen red})) \times (1 - 0.4)$ oe



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MATHEMATICS

0580/22

Paper 2 (Extended)

May/June 2024

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 The temperature at midnight is -4°C .
The temperature at noon is 25°C .

Work out the difference between these two temperatures.

..... $^{\circ}\text{C}$ [1]

- 2 A gardener charges \$6.55 for each hour he works plus a fixed charge of \$15.50 .

Calculate the total amount he charges when he works for 4 hours.

\$ [2]

- 3 A delivery driver records the number of pizzas she delivers each month for one year.

48	44	39	28	57	22
36	41	54	57	49	52

- (a) Complete the stem-and-leaf diagram.

2	
3	
4	
5	

Key: 4 | 8 represents 48 pizzas

[2]

- (b) Find the median.

..... [1]

- 4 Jonah has \$750.
He spends $\frac{1}{4}$ of this money on travel and some of this money on food.
He now has \$437.50 .

Work out the fraction of the \$750 he spends on food.

..... [3]

- 5 The table shows part of a tram timetable.

Newpoint	Westhill
10 30	11 17
12 18	
13 30	14 17

All the trams take the same number of minutes to complete the journey from Newpoint to Westhill.

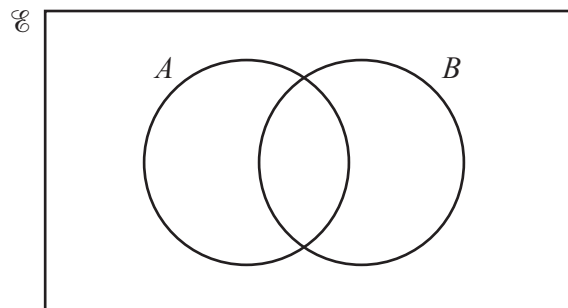
Complete the table.

[2]

- 6 Write 0.04628 correct to 2 significant figures.

..... [1]

7



On the Venn diagram, shade the region $A \cup B$.

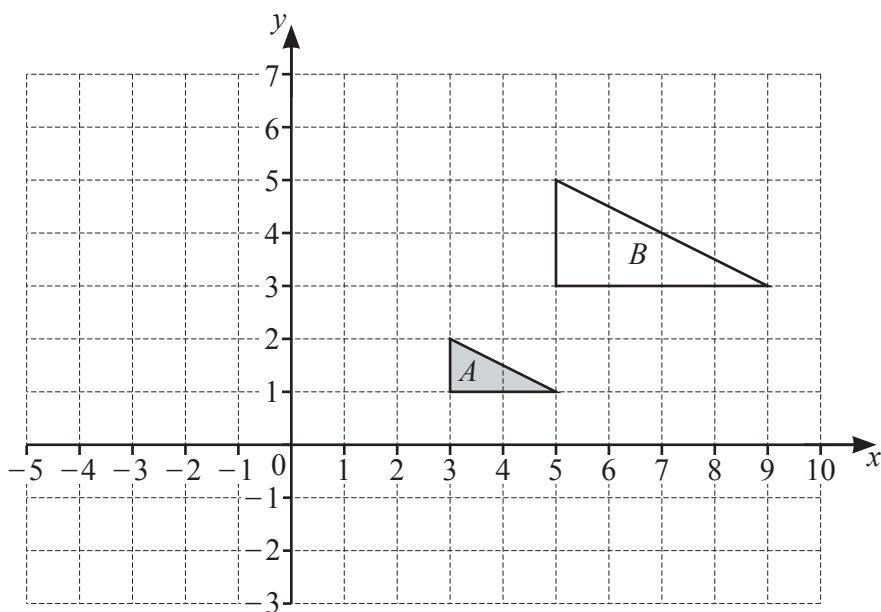
[1]

- 8 Kai invests \$5000 in an account paying simple interest at a rate of $r\%$ per year. At the end of 8 years, the value of his investment is \$5700.

Find the value of r .

$r = \dots\dots\dots$ [3]

9



- (a) Describe fully the **single** transformation that maps triangle A onto triangle B .

$\dots\dots\dots$
 $\dots\dots\dots$ [3]

- (b) On the grid, draw the image of triangle A after a translation by the vector $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$. [2]

- 10 Write 174 000 in standard form.

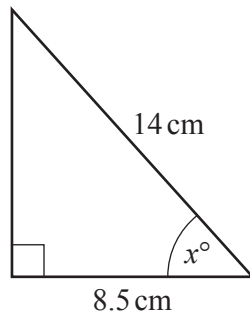
$\dots\dots\dots$ [1]

- 11 A company surveys 40 of its employees.
In the survey, 3 employees say they walk to work.
The company has a total of 1240 employees.

Find the expected number of employees in the company who walk to work.

..... [2]

12



NOT TO
SCALE

The diagram shows a right-angled triangle.

Calculate the value of x .

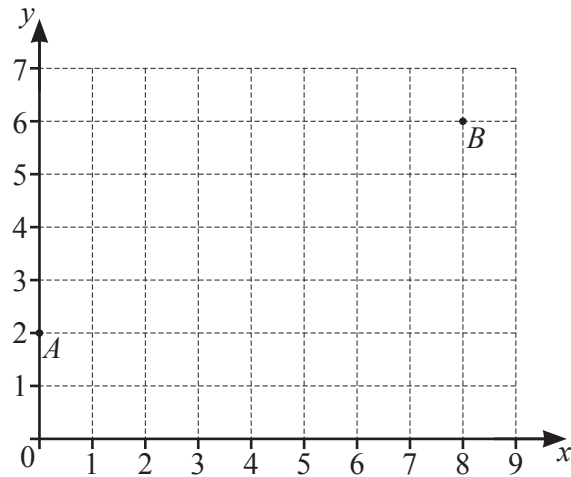
$x =$ [2]

- 13 **Without using a calculator**, work out $2\frac{1}{4} \div 1\frac{7}{8}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

14



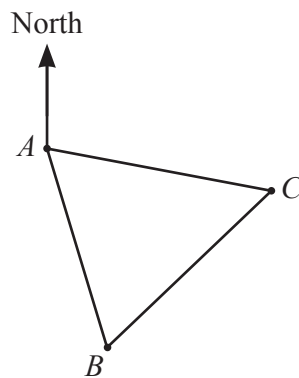
A is the point $(0, 2)$ and B is the point $(8, 6)$.

Find the equation of line AB .

Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [2]

15



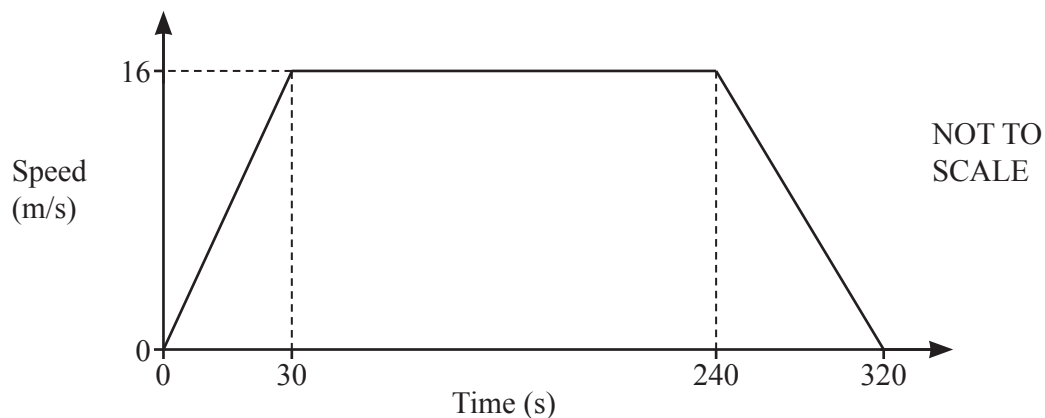
NOT TO
SCALE

Three towns, A , B and C , are equidistant from each other.
The bearing of C from A is 104° .

Calculate the bearing of B from C .

$\dots\dots\dots$ [3]

16 The speed–time graph shows information about a car journey.



(a) Find the deceleration of the car between 240 and 320 seconds.

..... m/s^2 [1]

(b) Calculate the total distance the car travels during the 320 seconds.

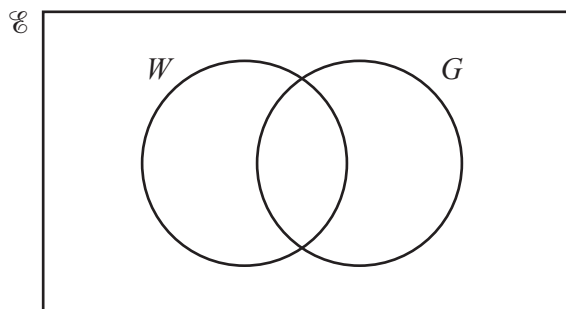
..... m [3]

17 $W = \{\text{students who walk to school}\}$
 $G = \{\text{students who wear glasses}\}$

There are 20 students in a class.

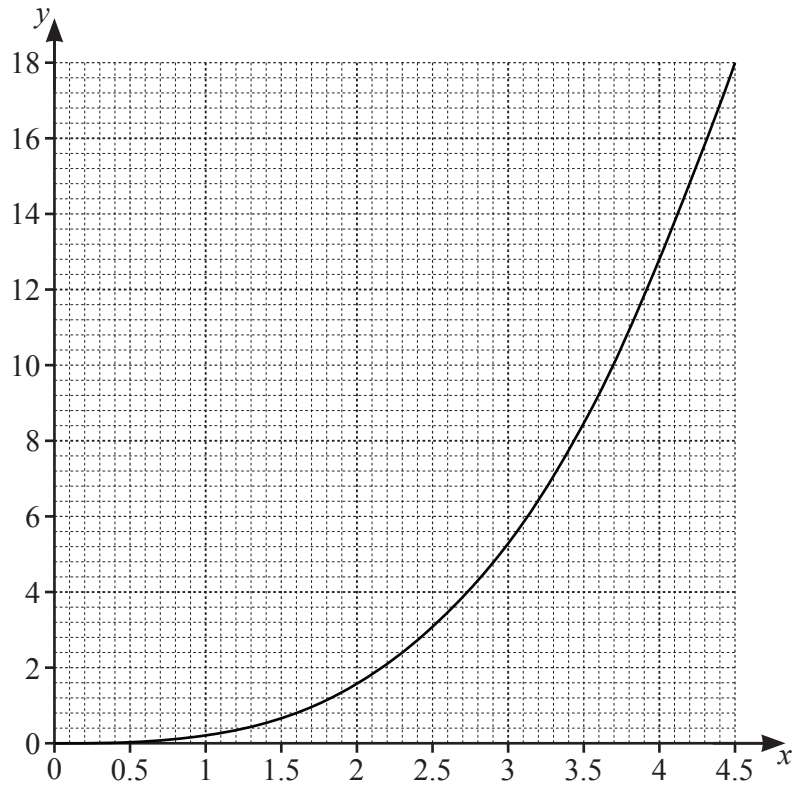
- 8 walk to school
- 3 wear glasses and walk to school
- 2 do not wear glasses and do not walk to school.

Complete the Venn diagram.



[2]

18



The graph of $y = f(x)$ is drawn on the grid.

(a) Draw the tangent to the graph at the point $x = 3$. [1]

(b) Use your tangent to find an estimate for the gradient of the curve at the point $x = 3$.

..... [2]

19 (a) y is directly proportional to $(x-1)^2$.
When $x = 4$, $y = 3$.

Find y when $x = 7$.

$y =$ [3]

(b) m is inversely proportional to the square root of p .

Explain what happens to the value of m when the value of p is multiplied by 9.

..... [1]

- 20 Two parcels are mathematically similar.
 The larger parcel has volume 80 cm^3 and height 5.2 cm .
 The smaller parcel has volume 33.75 cm^3 .

Calculate the height of the smaller parcel.

..... cm [3]

- 21 Solve the simultaneous equations.
 You must show all your working.

$$4y + 3x = 13$$

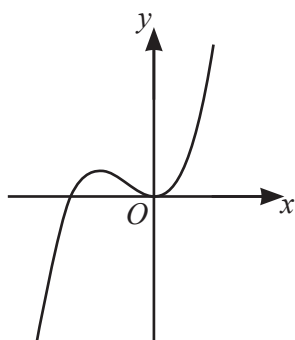
$$y = x^2 - 18$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$\text{or } x = \dots\dots\dots y = \dots\dots\dots [5]$$

22 (a) For each sketch, put a ring around the correct type of function shown.

(i)



linear

cubic

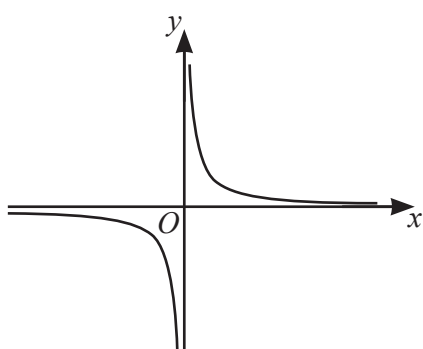
quadratic

reciprocal

exponential

[1]

(ii)



linear

cubic

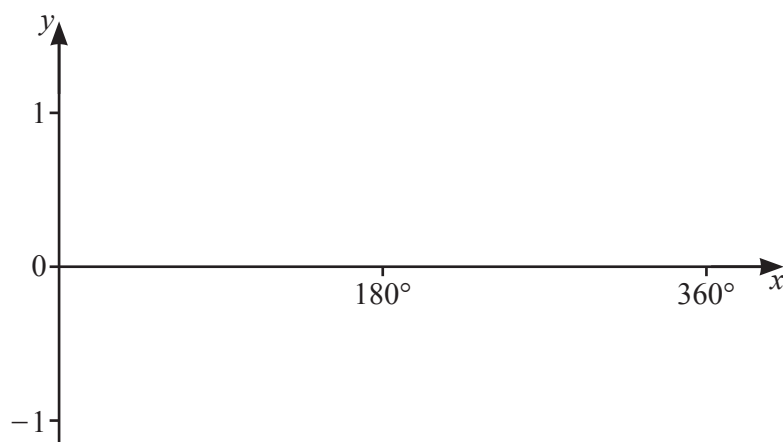
quadratic

reciprocal

exponential

[1]

(b) (i) On the grid, sketch the curve $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

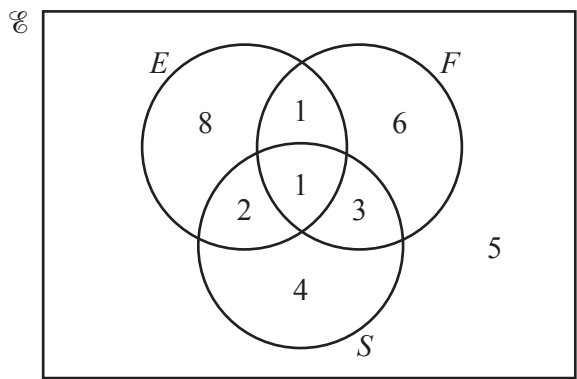


[2]

(ii) Solve the equation $\sin x + 0.4 = 0$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

23



The Venn diagram shows information about the number of students in a class. Some study English (E), some study French (F), some study Spanish (S) and some do not study any of these languages.

(a) Find $n((E \cup F)' \cup S)$.

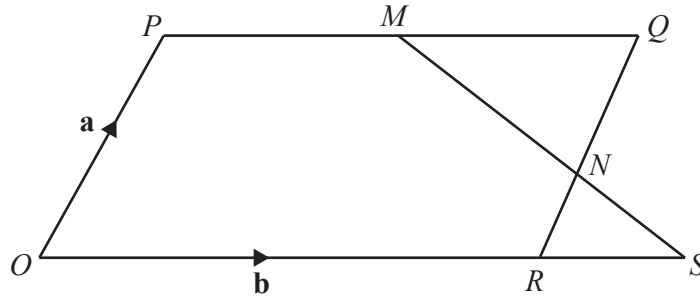
..... [1]

(b) One student is picked at random from those who study Spanish.

Find the probability that this student studies exactly two languages.

..... [2]

Question 24 is printed on the next page.



NOT TO
SCALE

O is the origin and $OPQR$ is a parallelogram.
 M is the midpoint of PQ and N divides QR in the ratio $2 : 1$.
 $\overrightarrow{OP} = \mathbf{a}$ and $\overrightarrow{OR} = \mathbf{b}$.

- (a) Find $\overrightarrow{MN}$.
 Give your answer in terms of $\mathbf{a}$ and/or $\mathbf{b}$ and in its simplest form.

$$\overrightarrow{MN} = \dots\dots\dots [2]$$

- (b) The lines MN and OR are extended to meet at S .

Find the position vector of S .
 Give your answer in terms of $\mathbf{a}$ and/or $\mathbf{b}$ and in its simplest form.

$$\dots\dots\dots [3]$$

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

May/June 2024

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

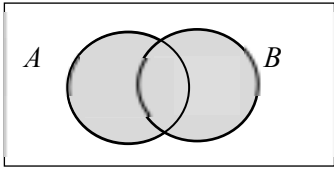
Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Mark	Partial Marks								
1	29	1									
2	41.7[0]	2	M1 for $6.55 \times 4 + 15.5$								
3(a)	Correct table <table><tr><td>2</td><td>2 8</td></tr><tr><td>3</td><td>6 9</td></tr><tr><td>4</td><td>1 4 8 9</td></tr><tr><td>5</td><td>2 4 7 7</td></tr></table>	2	2 8	3	6 9	4	1 4 8 9	5	2 4 7 7	2	B1 for two rows correct or for fully correct unordered stem-and-leaf diagram
2	2 8										
3	6 9										
4	1 4 8 9										
5	2 4 7 7										
3(b)	46	1									
4	$\frac{1}{6}$ or equivalent fraction	3	B2 for $\frac{625}{750}$ oe or M2 for $750 - \frac{750}{4} - 437.5$ oe or M1 for $750 - \frac{750}{4}$ oe or $\frac{750}{4} + 437.5$ oe or $\frac{437.5}{750}$ oe								
5	13 05 or 1 05pm	2	M1 for 47 [minutes]								
6	0.046 cao	1									

Question	Answer	Mark	Partial Marks
7		1	
8	1.75	3	M2 for $\frac{(5700-5000)[\times 100]}{5000 \times 8}$ oe or $\frac{(5700-5000) \times 100}{5000[\times 8]}$ oe or M1 for $[5700 - 5000] = \frac{5000 \times 8 \times r}{100}$ oe or B1 for 87.5 or 0.14 or 1.14 If 0 scored SC1 for answer 14.25
9(a)	Enlargement [s f] 2 [centre] (1, -1)	3	B1 for each
9(b)	image at $(-1, 4)(-1, 5)(1, 4)$	2	B1 for translation by $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 3 \end{pmatrix}$
10	1.74×10^5	1	
11	93	2	M1 for $\frac{3}{40}[\times 1240]$ oe or $\frac{1240}{40}[\times 3]$ oe or $\frac{40}{3} = \frac{1240}{x}$ oe
12	52.6 or 52.61 to 52.62	2	M1 for $\cos[\dots] = \frac{8.5}{14}$ oe
13	$\frac{9}{4} \times \frac{8}{15}$ oe or $\frac{18}{8} \div \frac{15}{8}$ oe with common denominator	M2	B1 for $\frac{9}{4}$ oe or $\frac{15}{8}$ oe or M1 for $\frac{\text{their } 9}{4} \times \frac{8}{\text{their } 15}$ oe
	$1\frac{1}{5}$ cao	A1	dep on M2

Question	Answer	Mark	Partial Marks
14	$y = \frac{1}{2}x + 2$ oe	2	M1 for $\frac{6-2}{8-0}$ oe or for $y = kx + 2$
15	224	3	M2 for a fully correct method e.g. $360 - (180 - 104 + 60)$ oe or B2 for 120, 136, 44, 46, 14, or 16 in the correct position or B1 for 60, 76, 104 or 284 in the correct position or for interior angle of triangle = 60 i.e. these positions for B2 or <u>B1</u>:
16(a)	0.2 oe	1	
16(b)	4240	3	M2 for $\frac{1}{2} \times (210 + 320) \times 16$ oe or M1 for one area correct
17		2	B1 for 2 sections out of 4 correct
18(a)	tangent ruled at $x = 3$	1	

Question	Answer	Mark	Partial Marks
18(b)	4.8 to 5.8	2	dep on a close attempt at a tangent M1 for $\frac{\text{rise}}{\text{run}}$ also dep on close attempt at tangent
19(a)	12	3	M1 for $y = k(x-1)^2$ oe M1 for $y = \text{their } k(7-1)^2$ oe
19(b)	divided by 3 oe	1	
20	3.9	3	M2 for $5.2 \times \sqrt[3]{\frac{33.75}{80}}$ oe or M1 for $\frac{\sqrt[3]{33.75}}{\sqrt[3]{80}}$ oe or $\frac{\sqrt[3]{80}}{\sqrt[3]{33.75}}$ oe or $\frac{h^3}{5.2^3} = \frac{33.75}{80}$ oe
21	$4x^2 + 3x - 85 [= 0]$ or $16y^2 - 113y + 7 [= 0]$ oe simplified	M2	M1 for $4(x^2 - 18) + 3x = 13$ or $x^2 - 18 = \frac{13-3x}{4}$ or $y = \left(\frac{13-4y}{3}\right)^2 - 18$ oe or better
	correct method to solve <i>their</i> quadratic equation e.g. factors, quadratic formula, completing the square	M1	$\frac{-3 \pm \sqrt{3^2 - 4 \times 4 \times -85}}{2 \times 4}$ oe, $(4x - 17)(x + 5)$ $\frac{-(-113) \pm \sqrt{(-113)^2 - 4 \times 16 \times 7}}{2 \times 16}$ oe, $(16y - 1)(y - 7)$
	$x = -5$ $y = 7$ $x = \frac{17}{4}$ oe $y = \frac{1}{16}$ oe	B2	B1 for one correct pair or two correct x values or two correct y values If B0 scored and at least 2 method marks scored, SC1 for correct substitution of both of their x values or their y values into $4y + 3x = 13$ or $y = x^2 - 18$
22(a)(i)	cubic	1	
22(a)(ii)	reciprocal	1	

Question	Answer	Mark	Partial Marks
22(b)(i)	correct sine curve sketch through (0, 0), (180, 0) and (360, 0) 	2	M1 for correct sine curve shape through the origin
22(b)(ii)	203.6 and 336.4	3	B2 for one correct or M1 for $\sin x = -0.4$ oe If 0 or M1 scored, SC1 for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
23(a)	15	1	
23(b)	$\frac{1}{2}$ oe nfw	2	M1 for $\frac{2+3}{2+1+3+4}$ oe or $1 - \frac{4+1}{2+1+3+4}$ oe with either the numerator or denominator correct
24(a)	$\frac{1}{2}\mathbf{b} - \frac{2}{3}\mathbf{a}$	2	B1 for answer $\frac{1}{2}\mathbf{b} + k\mathbf{a}$ or $j\mathbf{b} - \frac{2}{3}\mathbf{a}$ or correct unsimplified in terms of a and b
24(b)	$\frac{5}{4}\mathbf{b}$	3	M2 for $\overrightarrow{RS} = \frac{1}{4}\mathbf{b}$ oe or $\overrightarrow{MS} = \frac{3}{2}\left(\frac{1}{2}\mathbf{b} - \frac{2}{3}\mathbf{a}\right)$ oe or $\overrightarrow{NS} = \frac{1}{2}\left(\frac{1}{2}\mathbf{b} - \frac{2}{3}\mathbf{a}\right)$ oe or M1 for a correct route in terms of vertices and/or a and/or b or B1 for answer $j\mathbf{b}$ where $j > 1$ or $\overrightarrow{RS} = \frac{1}{2}\overrightarrow{MQ}$, $\overrightarrow{RS} = \frac{1}{4}\overrightarrow{OR}$, oe $\overrightarrow{NS} = \frac{1}{2}\overrightarrow{MN}$, $\overrightarrow{MS} = \frac{3}{2}\overrightarrow{MN}$ $\overrightarrow{NS} = \frac{1}{3}\overrightarrow{MS}$

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MATHEMATICS

0580/23

Paper 2 (Extended)

May/June 2024

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

* 0019655329602 *



2



- 1 Write the number two million two thousand and two in figures.

..... [1]

- 2 Put one pair of brackets into this calculation to make it correct.

$$5 - 4 \times 3 - 9 - 2 = 0$$

[1]

- 3 Simplify.

$$7x - 8y - x - y$$

..... [2]

- 4 The base of a cuboid measures 10 cm by 7 cm.
The volume of the cuboid is 280 cm^3 .

Calculate the height of the cuboid.

..... cm [2]

- 5 In a city, the probability that it will rain today is 0.15 .

Find the probability that it will not rain today in this city.

..... [1]

- 6 Factorise completely.

$$4x^2y - 5xy^2$$

..... [2]



* 0019655329603 *



3



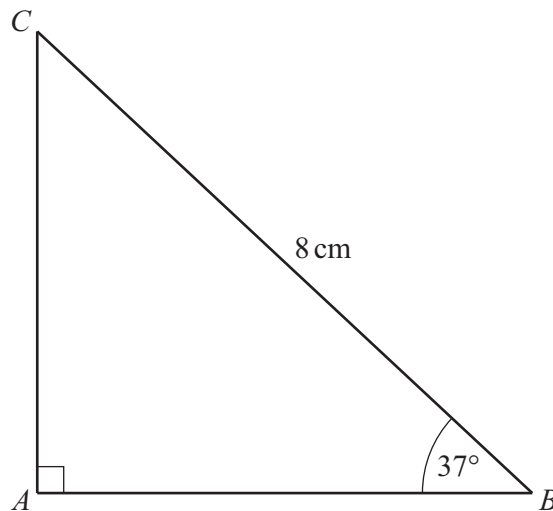
- 7 The scale of a map is 1 : 40 000.
On the map the distance between two villages is 37 cm.
- Calculate the actual distance between the two villages.
Give your answer in kilometres.

..... km [2]

- 8 **Without using a calculator**, work out $\frac{3}{7} - \frac{1}{14}$.
- You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

9



NOT TO
SCALE

The diagram shows a right-angled triangle.

Calculate AB .

$AB =$ cm [2]

[Turn over]



* 0019655329604 *



4



10 Find the gradient of the line joining the points $(-2, 7)$ and $(3, 1)$.

..... [2]

11 Solve the simultaneous equations.

$$5t - 2w = 19$$

$$3t + 2w = 5$$

$$t = \dots\dots\dots$$

$$w = \dots\dots\dots [2]$$

12 Simplify.

(a) $\frac{32g^{16}}{16g^8}$

..... [2]

(b) $(625k^8)^{\frac{3}{4}}$

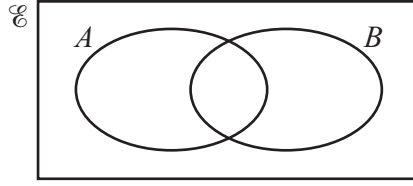
..... [2]

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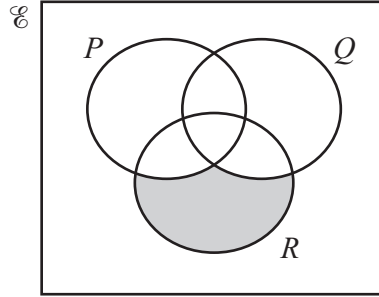
13 (a)



Shade the region $A \cup B'$.

[1]

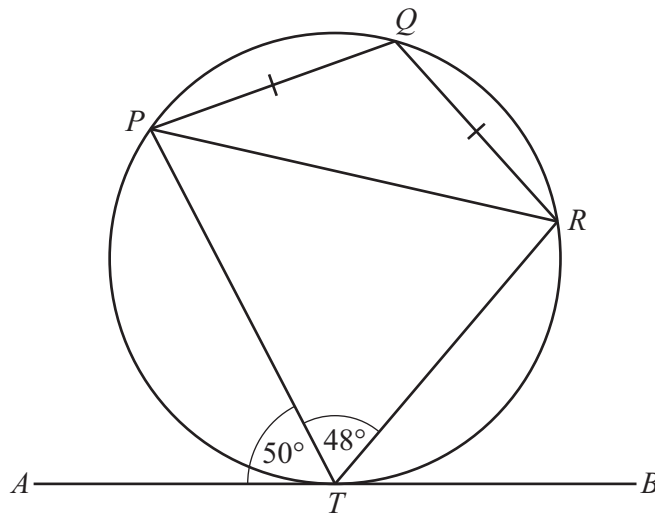
(b)



Use set notation to describe the shaded region.

..... [1]

14



NOT TO
SCALE

P, Q, R and T are points on the circle.
 AB is a tangent to the circle at T .
 Angle $ATP = 50^\circ$, angle $PTR = 48^\circ$ and $PQ = QR$.

(a) Find angle PRT .

Angle $PRT =$ [1]

(b) Find angle QPR .

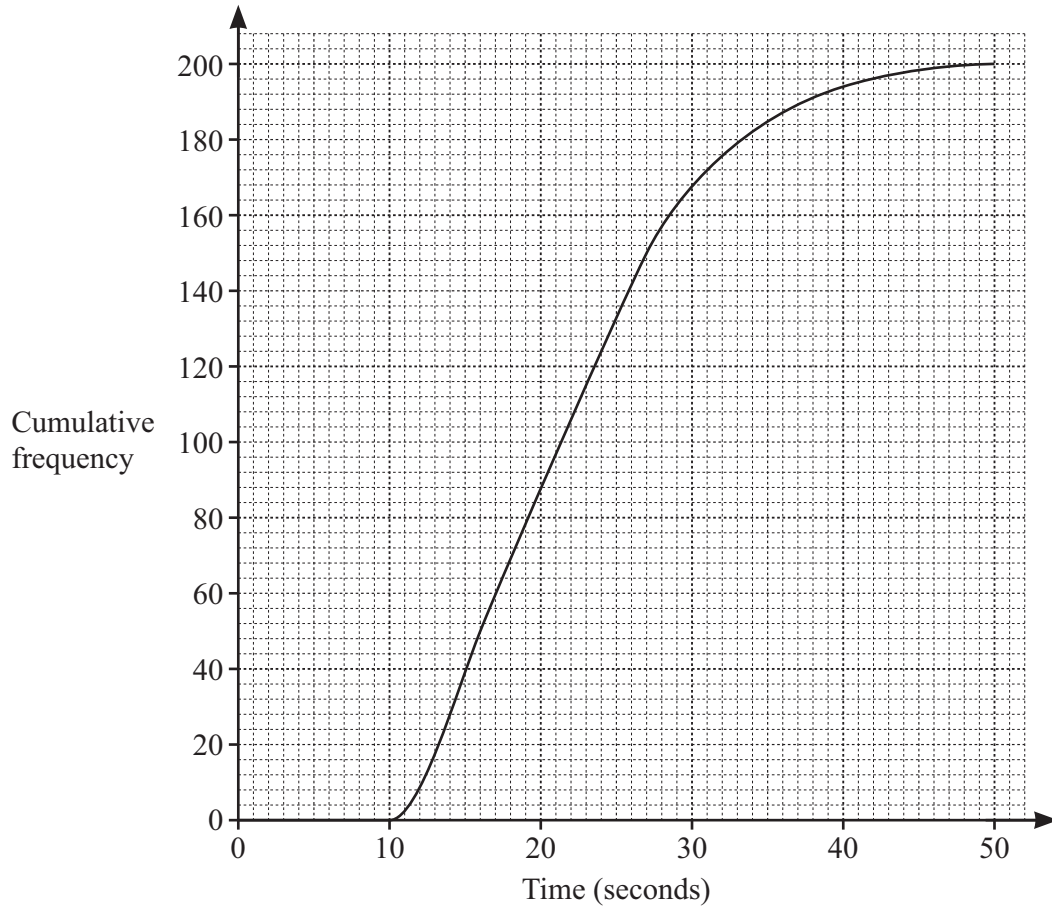
Angle $QPR =$ [2]

[Turn over]





15



The time taken for each of 200 students to complete a calculation is measured.
The cumulative frequency diagram shows the results.

Use the diagram to find an estimate for

(a) the interquartile range

..... s [2]

(b) the number of students taking more than 40 seconds to complete the calculation.

..... [2]



* 0019655329707 *



7



16

$$A = \pi r^2 + \pi dh$$

Rearrange the formula to make h the subject.

$$h = \dots\dots\dots [2]$$

17 Work out, giving each answer in standard form.

(a) $(2.1 \times 10^{101}) \times (8 \times 10^{101})$

$$\dots\dots\dots [2]$$

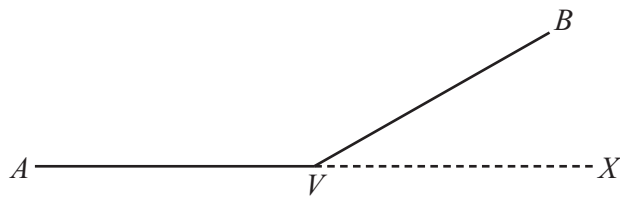
(b) $(2.1 \times 10^{101}) + (2.1 \times 10^{100})$

$$\dots\dots\dots [2]$$





18



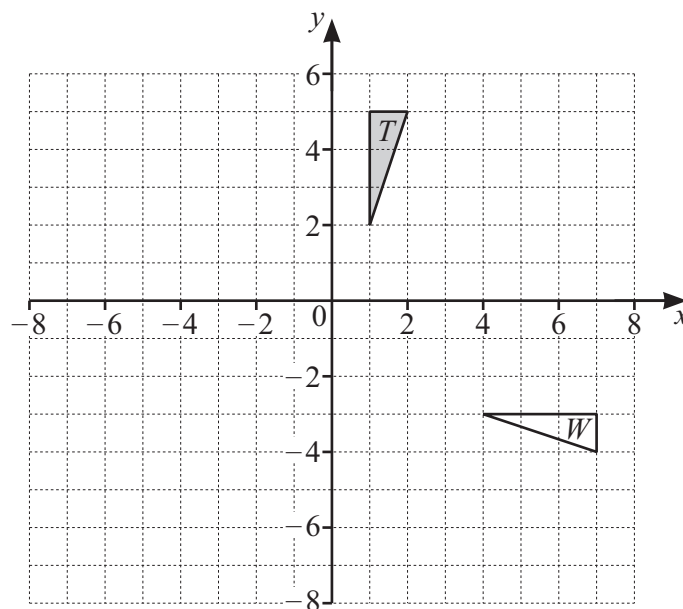
NOT TO
SCALE

The diagram shows two sides, VA and VB , of a regular polygon.
 AVX is a straight line.
 Angle $BVX = y^\circ$ and angle $AVB = 11.5y^\circ$.

Find the number of sides of this polygon.

..... [3]

19



(a) Describe fully the **single** transformation that maps triangle T onto triangle W .

.....
 [3]

(b) Draw the enlargement of triangle T with scale factor -2 and centre of enlargement $(-1, 1)$. [2]



* 0019655329709 *



9



20

$$f(x) = 3^x + 2$$

(a) Find x when $f(x) = 245$.

$$x = \dots\dots\dots [2]$$

(b) Find x when $f^{-1}(x) = 7$.

$$x = \dots\dots\dots [2]$$

21 Write the recurring decimal $0.4\dot{1}$ as a fraction in its simplest form.
You must show all your working.

$$\dots\dots\dots [2]$$

22 Solve the equation $\tan x + \sqrt{3} = 0$ for $0^\circ \leq x \leq 360^\circ$.

$$\dots\dots\dots [3]$$

[Turn over]



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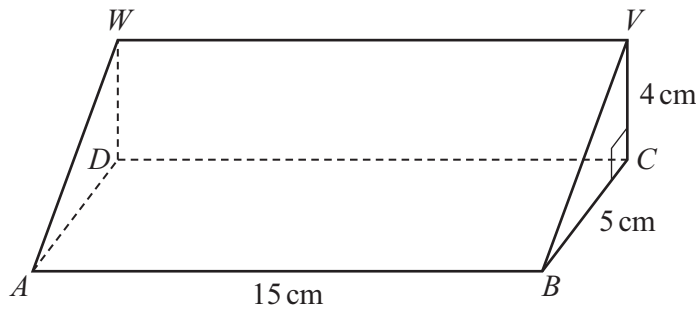
23 Simplify.

$$\frac{2}{y+1} - \frac{3}{y}$$

Give your answer as a single fraction in its simplest form.

..... [3]

24



NOT TO
SCALE

The diagram shows a triangular prism with cross-section triangle BCV .
Angle $BCV = 90^\circ$, $BC = 5\text{ cm}$, $CV = 4\text{ cm}$ and $AB = 15\text{ cm}$.

Calculate the angle between AV and the base $ABCD$.

..... [4]



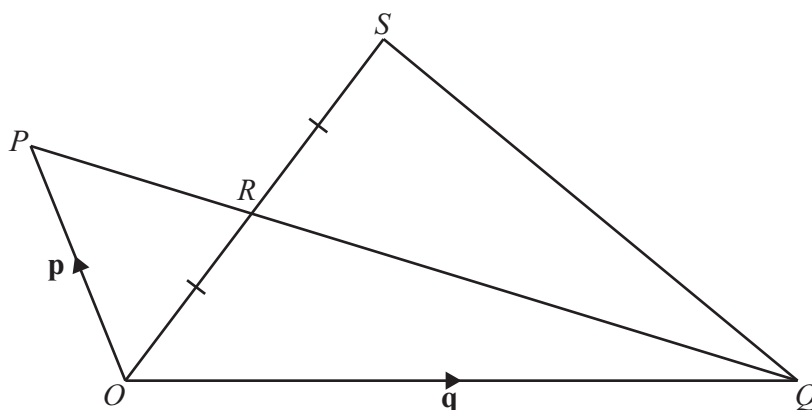


25 Simplify.

$$\frac{pt-p-t+1}{1-t^2}$$

..... [4]

26



NOT TO
SCALE

In the diagram, O is the origin.

$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

R is the point of intersection of PQ and OS , with $PR : RQ = 1 : 2$ and $OR = RS$.

Find the position vector of S in terms of $\mathbf{p}$ and $\mathbf{q}$.

Give your answer in its simplest form.

..... [4]





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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 (Extended)

May/June 2024

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **6** printed pages.

Generic Marking Principles

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- the standard of response required by a candidate as exemplified by the standardisation scripts.

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GENERIC MARKING PRINCIPLE 3:

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- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

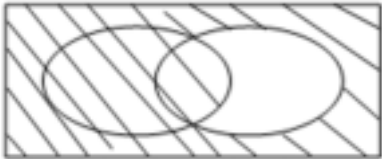
Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	2 002 002	1	
2	$5 - (4 \times 3 - 9) - 2$	1	
3	$6x - 9y$ or $3(2x - 3y)$ final answer	2	B1 for $6x$ or $-9y$ in final answer or $6x - 9y$ seen then spoilt
4	4	2	M1 for $10 \times 7 \times [\dots] = 280$ oe or better
5	0.85 oe	1	
6	$xy(4x - 5y)$ final answer	2	B1 for $y(4x^2 - 5xy)$ or $x(4xy - 5y^2)$ or $xy(4x - 5y)$ seen then spoilt
7	14.8	2	M1 for 1 cm represents 0.4 km soi or B1 for figs 148 as answer
8	$\frac{6}{14}$ and $\frac{1}{14}$ oe	M1	Allow any correct denominator $14k$
	$\frac{5}{14}$ cao	A1	
9	6.39 or 6.389...	2	M1 for $\cos 37 = \frac{AB}{8}$ oe
10	$-\frac{6}{5}$ oe	2	M1 for $\frac{1-7}{3--2}$ oe
11	$[t =] 3$ $[w =] -2$	2	B1 for each
12(a)	$2g^8$ final answer	2	B1 for final answer kg^8 or $2g^k$ or correct answer seen then spoilt
12(b)	$125k^6$ final answer	2	B1 for final answer ck^6 or $125k^c$ or correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
13(a)		1	
13(b)	$R \cap (P \cup Q)'$ or $R \cap P' \cap Q'$ oe	1	
14(a)	50	1	
14(b)	24	2	B1 for angle $PQR = 132$ soi or M1 for $\frac{180 - (180 - 48)}{2}$
15(a)	11	2	B1 for 16 or 27 seen
15(b)	6	2	M1 for 194 seen
16	$\frac{A - \pi r^2}{\pi d}$ oe final answer	2	M1 for $A - \pi r^2 = \pi dh$ or $\frac{A}{\pi d} = \frac{\pi r^2}{\pi d} + h$ or $\frac{A}{\pi} - r^2 = dh$
17(a)	1.68×10^{203}	2	B1 for 16.8×10^{202}
17(b)	2.31×10^{101}	2	B1 for figs 231
18	25	3	B2 for $[y =] 14.4$ oe or M1 for $y + 11.5y = 180$ or for $360 \div \text{their } y$
19(a)	Rotation 90° clockwise oe (0, -2)	3	B1 for each
19(b)	Triangle at (-5, -1), (-5, -7), (-7, -7)	2	B1 for enlargement s.f. -2 in wrong position
20(a)	5	2	M1 for $3^x + 2 = 245$
20(b)	2189	2	M1 for $x = f(7)$ or $3^7 + 2$
21	41.11...– 4.11... oe	M1	
	$\frac{37}{90}$ cao	A1	If M0 scored SC1 for answer $\frac{37}{90}$ with insufficient working.

Question	Answer	Marks	Partial Marks
22	120, 300	3	B2 for one correct or M1 for $\tan x = -\sqrt{3}$ oe If 0 or M1 scored SC1 for answers with difference of 180
23	$\frac{-y-3}{y(y+1)}$ or $\frac{-y-3}{y^2+y}$ or $-\frac{y+3}{y(y+1)}$ or $-\frac{y+3}{y^2+y}$ final answer	3	B1 for $2y-3(y+1)$ oe B1 for common denominator $y(y+1)$ or y^2+y isw
24	14.2 or 14.19 to 14.20	4	M3 for $\tan = \frac{4}{\sqrt{15^2+5^2}}$ oe or M2 for 15^2+5^2 or $15^2+5^2+4^2$ or M1 for recognition of angle VAC
25	$\frac{1-p}{1+t}$ oe final answer	4	B2 for $(p-1)(t-1)$ oe or B1 for $p(t-1)-(t-1)$ or $t(p-1)-(p-1)$ B1 for $(1-t)(1+t)$ oe
26	$\frac{4}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}$ oe	4	B3 for correct unsimplified answer or for $\overrightarrow{OR} = \mathbf{p} + \frac{1}{3}\mathbf{q} - \frac{1}{3}\mathbf{p}$ oe or M2 for $\overrightarrow{PR} = \frac{1}{3}(-\mathbf{p} + \mathbf{q})$ oe or $\overrightarrow{QR} = \frac{2}{3}(-\mathbf{q} + \mathbf{p})$ oe or M1 for $\overrightarrow{PQ} = -\mathbf{p} + \mathbf{q}$ oe or $\overrightarrow{QP} = -\mathbf{q} + \mathbf{p}$ oe or a correct route from O to S .



Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2024

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) The table shows the areas, in km^2 , of the four largest rainforests in the world.

Rainforest	Area (km^2)
Amazon	5 500 000
Congo	2 000 000
Atlantic	1 315 000
Valdivian	250 000

- (i) Find the area of the Valdivian rainforest as a percentage of the area of the Amazon rainforest.

..... % [1]

- (ii) Write, in its simplest form, the ratio of the areas of the rainforests Valdivian : Atlantic : Congo.

..... : : [2]

- (iii) The Amazon rainforest has 60% of its area in Brazil and 10% of its area in Colombia.
 $43\frac{1}{3}\%$ of the **remaining area** of the rainforest is in Peru.

Find the percentage of the Amazon rainforest that is in Brazil, Colombia and Peru.

..... % [3]

- (iv) The area of the Amazon rainforest represents $\frac{27}{50}$ of the total area of rainforest in the world.

Calculate the total area of rainforest in the world.

Give your answer correct to the nearest 100 000 km².

..... km² [3]

- (v) In the world, 60.7 hectares of rainforest are lost every minute.

Calculate the total area, in hectares, of rainforest that is lost in 365 days.

Give your answer in standard form.

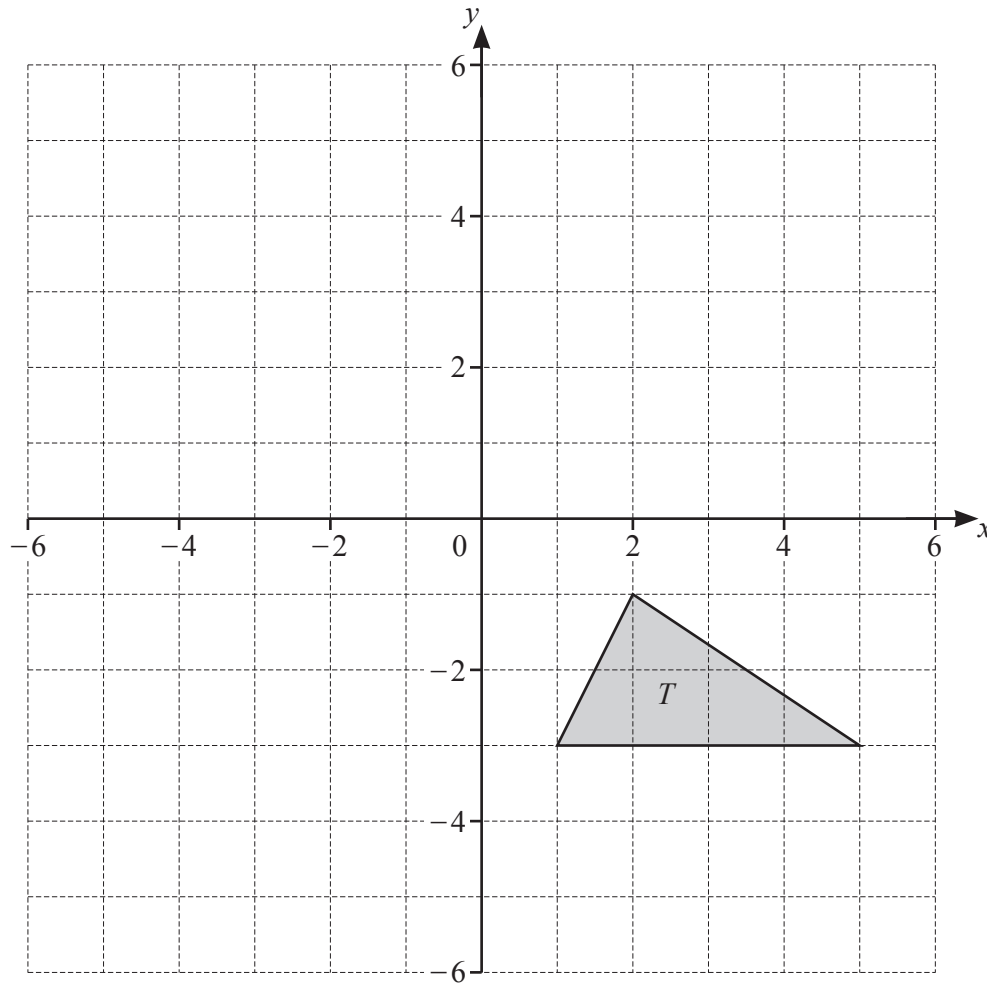
..... hectares [3]

- (b) The Amazon river has a length of 6440 km, correct to the nearest 10 km.
The Congo river has a length of 4400 km, correct to the nearest 100 km.

Calculate the upper bound of the difference between the lengths of the Amazon river and the Congo river.

..... km [3]

2 (a)



On the grid, draw the image of

- (i) triangle T after a reflection in the x -axis [1]
- (ii) triangle T after a translation by the vector $\begin{pmatrix} -5 \\ -2 \end{pmatrix}$ [2]
- (iii) triangle T after an enlargement by scale factor $-\frac{1}{2}$ with centre $(-1, 1)$. [2]

5

- (b) A shape P is enlarged by scale factor 3 to give shape Q .
Shape Q is then enlarged by scale factor $\frac{2}{5}$ to give shape R .

The area of shape P is 10 cm^2 .

Calculate the area of shape R .

..... cm^2 [3]

3 (a) $C = \frac{1}{4}xy^2$

(i) Find C when $x = 5$ and $y = 8$.

$$C = \dots\dots\dots [2]$$

(ii) Find the positive value of y when $C = 15$ and $x = 2.4$.

$$y = \dots\dots\dots [2]$$

(b) Write as a single fraction in its simplest form.

$$\frac{4}{x-1} - \frac{3}{2x+5}$$

$$\dots\dots\dots [3]$$

(c) Expand and simplify.

$$(2x+3)(4-x)^2$$

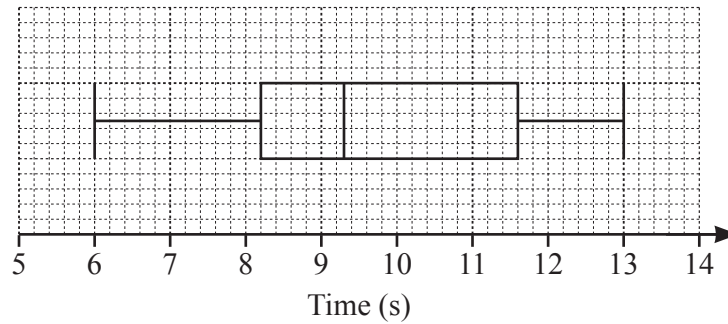
$$\dots\dots\dots [3]$$

(d) Simplify.

$$\left(\frac{y^8}{16x^{16}}\right)^{-\frac{3}{4}}$$

..... [3]

- 4 (a) Jianyu records the time, in seconds, that some cars take to travel 195 m. The box and whisker plot shows this information.



- (i) Find the median time.

..... s [1]

- (ii) Find the interquartile range.

..... s [1]

- (iii) Find the difference between the average speed of the fastest car and the average speed of the slowest car.
Give your answer in **kilometres per hour**.

..... km/h [5]

- (b) Matilda records the distances that 80 different cars can travel with a full tank of fuel. The table shows this information.

Distance (d km)	$250 < d \leq 300$	$300 < d \leq 400$	$400 < d \leq 420$	$420 < d \leq 450$	$450 < d \leq 500$
Frequency	7	13	19	21	20

- (i) Write down the class interval that contains the median.

..... $< d \leq$ [1]

- (ii) Calculate an estimate of the mean.

..... km [4]

- (iii) A histogram is drawn to show the information in the table.
The height of the bar for the interval $250 < d \leq 300$ is 2.8 cm.

Calculate the height of the bar for each of the following intervals.

$300 < d \leq 400$ cm

$400 < d \leq 420$ cm

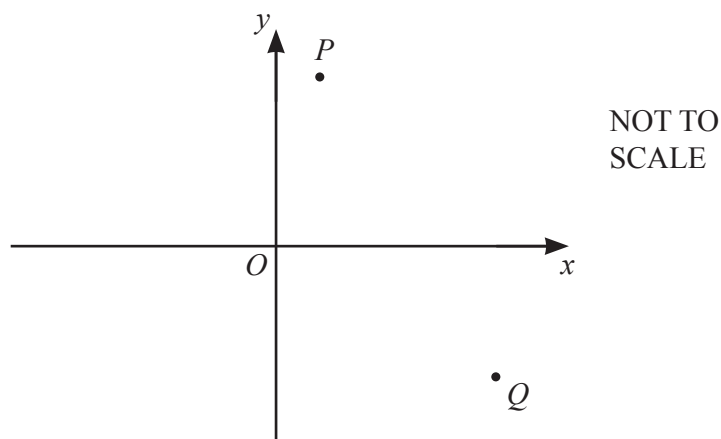
$420 < d \leq 450$ cm [3]

- (iv) Two of the 80 cars are chosen at random.

Find the probability that, with a full tank of fuel, one of the cars can travel more than 450 km and the other car can travel **not** more than 300 km.

..... [3]

- 5 (a) P is the point $(1, 7)$.
 Q is the point $(5, -5)$.



- (i) Find $\overrightarrow{PQ}$.

$$\overrightarrow{PQ} = \begin{pmatrix} \\ \end{pmatrix} \quad [2]$$

- (ii) Show that $|\overrightarrow{OP}| = |\overrightarrow{OQ}|$.

[3]

- (iii) PQ is a chord of a circle with centre O .

Calculate the circumference of this circle.

..... [2]

- (iv) PQ is the diameter of a different circle with centre R .

Find the coordinates of R .

(..... , ...) [2]

- (v) Find the equation of the perpendicular bisector of PQ .
Give your answer in the form $y = mx + c$.

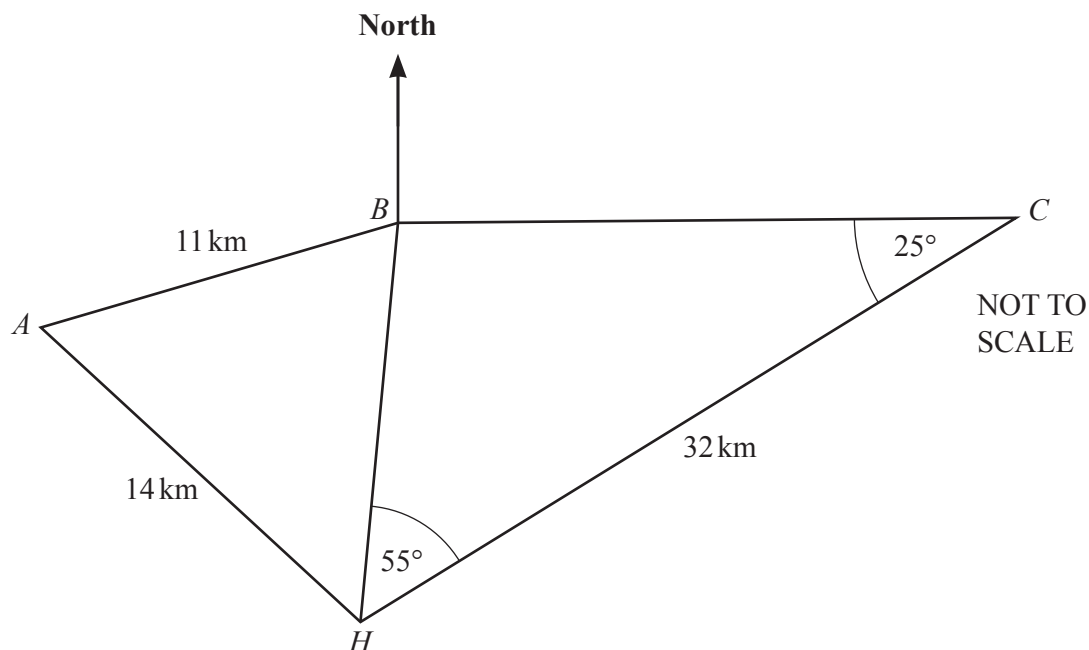
$y = \dots\dots\dots$ [4]

- (b) The position vector of A is $\mathbf{a}$.
The position vector of B is $\mathbf{b}$.

M is a point on AB such that $AM : MB = 2 : 3$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, the position vector of M .
Give your answer in its simplest form.

6



The diagram shows the positions of two lighthouses A and B , a boat C and a harbour H . C is due east of B .

- (a) Find the bearing of the harbour from boat C .

..... [1]

- (b) (i) Show that angle $CBH = 100^\circ$.

[1]

- (ii) Show that $BH = 13.7$ km, correct to 1 decimal place.

[3]

(c) Calculate the bearing of A from B .

..... [5]

(d) At 1 pm boat C sails 32 km directly to the harbour at a speed of 10 knots.

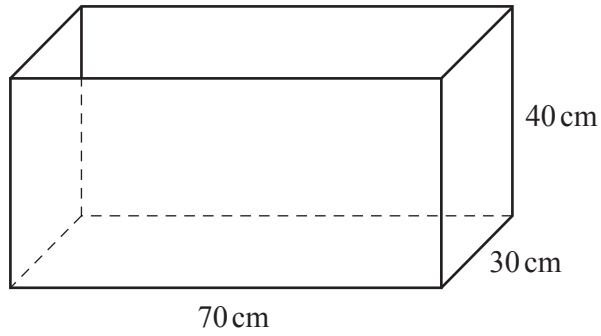
- (i) Calculate the time when boat C arrives at the harbour.
Give this time correct to the nearest minute.
[1 knot = 1.852 km/h]

..... [4]

- (ii) Calculate the distance of boat C to the harbour when boat C is at the shortest distance from lighthouse B .

..... km [3]

7 (a)



NOT TO
SCALE

The diagram shows a box in the shape of a cuboid.
The box is open at the top.

- (i) Work out the surface area of the inside of the open box.

..... cm^2 [3]

- (ii) Cylinders with height 20 cm and diameter 15 cm are placed in the box.

Work out the maximum number of these cylinders that can completely fit inside the box.

..... [3]

- (b) A solid bronze cone has a mass 750 g.
The density of the bronze is 8.9 g/cm^3 .

The ratio radius of cone : height of cone = 1 : 3.

- (i) Show that the radius of the cone is 2.99 cm, correct to 3 significant figures.
[Density = mass $\div$ volume]

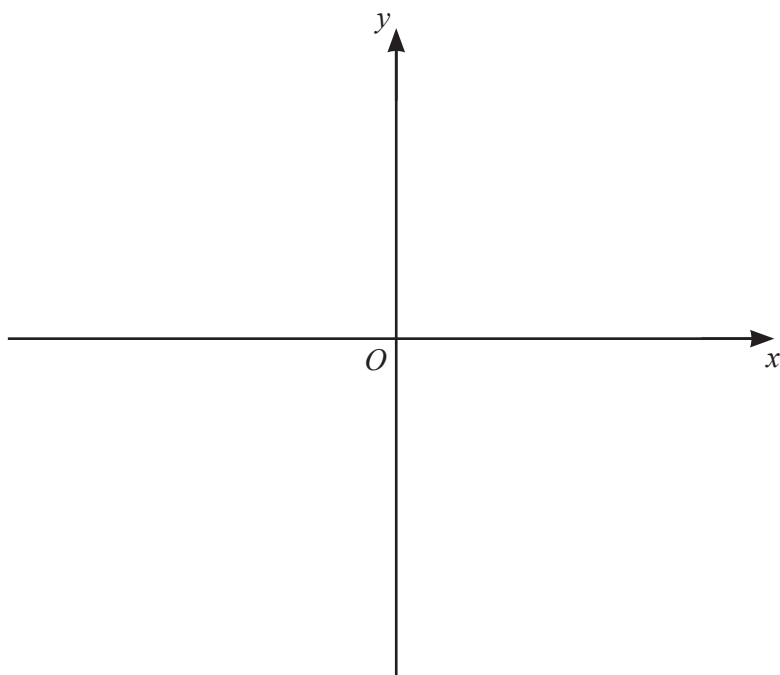
[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

[4]

- (ii) Calculate the total surface area of the cone.
[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

..... cm^2 [5]

- 8 (a) On the axes, sketch the graph of $y = x^2 + 7x - 18$.
On your sketch, write the values where the graph meets the x -axis and the y -axis.



[4]

- (b) (i) Find the derivative of $y = x^2 - 3x - 28$.

..... [2]

- (ii) Find the coordinates of the turning point of $y = x^2 - 3x - 28$.

(..... , ...) [3]

- (c) The line $y = 5 - 2x$ intersects the graph of $y = x^2 - 3x - 28$ at point P and point Q .

Find the coordinates of P and Q .

You must show all your working and give your answers correct to 2 decimal places.

(..... , ...)

(..... , ...) [6]

18

9 $f(x) = 4x + 1$ $g(x) = 6 - 2x$ $h(x) = 3^{x-2}$

(a) Find

(i) $f(3)$

..... [1]

(ii) $gf(3)$.

..... [1]

(b) Find $g^{-1}(x)$.

$g^{-1}(x) =$ [2]

(c) Find x when $f(x) = g(2x - 7)$.

$x =$ [4]

(d) Find the value of $h(h(2))$.

..... [2]

(e) Find x when $h^{-1}(x) = 10$.

$x =$ [2]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2024

MARK SCHEME

Maximum Mark: 130

Published

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- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	4.55 or 4.545...	1	
1(a)(ii)	50 : 263 : 400 cao	2	M1 for a correct simplification from 250 000 : 1 315 000 : 2 000 000
1(a)(iii)	83 cao	3	M2 for $43\frac{1}{3} \times (100 - 60 - 10)$ oe or M1 for 100 – 60 – 10 seen
1(a)(iv)	10 200 000 cao	3	B2 for 10 185 185 to 10 185 200 or M1 for $5\,500\,000 \div 27 [\times 50]$
1(a)(v)	3.19×10^7 or $3.190... \times 10^7$	3	B2 for 31903920 or M1 for $60.7 \times 60 \times 24 \times 365$ If B0 scored SC1 for correctly converting <i>their</i> number seen to standard form to 3sf or better
1(b)	2095 nfw	3	M2 for $6445 - C$ where $4300 \leq C < 4400$ oe or $A - 4350$ where $6440 < A \leq 6450$ oe or M1 for 6440 +5 or 6440 –5 or 4400 + 50 or 4400 – 50 seen oe
2(a)(i)	Triangle at (2, 1) (1, 3) (5, 3)	1	
2(a)(ii)	Triangle at (–4, –5) (–3, –3) (0, –5)	2	B1 for translation by $\begin{pmatrix} -5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -2 \end{pmatrix}$
2(a)(iii)	Triangle at (–2.5, 2) (–4, 3) (–2, 3)	2	B1 for enlargement by sf $-\frac{1}{2}$ with any centre
2(b)	14.4	3	M2 for $[10 \times] 3^2 \times \left(\frac{2}{5}\right)^2$ oe or M1 for 3^2 or $\left(\frac{2}{5}\right)^2$ soi
3(a)(i)	80	2	M1 for $\frac{1}{4} \times 5 \times 8^2$
3(a)(ii)	5	2	M1 for $[y^2 =] \frac{15 \times 4}{2.4}$ oe

Question	Answer	Marks	Partial Marks
3(b)	$\frac{5x+23}{(x-1)(2x+5)}$ or $\frac{5x+23}{2x^2+3x-5}$ final answer	3	B1 for $4(2x+5) - 3(x-1)$ oe isw B1 for common denominator = $(x-1)(2x+5)$ oe isw
3(c)	$2x^3 - 13x^2 + 8x + 48$ final answer	3	B2 for correct expansion of 3 brackets but unsimplified or for simplified four-term expression of correct form with 3 terms correct or B1 for correct expansion of two brackets with at least 3 terms out of 4 correct
3(d)	$\frac{8x^{12}}{y^6}$ or $8x^{12}y^{-6}$ final answer	3	B2 for two elements correct in final answer or for correct answer seen then spoiled or for correct expression where all parts of the power have been dealt with or for $()^{-1}$ or $\left(\frac{2x^4}{y^2}\right)^3$ or B1 for 8 or y^6 or y^{-6} or x^{12} correct in final answer or for $\left(\frac{16x^{16}}{y^8}\right)^{\frac{3}{4}}$ or $\left(\frac{y^2}{2x^4}\right)^{-3}$
4(a)(i)	9.3	1	
4(a)(ii)	3.4	1	
4(a)(iii)	63	5	M4 for $\frac{195}{6} \times \frac{3600}{1000} - \frac{195}{13} \times \frac{3600}{1000}$ oe or M3 for $\frac{195}{6} \times \frac{3600}{1000}$ oe or $\frac{195}{13} \times \frac{3600}{1000}$ oe or for $\left(\frac{195}{6} - \frac{195}{13}\right)[\times k]$ oe OR M1 for $\frac{195}{6}$ or $\frac{195}{13}$ or <i>their</i> speed $\times \frac{3600}{1000}$ seen M1 for selecting 6 and 13

Question	Answer	Marks	Partial Marks
4(b)(i)	$420 < d \leq 450$	1	
4(b)(ii)	411.25	4	M1 for 275, 350, 410, 435, 475 soi M1 for Σfx M1 dep for <i>their</i> $\Sigma fx \div 80$
4(b)(iii)	2.6 19 14	3	B1 for each If 0 scored, SC1 for 3 of 0.14, 0.13, 0.95 or 0.7 oe
4(b)(iv)	$\frac{7}{158}$ oe	3	M2 for $[2 \times] \frac{20}{80} \times \frac{7}{79}$ oe or M1 for $\frac{20}{80}$ or $\frac{7}{79}$ or $\frac{7}{80}$ or $\frac{20}{79}$ oe seen After 0 scored, SC1 for $\frac{7}{160}$ oe
5(a)(i)	$\begin{pmatrix} 4 \\ -12 \end{pmatrix}$	2	B1 for each
5(a)(ii)	$1^2 + 7^2$	M1	
	$5^2 + ([-]5)^2$	M1	
	Both $\sqrt{50}$ oe	A1	With no errors seen If M0M0A0 scored SC1 for $\sqrt{50}$ oe for each
5(a)(iii)	44.4 or 44.42[8...] to 44.435	2	FT <i>their (a)(ii)</i> correct to 3sf or better M1 for $2 \times \pi \times \text{their } \sqrt{50}$ oe
5(a)(iv)	(3, 1)	2	B1 for each

Question	Answer	Marks	Partial Marks
5(a)(v)	$[y =] \frac{1}{3}x$	4	B3 for a correct equation in the wrong form as final answer Or B2 for $1/3$ stated or used as perpendicular gradient OR M1 for $[\text{grad } PQ] = \frac{7 - -5}{1 - 5}$ oe M1 for $\frac{-1}{\text{their grad } PQ}$ M1dep for substituting <i>their(a)(iv)</i> or (0,0) into $y = \text{their } mx + c$ oe dep on the 2nd M1 or B2
5(b)	$\frac{3}{5}\mathbf{a} + \frac{2}{5}\mathbf{b}$ final answer	4	B3 for an unsimplified correct answer or B2 for $AM = \frac{2}{5}(\mathbf{b} - \mathbf{a})$ soi or $BM = \frac{3}{5}(\mathbf{a} - \mathbf{b})$ soi or B1 for $AB = \mathbf{b} - \mathbf{a}$ or $BA = \mathbf{a} - \mathbf{b}$ or for a correct route for OM or for correct diagram
6(a)	245	1	
6(b)(i)	$180 - (55 + 25) [=100]$	M1	
6(b)(ii)	$\frac{32 \times \sin 25}{\sin 100}$ oe	M2	M1 for $\frac{\sin 25}{BH} = \frac{\sin 100}{32}$ oe
	13.73...	A1	

Question	Answer	Marks	Partial Marks
6(c)	258 or 257.9 to 258.0...	5	B4 for 67.9 to 68.0... OR M2 for $[\cos =] \left(\frac{11^2 + 13.7^2 - 14^2}{2 \times 13.7 \times 11} \right)$ A1 for 0.3738 to 0.376 or M1 for $14^2 = 11^2 + 13.7^2 - 2 \times 11 \times 13.7 \times \cos B$ M1dep on at least M1 for 190 + <i>their</i> angle <i>B</i>
6(d)(i)	2 44 pm or 14 44 cao	4	B3 for 1 hour 44 or 1 hour 43.6 to 1 hour 43.8 or 104 or 103.6 to 103.8 or B2 for 1.727 to 1.73 or M2 for $\frac{32}{10 \times 1.852} \times 60$ or M1 for $32 \div (10 \times 1.852)$
6(d)(ii)	7.857 to 7.88	3	M2 for $\frac{x}{13.7} = \cos 55^\circ$ oe or M1 for dist to <i>H</i> occurs when perpendicular from <i>B</i> meets <i>CH</i> soi
7(a)(i)	10 100	3	M2 for $30 \times 70 + 2 \times 30 \times 40 + 2 \times 40 \times 70$ or M1 for 30×40 or 30×70 or 40×70
7(a)(ii)	16	3	M2 for 2 fit width, 2 fit height and 4 fit length soi or M1 for 70, 30 or $40 \div 15$ or 20
7(b)(i)	$\frac{1}{3} \pi r^2 \times 3r = \text{their } (750 \div 8.9) \text{ oe}$	M2	M1 for using 750 and 8.9 correctly in $v = m / d$ oe or $750 \div 8.9$
	$r^3 = \frac{\text{their}(750 \div 8.9)}{\pi} \text{ oe}$	M1dep	
	$r = 2.993 \dots$	A1	

Question	Answer	Marks	Partial Marks
7(b)(ii)	117 or 116.9 to 117.2	5	M4 for $\pi \times 2.99^2 + \pi \times 2.99 \times \sqrt{2.99^2 + (3 \times 2.99)^2}$ oe or M3 for $\pi \times 2.99 \times \sqrt{2.99^2 + (3 \times 2.99)^2}$ or M2 for $\sqrt{2.99^2 + (3 \times 2.99)^2}$ or M1 for $2.99^2 + (3 \times 2.99)^2$ or for $\pi \times 2.99^2$
8(a)	Correct sketch with roots indicated at $x = -9$ and $x = 2$ and y intercept $= -18$ Minimum should be in 3rd quadrant	4	B1 for U shaped parabola B2 for roots at -9 and 2 on diagram or M1 for $(x + 9)(x - 2) [= 0]$ B1 for y – intercept at -18 on diagram Maximum 3 marks if sketch not fully correct
8(b)(i)	$2x - 3$	2	B1 for $2x + k$ or $kx^{[p]} - 3$
8(b)(ii)	$(1.5, -30.25)$ oe	3	B2 for $x = 1.5$ or M1 for <i>their</i> (b)(i) $= 0$ or for $(x - 1.5)^2$
8(c)	$x^2 - x - 33 [= 0]$ seen	B1	
	$\frac{[- -]1 \pm \sqrt{([- -]1)^2 - 4(1)(-33)}}{2 \times 1}$ oe	B2FT	FT <i>their</i> quadratic dep on no factors B1 for $\sqrt{([- -]1)^2 - 4(1)(-33)}$ or better or B1 for $\frac{[- -]1 + \sqrt{q}}{2(1)}$ oe or $\frac{[- -]1 - \sqrt{q}}{2(1)}$ oe
	-5.27 or -5.267 to -5.266 and 6.27 or 6.266 to 6.267	B2	B1 for each If 0 scored, SC1 for -6.27 and 5.27
	$(-5.27, 15.53$ or $15.54)$ and $(6.27, -7.53$ or $-7.54)$	B1	
9(a)(i)	13	1	
9(a)(ii)	-20	1	FT $6 - 2(\text{their } (a)(i))$

Question	Answer	Marks	Partial Marks
9(b)	$\frac{6-x}{2}$ oe final answer	2	M1 for correct first step $x = 6 - 2y, y - 6 = -2x, \frac{y}{2} = 3 - x$
9(c)	2.375 oe	4	B1 for $6 - 2(2x - 7)$ oe B1 for $4x + 1 = 6 - 4x + 14$ M1 for $8x = 19$ FT <i>their</i> linear equation rearranged correctly from $ax + b = cx + d$ to form $ex = f$
9(d)	$\frac{1}{3}$ or 0.333...	2	M1 for $h(1)$ or $3^{(3^{x-2} - 2)}$ or $3^{(3^{2-2} - 2)}$ or better
9(e)	6561	2	M1 for 3^{10-2} or $x = h(10)$

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MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2024

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) A fruit drink is made using 1.5 litres of apple juice and 450 millilitres of mango juice.

Write the ratio apple juice : mango juice in its simplest form.

..... : [2]

- (b) One litre of fruit drink is shared between three cups.
The amount in the cups is in the ratio 9 : 6 : 10.

Calculate the number of millilitres in each cup.

..... ml , ... ml , ... ml [3]

- (c) A shop buys bottles of the fruit drink for \$3.20 each.
It sells them at a profit of 15%.

Calculate the selling price of each bottle of fruit drink.

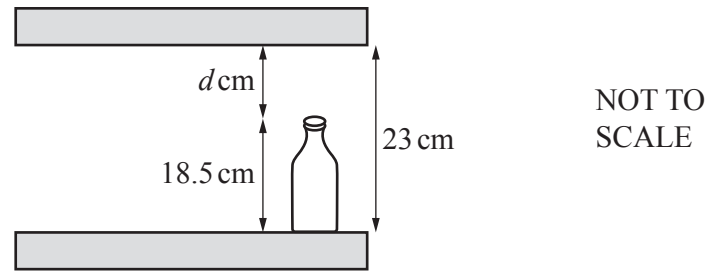
\$ [2]

- (d) The number of bottles of fruit drink sold has grown exponentially at a constant rate of 2.5% per year.
5 years ago, the shop sold 16 620 bottles.

Calculate the number of bottles sold this year.

..... [2]

(e)



The bottles of juice are 18.5 cm tall, correct to the nearest millimetre.

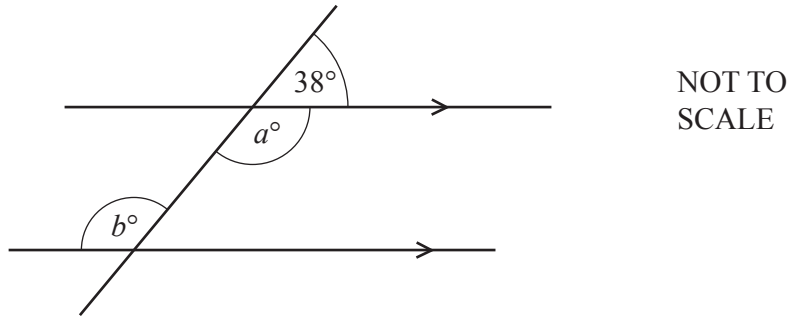
They are stored on shelves.

The distance between the shelves is 23 cm, correct to the nearest centimetre.

Calculate the lower bound for the distance, d cm, between the top of a bottle and the shelf above it.

..... cm [3]

2 (a)



The diagram shows a straight line intersecting two parallel lines.

Find the value of a and the value of b .

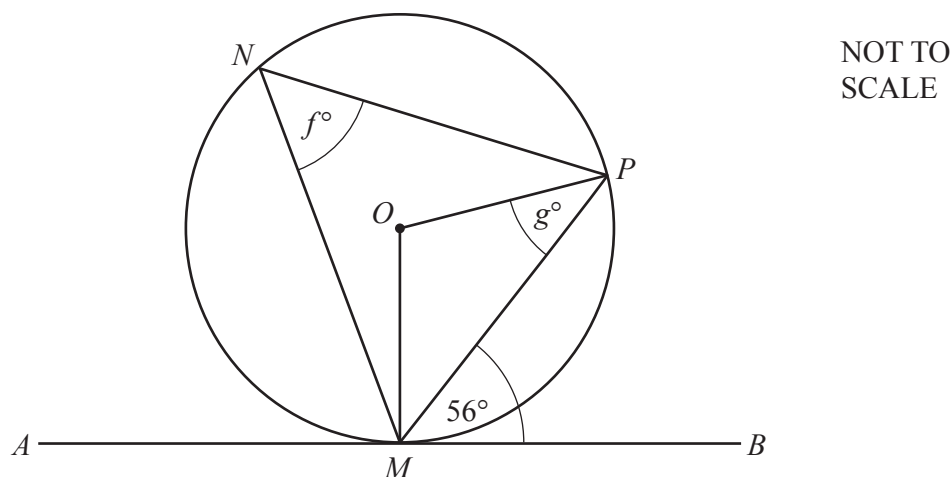
$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [2]$$

(b) Calculate the interior angle of a regular 12-sided polygon.

$$\dots\dots\dots [2]$$

(c)



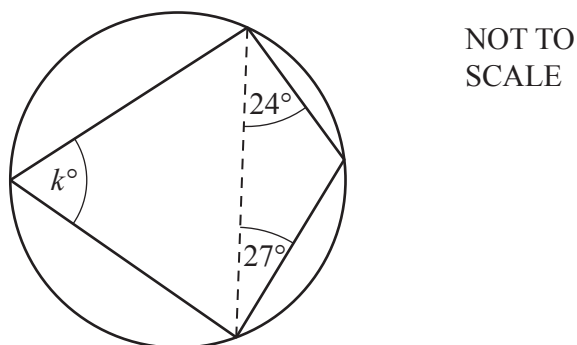
The diagram shows a circle, centre O .
The points M , N and P lie on the circumference of the circle.
 AMB is a tangent to the circle at M .

Find the value of f and the value of g .

$f =$

$g =$ [3]

(d)



The diagram shows a cyclic quadrilateral.

Find the value of k .

$k =$ [2]

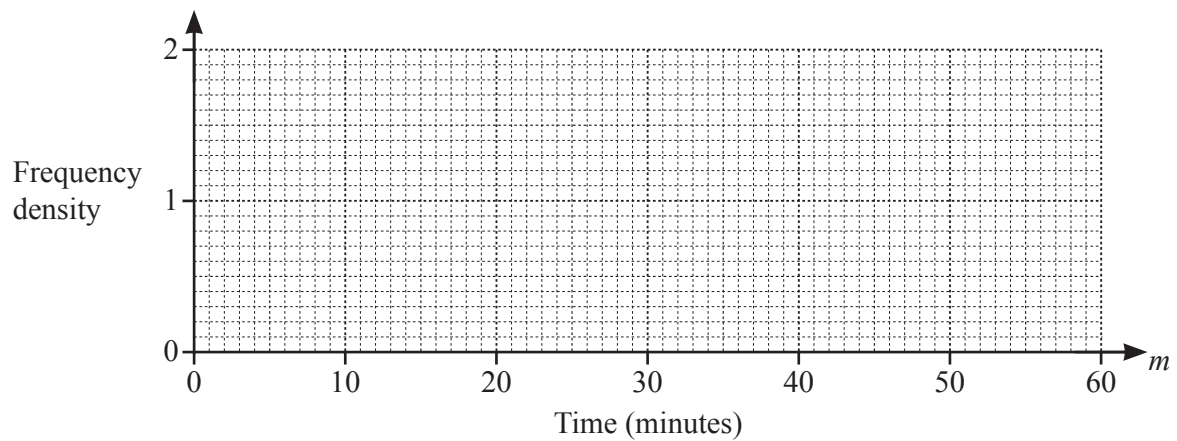
- 3 (a) The table shows the time that each of 40 students takes to travel to school.

Time (m minutes)	$0 < m \leq 10$	$10 < m \leq 25$	$25 < m \leq 40$	$40 < m \leq 60$
Frequency	3	18	15	4

- (i) Calculate an estimate of the mean.

..... min [4]

- (ii) On the grid, draw a histogram to show the information in the table.



[3]

- (iii) Two students are selected at random from the 40 students.

Calculate the probability that one student takes more than 25 minutes and the other student takes 10 minutes or less to travel to school.

..... [3]

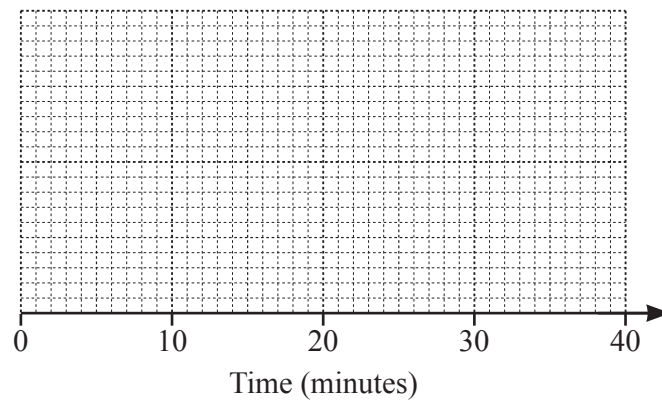
(b) This is some information about the time that 200 people took to fill in a questionnaire:

- The longest time taken was 30 minutes.
- The median time was 22 minutes.
- The lower quartile was 8 minutes.
- The interquartile range was 19 minutes.
- The range was 25 minutes.

(i) Write down the shortest time taken.

..... minutes [1]

(ii) On the grid, draw a box-and-whisker plot to show this information.



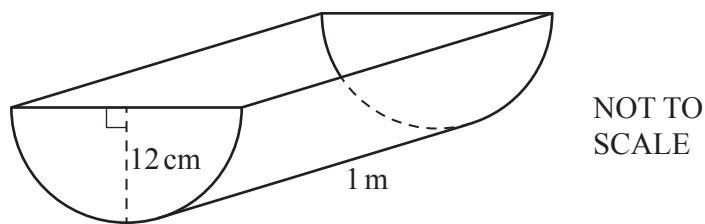
[3]

(iii) George says that 101 of the 200 people took more than 22 minutes to fill in the questionnaire.

Explain why he is wrong.

..... [1]

4 (a)

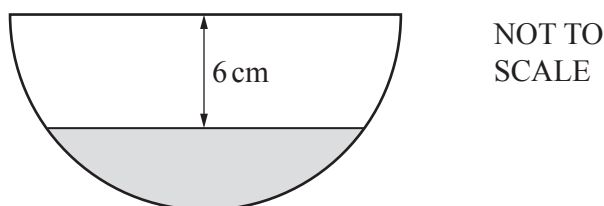


The diagram shows a tank in the shape of a half-cylinder of radius 12 cm and length 1 metre. The tank is fixed horizontally and is completely filled with water.

- (i) Calculate the volume of water in the tank.
Give your answer correct to the nearest 10 cm^3 .

..... cm^3 [3]

(ii)



Water is removed from the tank until the level of water is 6 cm below the top of the tank. The diagram shows the cross-section of the tank.

Calculate the volume of water that is now in the tank.

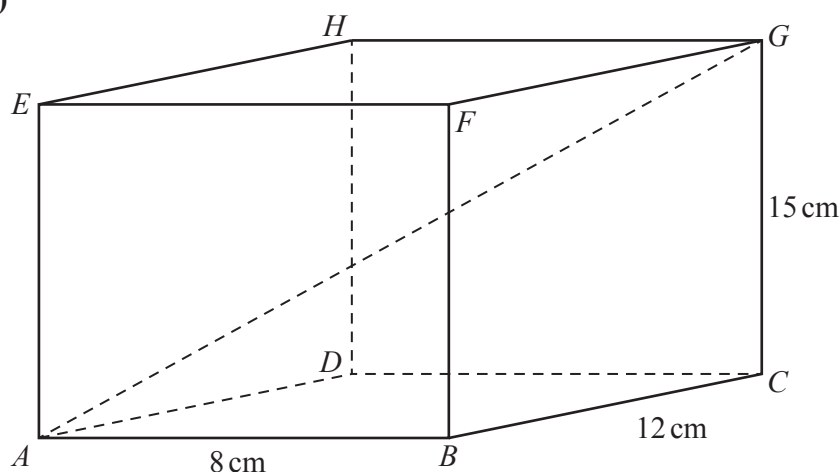
..... cm^3 [5]

- (b) A rectangular fish tank with length 42 cm and width 35 cm is full of water.
 A stone lies at the bottom of the tank.
 When the stone is removed from the tank, the depth of the water decreases by 0.2 cm.
 The density of the stone is 2.2 g/cm^3 .

Calculate the mass of the stone in grams.
 [Density = mass $\div$ volume]

..... g [3]

(c)



NOT TO
SCALE

The diagram shows a cuboid, $ABCDEFGH$.

Calculate the angle that AG makes with the base of the cuboid.

..... [4]

5 (a) Simplify $(25x^6)^{\frac{3}{2}}$.

..... [2]

(b) These are the first five terms of a sequence.

$\frac{1}{6}$ 1 6 36 216

Find the n th term of the sequence.

..... [2]

(c) Expand and simplify.

$$(x+4)(x-3)(3x-1)$$

..... [3]

- (d) (i) Show that $(3x+5) + \frac{7}{x-2} = x$ simplifies to $2x^2 + x - 3 = 0$.

[4]

- (ii) Solve by factorisation $2x^2 + x - 3 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

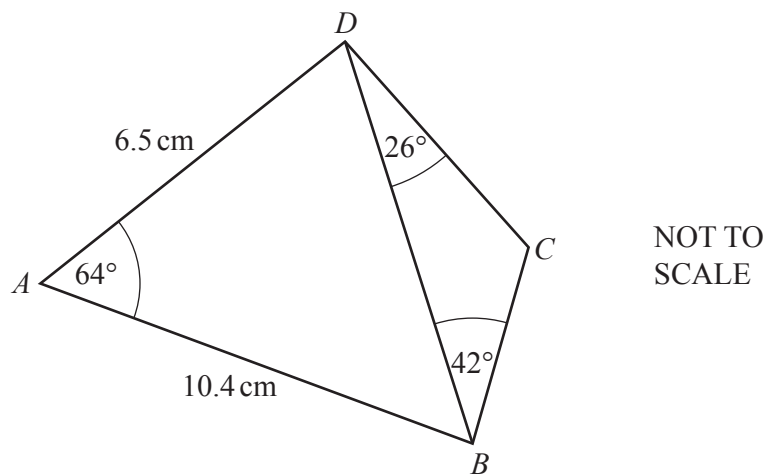
- (e) A solid cylinder has base radius x and height $3x$.
The **total** surface area of the cylinder is the same as the **total** surface area of a solid hemisphere of radius $5y$.

Show that $x^2 = \frac{75y^2}{8}$.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

[4]

6



$ABCD$ is a quadrilateral with $AB = 10.4$ cm and $AD = 6.5$ cm. Angle $DAB = 64^\circ$, angle $BDC = 26^\circ$ and angle $DBC = 42^\circ$.

(a) Show that $BD = 9.55$ cm, correct to 2 decimal places.

[3]

(b) (i) Show that angle $BCD = 112^\circ$.

[1]

(ii) Calculate CD .

$CD = \dots\dots\dots$ [3]

(c) Find the shortest distance from D to AB .

$\dots\dots\dots$ cm [3]

7 (a) Solve $3x - 8 = 6 - 4x$.

$x =$ [2]

(b) Factorise fully $10a^2 + 5a$.

..... [2]

(c) Factorise fully $(2x - 3)^2 - 9$.

..... [2]

(d) $f(x) = \frac{1}{4x-1}, x \neq \frac{1}{4}$ $g(x) = 3^x$

(i) Find $f(4)$.

..... [1]

(ii) Find $gg(2)$.

..... [2]

(iii) Find k when $g(k) = f(7)$.

..... [2]

- 8 A baker decorates x small cakes and y large cakes.
In one day, he decorates:

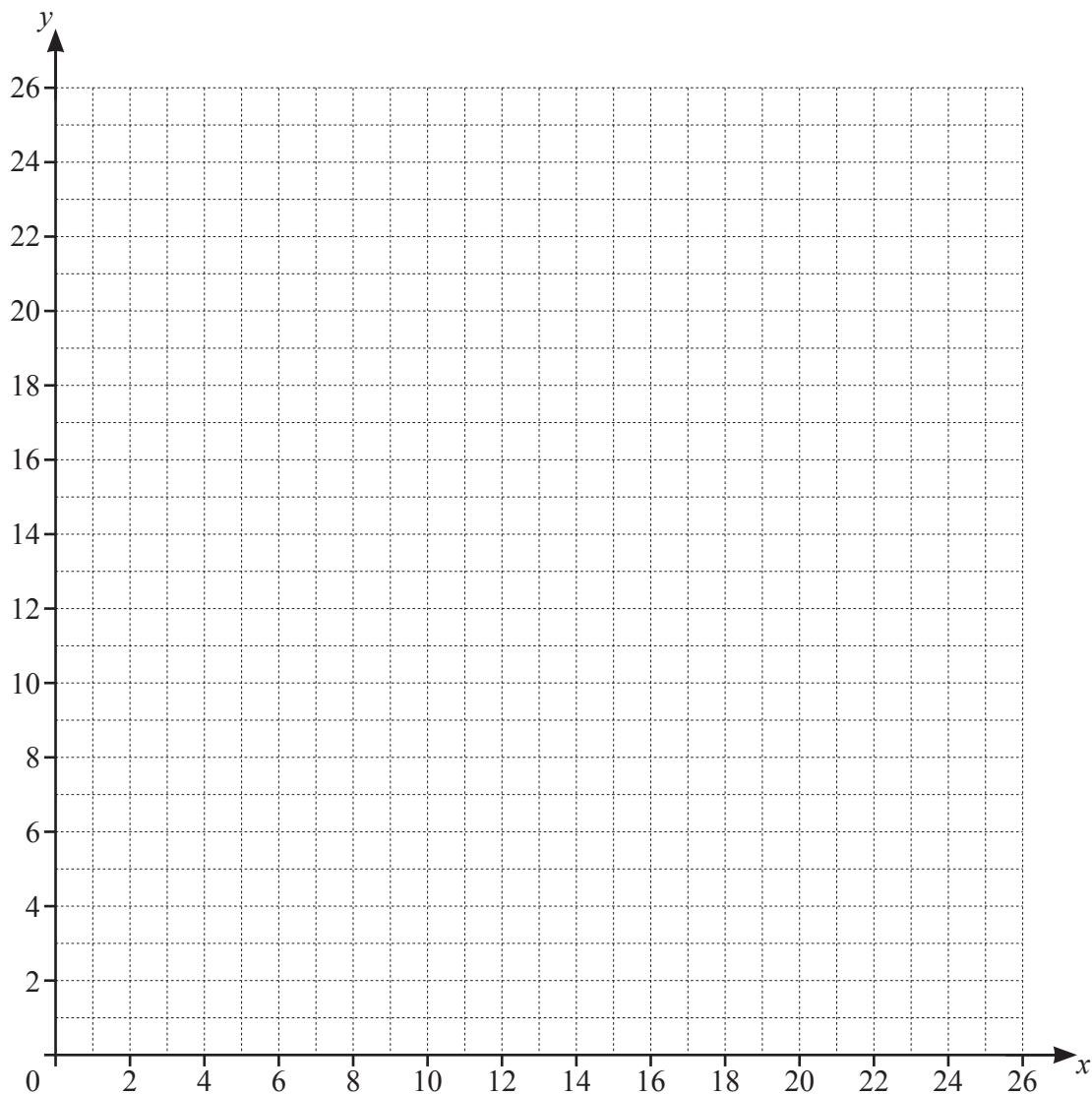
- not more than 16 small cakes
- less than 10 large cakes
- more small cakes than large cakes
- a total of not more than 24 cakes.

One of the inequalities that shows this information is $x \leq 16$.

- (a) Write down the other three inequalities in x and/or y .

..... [3]

- (b) On the grid, draw four straight lines and shade the unwanted regions to show these inequalities.
Label the region, R, which satisfies the four inequalities.



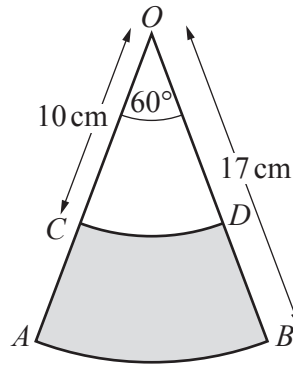
[6]

- (c) The baker earns \$8 for decorating a small cake and \$12 for decorating a large cake.

Use your diagram to find the largest amount the baker can earn in one day by decorating cakes.

\$ [2]

9 (a)

NOT TO
SCALE

OAB is a sector of a circle, centre O , radius 17 cm .

OCD is a sector of a circle, centre O , radius 10 cm .

OCA and ODB are straight lines and angle $AOB = 60^\circ$.

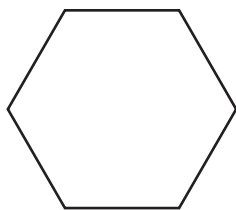
The perimeter of the shaded shape $ABDC$ can be written in the form $(a\pi + b)\text{ cm}$.

Find the value of a and the value of b .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [3]$$

(b)



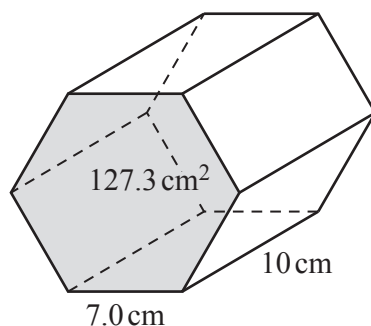
NOT TO
SCALE

The diagram shows a regular hexagon.
The area of the hexagon is 127.3 cm^2 .

- (i) Show that the length of one side of the hexagon is 7.0 cm , correct to 1 decimal place.

[4]

- (ii) The hexagon is the cross-section of a prism of length 10 cm .



NOT TO
SCALE

- (a) Find the volume of the prism.

..... cm^3 [1]

- (b) Calculate the surface area of the prism.

..... cm^2 [2]

10 (a) A is the point $(6, 2)$ and B is the point $(3, -4)$.

(i) Find the coordinates of the midpoint of AB .

(..... , ...) [2]

(ii) Calculate the length AB .

..... [3]

(b) The equation of line l is $4x + 3y - 12 = 0$.

(i) Find the gradient of l .

..... [2]

(ii) Find the coordinates of the point where l crosses the y -axis.

(..... , ...) [2]

(iii) Line p is perpendicular to l and passes through $(6, 5)$.

Find the equation of p in the form $y = mx + c$.

$y =$ [3]

- 11 (a) The point $(-1, 6)$ lies on a curve.

This curve has the derived function $\frac{dy}{dx} = -4x^3 - 9x^2 + 5$.

Show that $(-1, 6)$ is a stationary point of the curve.

[2]

- (b) A different curve has equation $y = 2x^3 - 6x + 8$.

- (i) Calculate the gradient of the tangent to this curve at the point $(-2, 2)$.

..... [3]

- (ii) Find the x -coordinates of the stationary points of this curve.

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [2]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2024

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

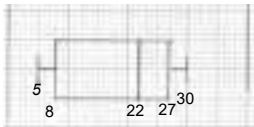
Mathematics-Specific Marking Principles

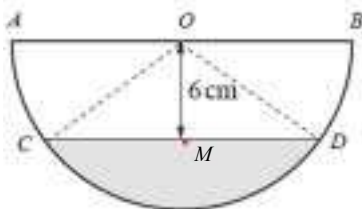
- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

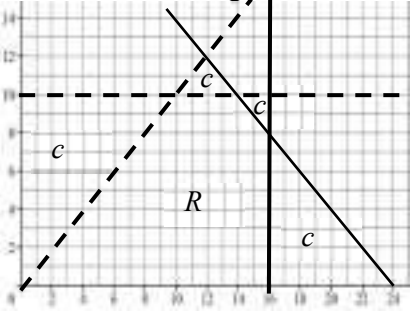
Question	Answer	Marks	Partial Marks
1(a)	10 : 3 final answer	2	M1 for 1500 : 450 oe in ratio form If 0 scored SC1 for answer 3 : 10
1(b)	360 240 400	3	B2 for answer 0.36 0.24 0.4 or for answer two of 360 240 400 or M1 for $\frac{1000}{9+6+10}[\times k]$ where $k = 1, 9,$ 6 or 10 If 0 scored, SC1 for answer with 3 values in ratio 9 : 6 : 10 in that order
1(c)	3.68 cao	2	M1 for $\left(1 + \frac{15}{100}\right) \times 3.2$ oe or B1 for answer 0.48
1(d)	18 804[.0...]	2	1 for $16620 \times \left(1 + \frac{2.5}{100}\right)^5$ oe
1(e)	3.95	3	M2 for $22.5 - (18.5 \text{ to } 18.6)$ or $(22 \text{ to } 23) - 18.55$ or M1 for $23 - 0.5$ oe seen or $23 + 0.5$ oe seen or $18.5 - 0.05$ oe seen or $18.5 + 0.05$ oe seen
2(a)	142 142	2	B1 for each FT angle $b = \textit{their angle } a$
2(b)	150	2	M1 for $\frac{360}{12}$ oe isw or $180 \times (12 - 2)$ oe isw

Question	Answer	Marks	Partial Marks
2(c)	56	B1	
	34	B2	M1 for angle at centre = $2 \times$ <i>their</i> 56 oe soi or for angle $OMB = 90$ oe soi
2(d)	51	2	B1 for opp angle = 129 soi
3(a)(i)	25.4375	4	M1 for mid-points soi (5, 17.5, 32.5, 50) M1 for use of Σfm with m in correct interval including both boundaries M1 for (dep on 2 nd M1) for $\Sigma fm \div 40$
3(a)(ii)	correct histogram	3	B2 for 3 correct blocks or B1 for 2 correct blocks If 0 scored SC1 for 4 correct frequency densities 0.3, 1.2, 1, 0.2 oe soi
3(a)(iii)	$\frac{19}{260}$ oe	3	M2 for $\frac{19}{40} \times \frac{3}{39} [\times 2]$ oe or M1 for any of $\frac{19}{40}, \frac{3}{40}, \frac{19}{39}, \frac{3}{39}$ oe seen If 0 scored, SC1 for $\frac{57}{800}$ oe
3(b)(i)	5	1	
3(b)(ii)	 Correct box plot	3	B2 for with LQ at 8 and median at 22 and UQ at 27 and boxed or M1 for LQ at 8 and median at 22 or for UQ at 27 B1 for lowest = 5 and highest = 30 Max B1 if not box and whisker diagram

Question	Answer	Marks	Partial Marks
3(b)(iii)	Correct explanation which states the median is 22 and correct reference to 100 or 101 e.g. - Median is 22 which is 50% of the people and 101 is more than 50% oe - The median is 22 which is the 100th number (accept 100.5th number)	1	
4(a)(i)	22 620 cao	3	B2 for 7200π or 22 608 to 22 629 or M1 for $\frac{1}{2} \times \pi \times 12^2$ [× figs 1] oe
4(a)(ii)	8840 or 8850 or 8836 to 8850. 	5	M1 for $\cos COM = \frac{6}{12}$ oe or $\sin AOC = \frac{6}{12}$ oe M1 for $\left(\frac{\text{their } COD}{360} \times \pi \times 12^2 \right)$ oe M1 for $\left(\frac{1}{2} \times 12^2 \times \sin(\text{their } COD) \right)$ oe M1dep for (their area of sector COD – their area of triangle COD) × 100 dep on at least M1M1 oe
4(b)	647 or 646.8	3	M2 for $2.2 = \frac{m}{42 \times 35 \times 0.2}$ oe or M1 for [vol of stone =] $42 \times 35 \times 0.2$ oe If 0 scored SC1 for answer figs 647 or figs 6468
4(c)	46.1 or 46.12 to 46.14	4	M3 for $\tan = \frac{15}{\sqrt{8^2 + 12^2}}$ oe or M2 for $8^2 + 12^2$ oe or $8^2 + 12^2 + 15^2$ oe or M1 for identifying the angle GAC
5(a)	$125x^9$ final answer	2	B1 for answer $125x^k$ or mx^9 or for correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
5(b)	6^{n-2} oe final answer	2	B1 for answer of form 6^k oe or answer of the form $\left(\frac{1}{6}\right)^{-k}$ oe or for correct answer seen
5(c)	$3x^3 + 2x^2 - 37x + 12$ final answer	3	B2 for correct expansion of three brackets unsimplified or for simplified four-term expression of correct form with 3 terms correct or B1 for correct expansion of two brackets with at least 3 terms out of 4 correct
5(d)(i)	eliminates the fraction correctly eg $(3x + 5)(x - 2) + 7 = x(x - 2)$	M1	
	$3x^2 + 5x - 6x - 10 + 7 = x^2 - 2x$ oe	B2	B1 for $3x^2 + 5x - 6x - 10 [+ 7]$ oe seen with at least 3 terms correct
	leading to $2x^2 + x - 3 = 0$	A1	dep on M1 B2 with no errors or omissions
5(d)(ii)	$(2x + 3)(x - 1)$	M2	or M1 for $(2x + a)(x + b)$ where $ab = -3$ or $2b + a = [+1]$ or for partial factors $2x(x - 1) + 3(x - 1)$ or $x(2x + 3) - [1](2x + 3)$
	-1.5 oe and $+1$	B1	
5(e)	[TSA cylinder =] $2\pi x^2 + 2\pi x \times 3x$	M1	
	[TSA hemisphere =] $\pi(5y)^2 + \frac{4\pi(5y)^2}{2}$	M1	
	Leading to $2\pi x^2 + 6\pi x^2 = 50\pi y^2 + 25\pi y^2$ oe	M1	dep M1M1
	$x^2 = \frac{75y^2}{8}$	A1	dep on M1M1M1
6(a)	$\sqrt{10.4^2 + 6.5^2 - 2 \times 10.4 \times 6.5 \times \cos 64}$	M2	M1 for $10.4^2 + 6.5^2 - 2 \times 10.4 \times 6.5 \times \cos 64$ A1 for 91.1 to 91.2
	9.546 to 9.547	A1	

Question	Answer	Marks	Partial Marks
6(b)(i)	$180 - (26 + 42)$	B1	
6(b)(ii)	6.89 or 6.888 to 6.892...	3	M2 for $\frac{9.55}{\sin 112} \times \sin 42$ oe or M1 for $\frac{\sin 112}{9.55} = \frac{\sin 42}{CD}$ oe
6(c)	5.84[2...]	3	M2 for $\frac{x}{6.5} = \sin 64$ oe or M1 for identifying shortest distance from D is perpendicular to AB
7(a)	2	2	M1 for $3x + 4x = 6 + 8$ or better
7(b)	$5a(2a + 1)$ final answer	2	B1 for $a(10a + 5)$ or $5(2a^2 + a)$ or $5a(2a + 1)$ then spoilt
7(c)	$4x(x - 3)$ final answer	2	M1 for $((2x - 3) - 3)((2x - 3) + 3)$ or better or for $4x^2 - 6x - 6x + 9 [-9]$ oe or better
7(d)(i)	$\frac{1}{15}$ oe	1	
7(d)(ii)	19 683	2	B1 for $g(9)$, 3^9 or 3^{3^2} seen
7(d)(iii)	-3	2	M1 for $3^k = \frac{1}{27}$ or $3^k = 3^{-3}$ or answer $g(-3)$
8(a)	$y < 10$ $y < x$ oe $x + y \leq 24$ oe	3	B1 for each If 0 scored, SC1 for $y \leq 10$ and $y \leq x$ and $x + y < 24$

Question	Answer	Marks	Partial Marks
8(b)	Correct lines and region indicated 	6	B1 for each correct line and B2 for R in correct region for all 4 correct lines or B1 for R in any one of the regions marked <i>c</i> or B1 for R that satisfies 3 of the correct inequalities
8(c)	228 nfw	2	M1 for $8x + 12y$ for any (x, y) in <i>their</i> R, x, y both integer or $x = 15, y = 9$
9(a)	$[a =] 9$ $[b =] 14$	3	B2 for $a = 9$ OR M2 for $\frac{60}{360} \times 2 \times \pi \times 17 + \frac{60}{360} \times 2 \times \pi \times 10 + 7 + 7$ oe or M1 for $\frac{60}{360} \times 2 \times \pi \times 17 \text{ oe or } \frac{60}{360} \times 2 \times \pi \times 10 \text{ oe}$ If 0 scored SC1 for $b = 14$
9(b)(i)	60° at centre or interior angle = 120°	B1	
	$[6 \times] \frac{1}{2} \times d^2 \times \sin 60$ oe	M1	
	$[d^2 =] \frac{127.3}{6 \times \frac{1}{2} \times \sin 60}$	M1	
	6.99[9...] to 7.00[...]	A1	Dep on M1M1
9(b)(ii)(a)	1273	1	
9(b)(ii)(b)	675 or 674.5 to 674.6	2	M1 for 2×127.3 oe or $6 \times 7 \times 10$ oe
10(a)(i)	(4.5, -1)	2	B1 for each

Question	Answer	Marks	Partial Marks
10(a)(ii)	6.71 or 6.708...	3	M2 for $(6-3)^2 + (2--4)^2$ oe or better or M1 for $[-](6-3)$ and $[-](2--4)$ oe or for $([-]3)^2$ and $([-]6)^2$ oe
10(b)(i)	$-\frac{4}{3}$	2	M1 for $3y = -4x + 12$ or $\frac{4}{3}x + y - \frac{12}{3} [= 0]$ or better seen
10(b)(ii)	(0, 4)	2	B1 for each or for $y = 4$ not in coordinate form
10(b)(iii)	$[y =] \frac{3}{4}x + \frac{1}{2}$ final answer	3	M1 for gradient $\frac{3}{4}$ or $\frac{-1}{\text{their}(\mathbf{b})(\mathbf{i})}$ oe or better M1 for (6, 5) substituted into $y = \frac{3}{4}x + c$ or $y = \text{their } mx + c$ oe
11(a)	$-4(-1)^3 - 9(-1)^2 + 5$ or better	M1	
	$= 0$ [so stationary point]	A1	with no errors
11(b)(i)	18	3	B2 for $6x^2 - 6$ isw OR B1 for $6x^2 + k$ (any k) isw or $px^2 - 6$ isw ($p \neq 0$) or $6x^2 - 6 + 8$ M1 dep on B1 for $x = -2$ substituted into $\text{their } \frac{dy}{dx}$
11(b)(ii)	1 and -1	2	M1 for $6x^2 - 6 = 0$ oe seen or for $\text{their } \frac{dy}{dx} = 0$ if B1 scored in part (b)(i)

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MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2024

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **24** pages. Any blank pages are indicated.



- 1 (a) In 2023 a football club had 50 adult members and 70 child members.
The membership fee for an adult was \$40 and the membership fee for a child was \$15.

(i) Calculate the total of the membership fees received by the club in 2023.

\$ [2]

(ii) The cost of running the club in 2023 was \$2780.

Calculate \$2780 as a percentage of the total of the membership fees received by the club.

..... % [1]

(iii) In 2023 there were 120 members.
This was a decrease by 4% of the number of members in 2022.

Calculate the number of members in 2022.

..... [2]

(iv) In 2024 the total number of members increased from the 120 members in 2023.
The number of adult members and the number of child members each increased by the same number.
The ratio number of adult members : number of child members changed to 14 : 19.

(a) Find the total number of members in 2024.

..... [2]



* 0019655323303 *



3



(b) Calculate the percentage increase in the total number of members from 2023 to 2024.

..... % [2]

(b) The population of a village is 2500.
The population is decreasing exponentially at a rate of 3% per year.

(i) Calculate the population at the end of 3 years.

..... [2]

(ii) Find the number of complete years it takes for the population to first fall below 2000.

..... years [2]



* 0019655323304 *



4



2 (a) The n th term of a sequence is $120 - n^3$.

(i) Find the 4th term of this sequence.

..... [1]

(ii) Find the value of n when the n th term is -1211 .

$n =$ [2]

(b) The n th term of a different sequence is $3 \times (0.2)^{n-1}$.

Find the 5th term of this sequence.

..... [1]

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(c) The table shows the first four terms of sequences A , B and C .

Sequence	1st term	2nd term	3rd term	4th term	5th term		n th term
A	7	4	1	-2			
B	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{3}{6}$	$\frac{4}{7}$			
C	0	2	6	12			

Complete the table for each sequence.





- 3 (a) Rahul rolls a dice 60 times.
The results are shown in the table.

Score	1	2	3	4	5	6
Frequency	10	6	11	13	14	6

Find the mode, the median and the mean.

mode = ...

median = ...

mean = ... [5]

- (b) Sangita measures the speed of each of 100 cars.
The results are shown in the table.

Speed (v km/h)	$20 < v \leq 30$	$30 < v \leq 50$	$50 < v \leq 75$
Frequency	10	72	18

- (i) Calculate an estimate of the mean speed.

..... km/h [4]



* 0019655323307 *



7



- (ii) Sangita draws a histogram to show the information in the table.
The height of the bar that represents $20 < v \leq 30$ is 3 cm.

Calculate the height of each of the other two bars on this histogram.

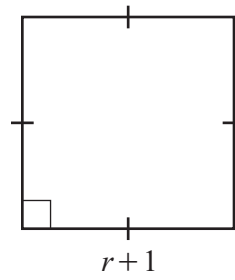
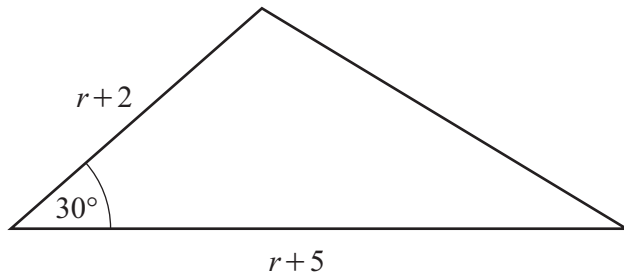
height of bar for $30 < v \leq 50$ cm

height of bar for $50 < v \leq 75$ cm [2]





4 In this question all the measurements are in centimetres.



NOT TO
SCALE

The area of the triangle is equal to the area of the square.

(a) Show that $3r^2 + r - 6 = 0$.

[4]

(b) Solve the equation $3r^2 + r - 6 = 0$.
Give your answer to 2 decimal places.
You must show all your working.

$r = \dots\dots\dots$ or $r = \dots\dots\dots$ [3]



* 0019655323309 *



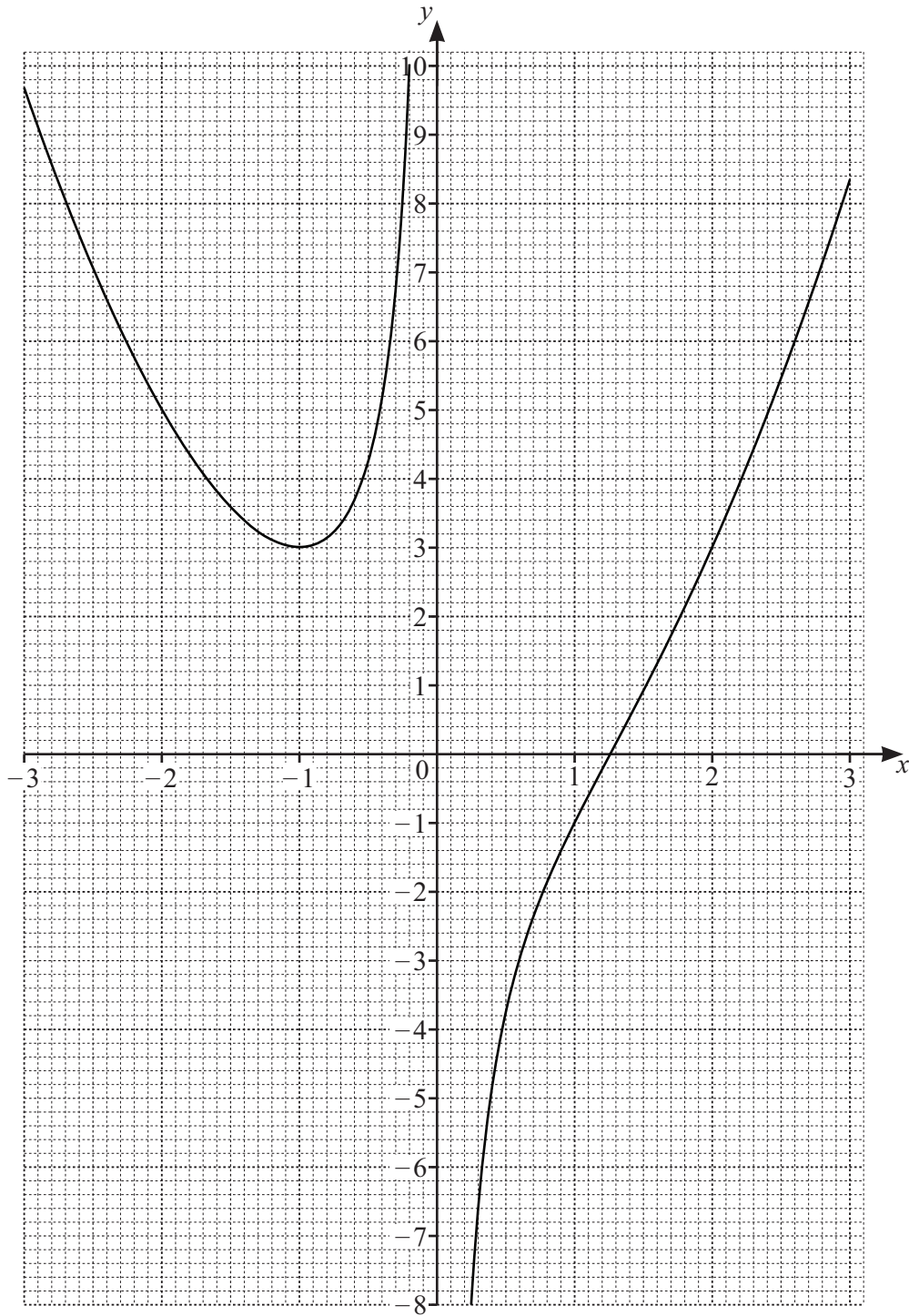
9



(c) Find the perimeter of the square.

..... cm [2]





The diagram shows the graph of $y = f(x)$ for values of x from -3 to 3 .

(a) (i) Use the graph to find $f(2)$.

..... [1]

(ii) Use the graph to solve the equation $f(x) = 5$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]





- (iii) The equation $f(x) = k$ has exactly two solutions.

Write down the value of k .

$k = \dots\dots\dots$ [1]

- (iv)

tangent	asymptote	root	perpendicular

Choose the correct word from the box to complete the statement.

The line $x = 0$ is the $\dots\dots\dots$ to the graph of $y = f(x)$. [1]

- (b) (i) On the grid, draw the graph of $y = x - 2$ for values of x from -3 to 3 . [2]

- (ii) Find x when $f(x) = x - 2$.

$x = \dots\dots\dots$ [1]

- (c) $f(x) = x^2 - \frac{c}{x}, x \neq 0$

Use the graph to show that $c = 2$.

[2]

- (d) The equation $f(x) = x - 2$ can be written as $x^3 + px^2 + qx = 2$.

Find the value of p and the value of q .

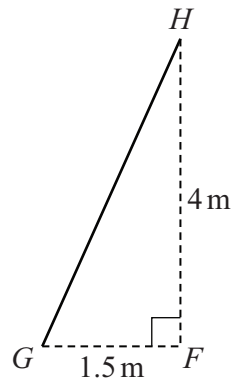
$p = \dots\dots\dots$

$q = \dots\dots\dots$ [2]





6 (a)



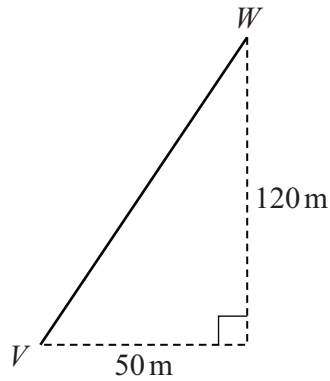
NOT TO
SCALE

The diagram shows a ladder, GH , on horizontal ground, leaning against a vertical wall, HF .
 $GF = 1.5$ m and $HF = 4$ m.

Calculate the length of the ladder, GH .

..... m [2]

(b)



NOT TO
SCALE

W is 120 m north of V and 50 m east of V .

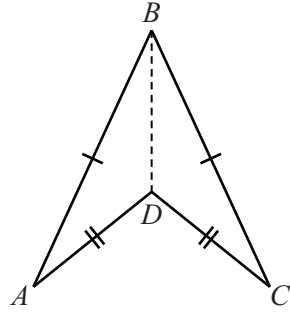
Calculate the bearing of V from W .

..... [3]





(c)

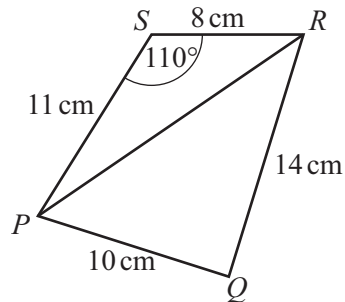
NOT TO
SCALE

In the quadrilateral $ABCD$, $AD = DC = 5$ cm and $AB = BC$.
Angle $ABD = 25^\circ$ and angle $BAD = 15^\circ$.

Calculate the perimeter of the quadrilateral $ABCD$.

..... cm [5]

(d)

NOT TO
SCALE

$PQRS$ is a quadrilateral.

Calculate angle PQR .

Angle $PQR =$ [5]

[Turn over]





- 7 (a) (i) A car travels 50 km at an average speed of 75 km/h.

Find the time taken.

Give your answer in minutes.

..... min [2]

- (ii) Another car travels 47 km, correct to the nearest kilometre.
The average speed of this car is 75 km/h, correct to the nearest 5 km/h.

Calculate the lower bound of the time taken.

Give your answer in minutes.

..... min [3]



* 0019655323415 *



15



- (b) A train travels a total of 240 km.
The train travels for t **minutes** at an average speed of 100 km/h.
It then travels for $(t + 60)$ **minutes** at an average speed of 110 km/h.

Find the average speed for the whole journey.

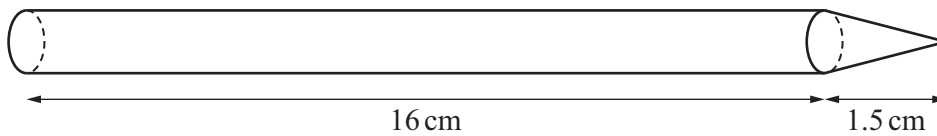
..... km/h [6]

[Turn over]





8 (a)



NOT TO SCALE

The diagram shows a solid made from a cylinder and a cone.
The height of the cylinder is 16 cm and the height of the cone is 1.5 cm.
The radius of the cylinder and the base radius of the cone are each 0.35 cm.

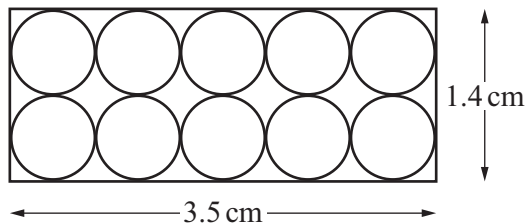
- (i) Calculate the total surface area of the solid.
[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi rl$.]

..... cm^2 [5]

- (ii) Calculate the volume of the solid.
[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [3]

(iii)



NOT TO SCALE

10 of the solids are placed in a box in the shape of a cuboid of length 17.5 cm.
The diagram shows one end of the box.

Calculate the volume of the empty space in the box.

..... cm^3 [3]



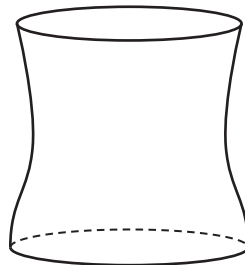
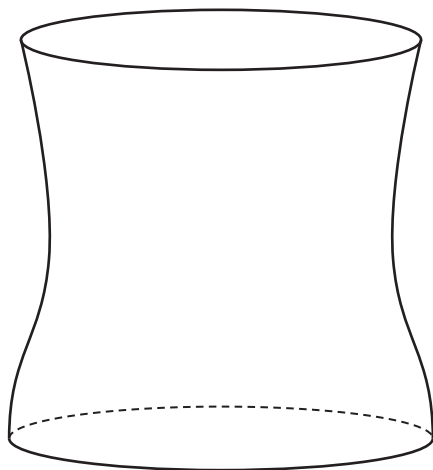
* 0019655323417 *



17



(b)

NOT TO
SCALE

The diagram shows two mathematically similar solids.

The surface area of the larger solid is 200 cm^2 and the surface area of the smaller solid is 98 cm^2 .

The volume of the larger solid is 450 cm^3 .

Calculate the volume of the smaller solid.

..... cm^3 [3]



* 0019655323418 *



18



9



The diagram shows 7 cards.

- (a) Amir picks a card at random.

Find the probability that the card shows

- (i) the letter H

..... [1]

- (ii) the letter B.

..... [1]

- (b) Fumika picks one of the 7 cards at random.
She replaces it and picks a second card at random.

Find the probability that both cards show the letter I.

..... [2]

- (c) Marcos picks two of the 7 cards at random, **without** replacement.

- (i) Find the probability that one card shows the letter I and the other card shows the letter N.

..... [3]

- (ii) Find the probability that the two cards show different letters.

..... [3]

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* 0019655323419 *



19



- (d) Nina picks one of the 7 cards at random without replacement.
She continues picking cards at random without replacement until she picks a card that shows the letter A.

The probability that this occurs when she picks the n th card is $\frac{4}{21}$.

Find the value of n .

$n = \dots\dots\dots$ [2]



* 0019655323420 *



20



10

$$y = x^7 - 7x^6$$

(a) Find the derivative of y with respect to x .

..... [2]

(b) Find the equation of the tangent to the graph of $y = x^7 - 7x^6$ at the point where $x = -1$.
Give your answer in the form $y = mx + c$.

$y =$ [4]

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* 0019655323421 *



21



- (c) The graph of $y = x^7 - 7x^6$ has two turning points.

Find the coordinates of these points.

You must show all your working.

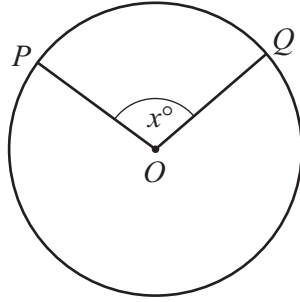
(..... , ...)

(..... , ...) [5]





11 (a)

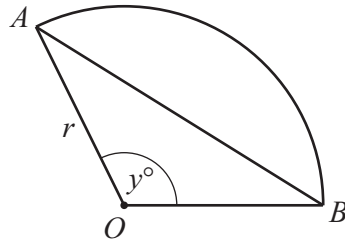
NOT TO
SCALE

In the circle, centre O , the length of the minor arc PQ is $\frac{3}{7}$ of the length of the major arc PQ .
Show that $x = 108$.

[3]



(b)

NOT TO
SCALE

The diagram shows a sector, OAB , of a circle with centre O and radius r .
The area of triangle OAB is half the area of the sector.
Angle $AOB = y^\circ$ and is obtuse.

(i) Show that $360 \sin y = \pi y$.

[2]

(ii) Complete the table, giving your answers correct to two decimal places.

y	$360 \sin y$	πy
108.4	341.60	340.55
108.5	341.40	340.86
108.6	341.20	
108.7		

[3]

(iii) Complete the statement.

The value of y , correct to one decimal place, that satisfies
the equation $360 \sin y = \pi y$ is

[1]





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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2024

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

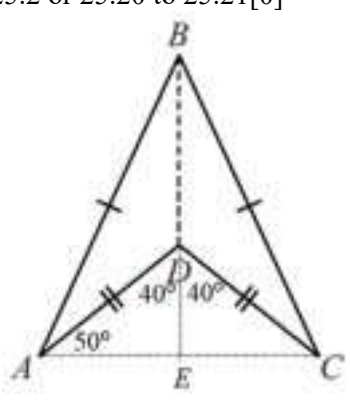
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	3050	2	M1 for $50 \times 40 + 70 \times 15$ or better
1(a)(ii)	91.1 or 91.14 to 91.15	1	FT $\frac{2780}{\text{their } 3050} \times 100$
1(a)(iii)	125 nfw	2	M1 for $[\dots] \times \frac{100-4}{100} = 120$ oe
1(a)(iv)(a)	132	2	B1 for increase of 6 in adult or junior or M1 for $56 : 76$ or for multiples of 33 seen 33, 66, 99, 132, ... or $50 + x : 70 + x = 14 : 19$ oe or $(70 - 50) \times \frac{19+14}{19-14}$ oe or $50 + x = (120 + 2x) \times \frac{14}{19+14}$ oe
1(a)(iv)(b)	10	2	FT $\frac{\text{their(a)} - 120}{120} \times 100$ dep on <i>their (a)</i> > 120 M1 for $\frac{\text{their(a)} - 120}{120} [\times 100]$ or $\frac{\text{their(a)}}{120} \times 100 [-100]$
1(b)(i)	2280 or 2281 to 2282 nfw	2	M1 for $2500 \times \left(1 - \frac{3}{100}\right)^3$ oe
1(b)(ii)	8	2	M1 for $2500 \times \left(1 - \frac{3}{100}\right)^n$ or 0.97^n evaluated with $n > 3$
2(a)(i)	56	1	
2(a)(ii)	11	2	M1 for $120 - n^3 = -1211$ or $120 - 11^3 = -1211$
2(b)	0.0048 or $\frac{3}{625}$ oe	1	

Question	Answer	Marks	Partial Marks												
2(c)	<table border="1"> <tr> <td>A</td><td>-5</td><td></td><td>$10 - 3n$</td></tr> <tr> <td>B</td><td>$\frac{5}{8}$</td><td></td><td>$\frac{n}{n+3}$</td></tr> <tr> <td>C</td><td>20</td><td></td><td>$n^2 - n$</td></tr> </table>	A	-5		$10 - 3n$	B	$\frac{5}{8}$		$\frac{n}{n+3}$	C	20		$n^2 - n$	8	B1 for -5 B2 for $10 - 3n$ oe or B1 for $k - 3n$ or for $10 - kn$ B1 for $\frac{5}{8}$ B1 for $\frac{n}{n+3}$ oe B1 for 20 B2 for $n^2 - n$ oe or B1 for any quadratic or for at least two second differences of 2
A	-5		$10 - 3n$												
B	$\frac{5}{8}$		$\frac{n}{n+3}$												
C	20		$n^2 - n$												
3(a)	5	B1													
	4	B1													
	3.55	3	M2 for $(10 \times 1 + 6 \times 2 + 11 \times 3 + 13 \times 4 + 14 \times 5 + 6 \times 6) \div 60$ oe or M1 for $10 \times 1 + 6 \times 2 + 11 \times 3 + 13 \times 4 + 14 \times 5 + 6 \times 6$ oe												
3(b)(i)	42.55 or 42.6	4	M1 for 25, 40, 62.5 soi M1 for Σfx with x values in correct intervals, including boundaries M1 dep on second M1 for $\frac{\Sigma fx}{100}$												
3(b)(ii)	10.8 2.16	2	B1 for each or for frequency densities 3.6 and 0.72 seen												
4(a)	$\frac{1}{2}(r+5)(r+2)\sin 30 = (r+1)^2$	M2	M1 for $\frac{1}{2}(r+5)(r+2)\sin 30$ oe												
	$r^2 + 5r + 2r + 10$ or $r^2 + r + r + 1$ soi	B1													
	Leading to $3r^2 + r - 6 = 0$ with no errors or omissions	A1	Dependent on both expansions seen												

Question	Answer	Marks	Partial Marks
4(b)	$\frac{-1 \pm \sqrt{1^2 - 4(3)(-6)}}{2(3)}$ Or $-\frac{1}{6} \pm \sqrt{2 + \left(\frac{1}{6}\right)^2} \text{ oe}$ or $\frac{1}{3} \left(-\frac{1}{2} \pm \sqrt{18 + \left(\frac{1}{2}\right)^2} \right) \text{ oe}$	B2	B1 for $\sqrt{1^2 - 4(3)(-6)}$ or for $\frac{-1 + \sqrt{p}}{2(3)}$ or $\frac{-1 - \sqrt{p}}{2(3)}$ or $\left(r + \frac{1}{6}\right)^2$ or $\left(3r + \frac{1}{2}\right)^2$
	-1.59 and 1.26	B1	
4(c)	9.028 to 9.040	2	M1 for (<i>their</i> root (greater than -1) + 1) × 4
5(a)(i)	3 cao	1	
5(a)(ii)	-2, -0.45 to -0.4, 2.40 to 2.45	3	B1 each
5(a)(iii)	3 cao	1	
5(a)(iv)	Asymptote	1	
5(b)(i)	Correct ruled line	2	B1 for ruled line through (0, -2) but not $y = -2$ or for ruled line with gradient 1
5(b)(ii)	1 cao	1	
5(c)	Substituting values of x and y into $y = x^2 - \frac{c}{x}$ for an exact point on graph of $y = f(x)$ or substituting <i>their</i> value of x from 5b(ii) into $x^2 - \frac{c}{x} = x - 2$	M1	
	leading to $c = 2$ with no errors	A1	
5(d)	$[p =] -1$ and $[q =] 2$ nfw	2	M1 for $x^3 - x^2 + 2x = 2$ seen or B1 for each nfw
6(a)	4.27 or 4.272...	2	M1 for $4^2 + 1.5^2$ oe

Question	Answer	Marks	Partial Marks
6(b)	203 or 202.6...	3	B2 for [angle at W =] 22.6... or for [angle at V =] 67.4 or 67.38... or M1 for $\tan = \frac{5}{12}$ or $\frac{12}{5}$ oe
6(c)	25.2 or 25.20 to 25.21[0] 	5	B4 for [BC or AB =] 7.6[0] or 7.604 to 7.605 OR M3 for a complete explicit method leading to AB or BC, e.g. $\frac{5 \sin 140}{\sin 25}$ OR M2 for a complete implicit method leading to AB or BC, e.g. $\frac{\sin 25}{5} = \frac{\sin 140}{BC \text{ or } AB}$ oe and M1 (dep on AB from trig) for $2 \times \text{their } AB + 10$ OR B1 for any relevant angle E.g. $\angle BDA$ or $\angle BDC = 140$, $\angle DAE$ or $\angle DCE = 50$ or $\angle ADE$ or $\angle CDE = 40$ or $\angle ADC = 80$
6(d)	79.5 or 79.6 or 79.54 to 79.55...	5	B2 for [$PR^2 =$] 245 or 245.1 to 245.2 or [$PR =$] 15.65 to 15.66 or 15.7 or M1 for [$PR^2 =$] $11^2 + 8^2 - 2 \times 11 \times 8 \times \cos 110$ M2 for [$\cos PQR =$] $\frac{10^2 + 14^2 - (\text{their } PR)^2}{2 \times 10 \times 14}$ oe or M1 for $(\text{their } PR)^2 = 10^2 + 14^2 - 2 \times 10 \times 14 \cos PQR$ oe
7(a)(i)	40	2	M1 for $\frac{50}{75}$ [$\times 60$] oe
7(a)(ii)	36 nfw	3	M2 for $\frac{47 - 0.5}{75 \text{ to } 80}$ [$\times 60$] or $\frac{46 \text{ to } 47}{75 + 2.5}$ [$\times 60$] or M1 for $47 + 0.5$ or $47 - 0.5$ or $75 + 2.5$ or $75 - 2.5$

Question	Answer	Marks	Partial Marks
7(b)	107 or 107.2...	6	M5 for [speed =] $\frac{240}{(2 \times \frac{260}{7} + 60)} \times 60$ oe OR B5 for [total time =] 134 or 134.2 to 134.3 or 2.24 or 2.238... or B4 for ($t =$) 37.1 or 37.14... OR M2 for $\frac{t}{60} \times 100 + \frac{t+60}{60} \times 110 = 240$ oe or M1 for $\frac{t}{60} \times 100$ or $\frac{t+60}{60} \times 110$ oe M1 for correct equation of form $at = b$ from <i>their</i> equation containing two terms in t and involving the speeds. M1 for $\frac{240}{2 \times \text{their } t + 60} [\times 60]$
8(a)(i)	37.3 or 37.26 to 37.27	5	M2 for $\pi \times 0.35 \times \sqrt{0.35^2 + 1.5^2}$ oe or M1 for $0.35^2 + 1.5^2$ or better M1 for $\pi \times 0.35^2$ M1 for $2 \times \pi \times 0.35 \times 16$
8(a)(ii)	6.35 or 6.349 to 6.351	3	M1 for $\pi \times 0.35^2 \times 16$ M1 for $\frac{1}{3} \times \pi \times 0.35^2 \times 1.5$
8(a)(iii)	22.2 or 22.3 or 22.24 to 22.26	3	M2 for $17.5 \times 3.5 \times 1.4 - 10 \times$ <i>their(a)(ii)</i> or M1 for $17.5 \times 3.5 \times 1.4$

Question	Answer	Marks	Partial Marks
8(b)	154 or 154.3 to 154.4	3	M2 for $450 \times \left(\sqrt{\frac{98}{200}} \right)^3$ oe or M1 for $\left(\sqrt{\frac{98}{200}} \right)^3$ or $\left(\sqrt{\frac{200}{98}} \right)^3$ oe or for $\left(\frac{450}{V} \right)^2 = \left(\frac{200}{98} \right)^3$ oe
9(a)(i)	0	1	
9(a)(ii)	$\frac{1}{7}$ oe	1	
9(b)	$\frac{4}{49}$ oe	2	M1 for $\frac{2}{7} \times \frac{2}{7}$
9(c)(i)	$\frac{2}{21}$ oe	3	M2 for $\frac{2}{7} \times \frac{1}{6} + \frac{1}{7} \times \frac{2}{6}$ oe or M1 for $\frac{2}{7} \times \frac{1}{6}$ or $\frac{1}{7} \times \frac{2}{6}$ oe seen If 0 scored SC1 for $\frac{4}{49}$
9(c)(ii)	$\frac{19}{21}$ oe	3	M2 for $1 - \left(\frac{2}{7} \times \frac{1}{6} \right) - \left(\frac{2}{7} \times \frac{1}{6} \right)$ oe or M1 for $\left(\frac{2}{7} \times \frac{1}{6} \right) + \left(\frac{2}{7} \times \frac{1}{6} \right)$ oe ALTERNATIVE M2 for $\frac{1}{7} [\times 1] \times 3 + \frac{2}{7} \times \frac{5}{6} \times 2$ or M1 for $\frac{2}{7} \times \frac{5}{6}$ or $\frac{1}{7} [\times 1] \times 3$ If 0 scored SC1 for $\frac{38}{49}$
9(d)	3	2	M1 for $\frac{5}{7} \times \frac{4}{6} \times \frac{2 \text{ or } 3}{5}$
10(a)	$7x^6 - 42x^5$ final answer	2	B1 for one correct term $7x^6$ or $42x^5$ or for $7x^6 - 42x^5$ seen and spoiled

Question	Answer	Marks	Partial Marks
10(b)	$49x + 41$	4	M1 for substituting $x = -1$ into $[y =] x^7 - 7x^6$ M1 for $x = -1$ substituted in <i>their</i> (a) or the correct derivative to give <i>their</i> m M1 for <i>their</i> $-8 = (their\ m)(-1) + c$ oe
10(c)	$(0, 0)$ $(6, -46\ 656)$	5	B4 for $(6, -46\ 656)$ or B3 for $x = 0$ and 6 OR M1 for <i>their</i> $\frac{dy}{dx} = 0$ or stating $\frac{dy}{dx} = 0$ and M1 for a correct method to solve <i>their</i> $7x^6 - 42x^5$
11(a)	$\frac{3}{10} \times 360$ oe	M2	M1 for $\frac{3}{3+7} = \frac{x}{360}$ or for $\frac{x}{360} [\times 2\pi r] = \frac{3}{7} \times \frac{360-x}{360} [\times 2\pi r]$ oe or better or $1 [\times 2\pi r] = \frac{10}{7} \times \frac{360-x}{360} [\times 2\pi r]$ oe or better or $\frac{360}{7+3} \times k$ ($k = 1$ or 7)
	108	A1	
11(b)(i)	$\frac{1}{2} r^2 \sin y = \frac{1}{2} \times \frac{y}{360} \times \pi r^2$ or $\frac{y}{360} \times \pi r^2 = [2 \times \frac{1}{2}] r^2 \sin y$ and one further step leading to $360 \sin y = \pi y$ with no errors	2	M1 for $\frac{y}{360} \times \pi r^2$ or for $\frac{1}{2} r^2 \sin y$
11(b)(ii)	341.18 or 341.22 341.00 341.49 or 341.54	3	B1 for each
11(b)(iii)	108.6 cao	1	



Cambridge IGCSE™

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MATHEMATICS

0580/12

Paper 1 (Core)

February/March 2024

1 hour

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 56.
- The number of marks for each question or part question is shown in brackets [].

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2

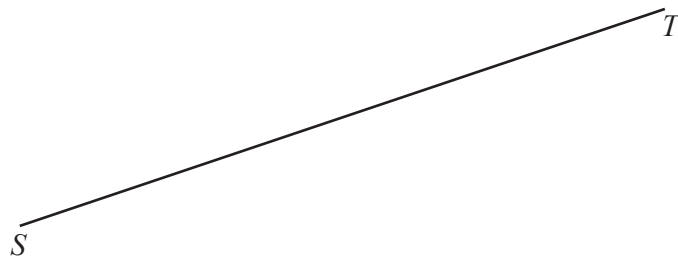
- 1 Write the number thirty thousand and fifty in figures.

..... [1]

- 2 Write 5926 correct to the nearest 10.

..... [1]

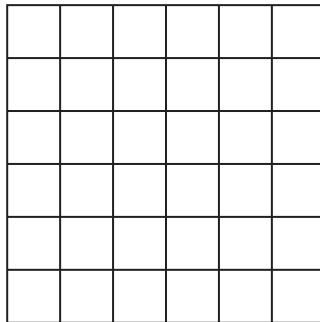
3



Mark the midpoint of the line ST .

[1]

- 4 (a) Shade $\frac{2}{9}$ of this shape.



[1]

- (b) Write $\frac{2}{9}$ as a percentage.

..... % [1]

- 5 A night bus runs from 21 50 to 05 18 the next day.

Work out the number of hours and minutes that the night bus runs.

..... h min [1]

- 6 (a) 34 55 76 83 111 121

From this list of numbers, write down all the multiples of 11.

..... [1]

- (b) Zaid has a non-calculator method for working out if a number is a multiple of 11.
He shows his method for the number 919 281.

Subtract and add alternately the digits in the number. $9 - 1 + 9 - 2 + 8 - 1 = 22$

Check if the answer is a multiple of 11. $22 = 2 \times 11$

As 22 is a multiple of 11 then 919 281 is a multiple of 11.

Show that the number 918 271 937 is a multiple of 11 by using Zaid's method.

[2]

- 7 The range of eight numbers is 31.
These are seven of the numbers.

28 36 42 24 38 16 21

Find the two possible values of the eighth number.

..... or [2]

8 Calculate $\sqrt{5.76} + 2.8^3$.

..... [1]

9 Simplify $4m + 7k - m + 3k$.

..... [2]

10 $-9 \quad -7 \quad -3 \quad -1 \quad 0 \quad 2 \quad 5 \quad 6 \quad 8$

From this list of numbers, find

(a) the highest number possible from the product of **two** of the numbers

..... [1]

(b) the lowest number possible from the product of **three** of the numbers.

..... [1]

11 Sarah records the number of people who play golf on each of 14 days.

28	46	54	71	70	65	49
50	64	77	68	72	45	58

(a) Complete the stem-and-leaf diagram.

2	
3	
4	
5	
6	
7	

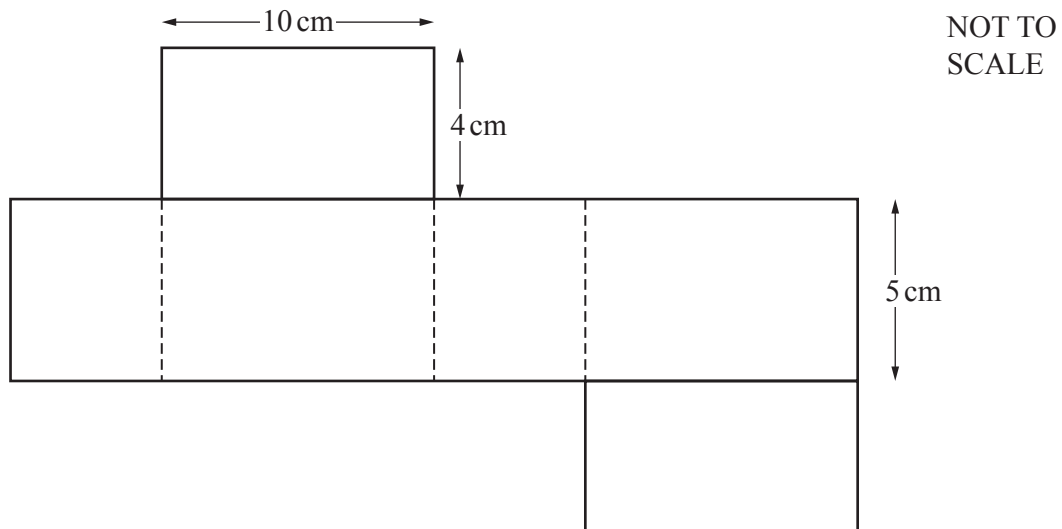
Key : 2 | 8 represents 28

[2]

(b) Find the median.

..... [1]

12



The diagram shows the net of a cuboid.

- (a) Work out the surface area of this cuboid.

..... cm^2 [2]

- (b) Work out the volume of this cuboid.

..... cm^3 [2]

- 13 There are 20 cars in a car park and 3 of the cars are blue.

- (a) James wants to draw a pie chart to show this information.

Find the angle of the sector for the blue cars in this pie chart.

..... [2]

- (b) One of the 20 cars is picked at random.

Find the probability that this car is **not** blue.

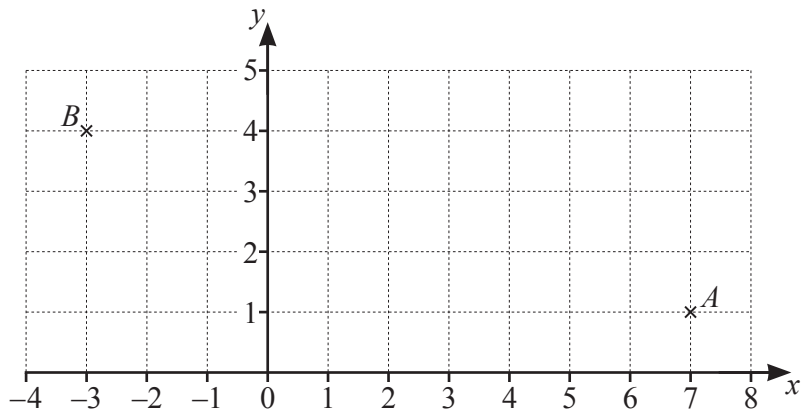
..... [1]
[Turn over]

14 Factorise.

$$3x^3 - 7xy$$

..... [1]

15

Write $\overrightarrow{AB}$ as a column vector.

$$\overrightarrow{AB} = \begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

16

Exchange rates
1 euro = 1.05 dollars
1 rupee = 0.013 dollars

Vani changes x euros into dollars.
She then changes the dollars into 17 850 rupees.

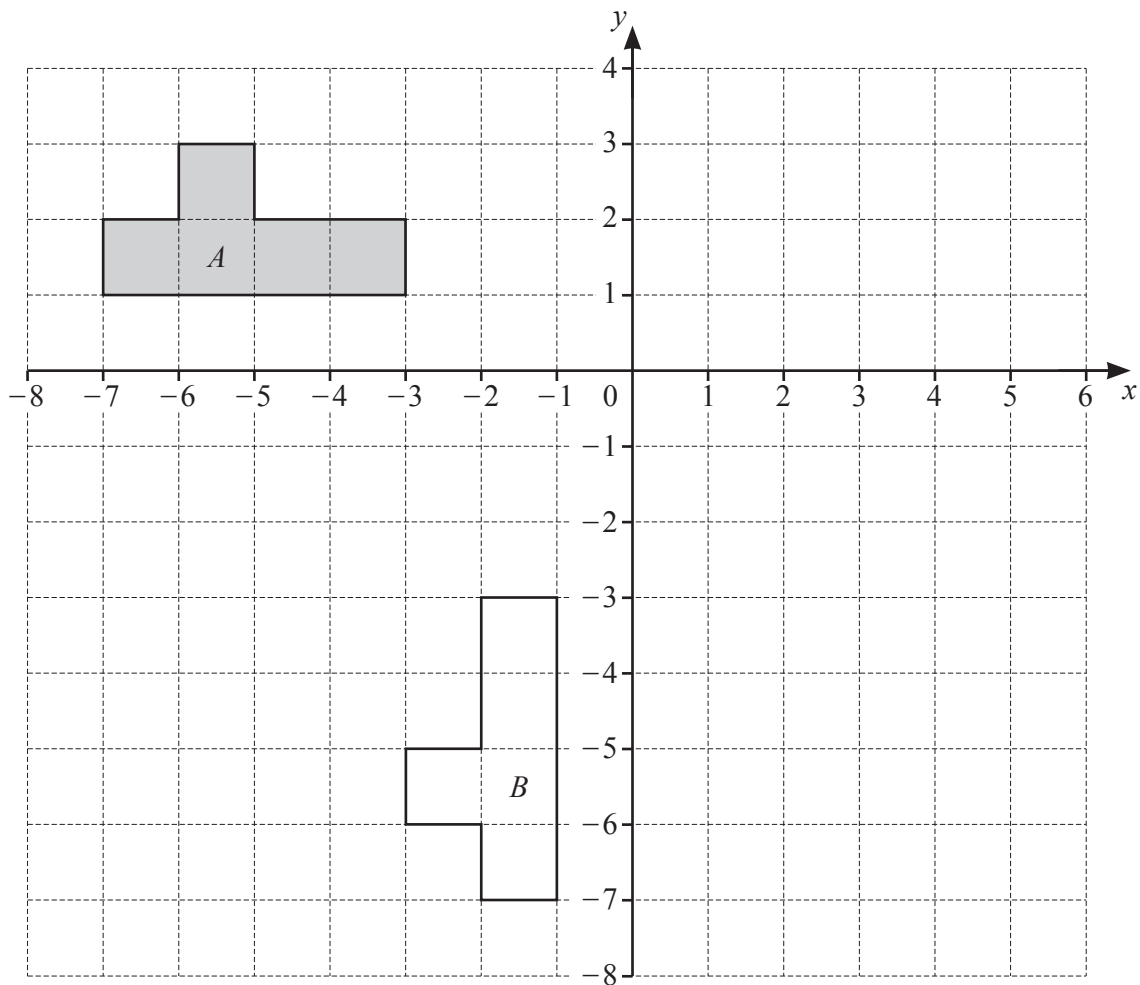
Calculate the value of x . $x =$ [3]

- 17 The line $y = 2x - 5$ intersects the line $y = 3$ at the point P .

Find the coordinates of the point P .

(..... , ...) [2]

- 18 The diagram shows two shapes, A and B , on a grid.



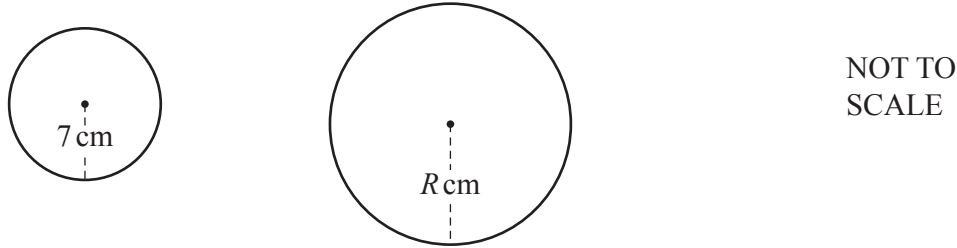
- (a) Describe fully the **single** transformation that maps shape A onto shape B .

.....
 [3]

- (b) On the grid, draw the image of shape A after a reflection in the line $x = -1$.

[2]

19



The diagram shows a small circle with radius 7 cm and a large circle with radius R cm. The area of 16 small circles is the same as the area of one large circle.

Calculate the value of R .

$$R = \dots\dots\dots [3]$$

20 (a) The n th term of a sequence is $n^2 - 3$.

Find the first three terms of this sequence.

$\dots\dots\dots, \dots\dots\dots, \dots\dots\dots [2]$

(b) These are the first five terms of a different sequence.

2 9 16 23 30

Find the n th term of this sequence.

$\dots\dots\dots [2]$

- 21 The length, l m, of a rope is 18.7 m, correct to the nearest 10 centimetres.

Complete this statement about the value of l .

$$\dots\dots\dots \leq l < \dots\dots\dots [2]$$

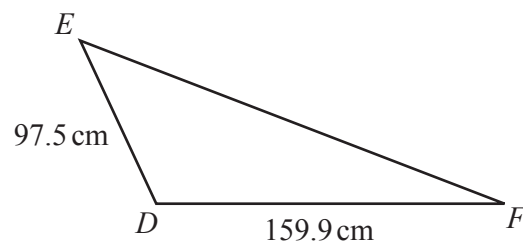
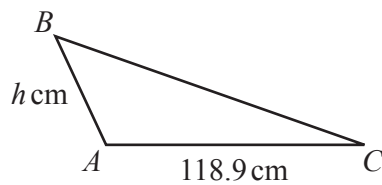
22 $6.5 \times 10^{19} \times n = 5.46 \times 10^{23}$

Calculate the value of n .

Give your answer in standard form.

$$n = \dots\dots\dots [2]$$

23



NOT TO
SCALE

Triangle ABC is mathematically similar to triangle DEF .

Calculate the value of h .

$$h = \dots\dots\dots [2]$$

10

- 24 Without using a calculator, work out $1\frac{1}{4} - \frac{5}{6}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

- 25 The highest common factor (HCF) of two numbers is 6.
The lowest common multiple (LCM) of the two numbers is 90.
Both numbers are greater than 6.

Work out the two numbers.

..... and [2]

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Cambridge IGCSE™

MATHEMATICS

0580/12

Paper 1 (Core)

February/March 2024

MARK SCHEME

Maximum Mark: 56

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Cambridge International is publishing the mark schemes for the February/March 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **6** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

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Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

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- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

- M** Method marks, awarded for a valid method applied to the problem.
- A** Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.
- B** Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation 'dep' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfw	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks												
1	30 050	1													
2	5930	1													
3	Midpoint of ST marked	1													
4(a)	8 squares shaded	1													
4(b)	22.2 or 22.22...	1													
5	7h 28min	1													
6(a)	55 121	1													
6(b)	$9-1+8-2+7-1+9$ $-3+7$	M1													
	$33=3\times 11$	A1													
7	11, 47	2	B1 for each												
8	24.352	1													
9	$3m+10k$ final answer	2	B1 for $3m$ or $10k$ in final answer or for $3m+10k$ seen and spoilt												
10(a)	63	1													
10(b)	−432	1													
11(a)	<table><tr><td>2</td><td>8</td></tr><tr><td>3</td><td></td></tr><tr><td>4</td><td>5 6 9</td></tr><tr><td>5</td><td>0 4 8</td></tr><tr><td>6</td><td>4 5 8</td></tr><tr><td>7</td><td>0 1 2 7</td></tr></table>	2	8	3		4	5 6 9	5	0 4 8	6	4 5 8	7	0 1 2 7	2	B1 for three rows fully correct or for a correct unordered stem-and-leaf diagram
2	8														
3															
4	5 6 9														
5	0 4 8														
6	4 5 8														
7	0 1 2 7														
11(b)	61	1													
12(a)	220	2	M1 for [2] ($5\times 4+4\times 10+5\times 10$)												
12(b)	200	2	M1 for $5\times 4\times 10$												
13(a)	54	2	M1 for $\frac{3}{20}[\times 360]$ oe or $\frac{360}{20}[\times 3]$ oe												

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Question	Answer	Marks	Partial Marks
13(b)	$\frac{17}{20}$ oe	1	
14	$x(3x^2 - 7y)$	1	
15	$\begin{pmatrix} -10 \\ 3 \end{pmatrix}$	1	
16	221	3	M2 for $\frac{17850 \times 0.013}{1.05}$ or M1 for 17850×0.013 or for $\frac{1.05x}{0.013} = 17850$
17	(4,3)	2	B1 for each or M1 for $3 = 2x - 5$ or better
18(a)	Rotation [centre] (0,0) 90° [anticlockwise]	3	B1 for each
18(b)	Shape drawn correctly	2	M1 for reflection in $x = k$ or in $y = -1$
19	28	3	M2 for $16 \times \pi 7^2 = \pi R^2$ or better or M1 for $\pi 7^2$
20(a)	-2 1 6	2	B1 for any 2 in correct position If 0 scored SC1 for -3, -2, 1
20(b)	$7n - 5$ oe final answer	2	B1 for $7n + j$ or $kn - 5$, $k \neq 0$ or $7n - 5$ seen then spoilt
21	18.65 18.75	2	B1 for each If 0 scored SC1 for both correct but reversed or written in centimetres.
22	8.4×10^3	2	B1 for 8400 oe seen or M1 for <i>their</i> answer correctly converted to standard form
23	72.5	2	M1 for $\frac{118.9}{h} = \frac{159.9}{97.5}$ oe or better

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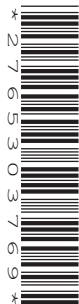
Question	Answer	Marks	Partial Marks
24	$\frac{5}{4}$ or $\frac{1}{4} + \frac{1}{6}$	B1	Correct method for dealing with mixed number Allow $\frac{5k}{4k}$
	$\frac{15}{12}$ and $\frac{10}{12}$	M1	Correct method to find common denominator e.g. [1] $\frac{3}{12}$ and $\frac{10}{12}$
	$\frac{5}{12}$ cao	A1	
25	18 30	2	B1 for 2 numbers with HCF 6 or LCM 90 or for 2 numbers greater than 6 with product 540 OR M1 for some multiples of 6 including 18 and 30 or for some factors of 90 including 18 and 30 or for a tree diagram/table showing prime factors of 540 or 6 and 90



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**MATHEMATICS****0580/22**

Paper 2 (Extended)

February/March 2024**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 A night bus runs from 21 50 to 05 18 the next day.

Work out the number of hours and minutes that the night bus runs.

..... h min [1]

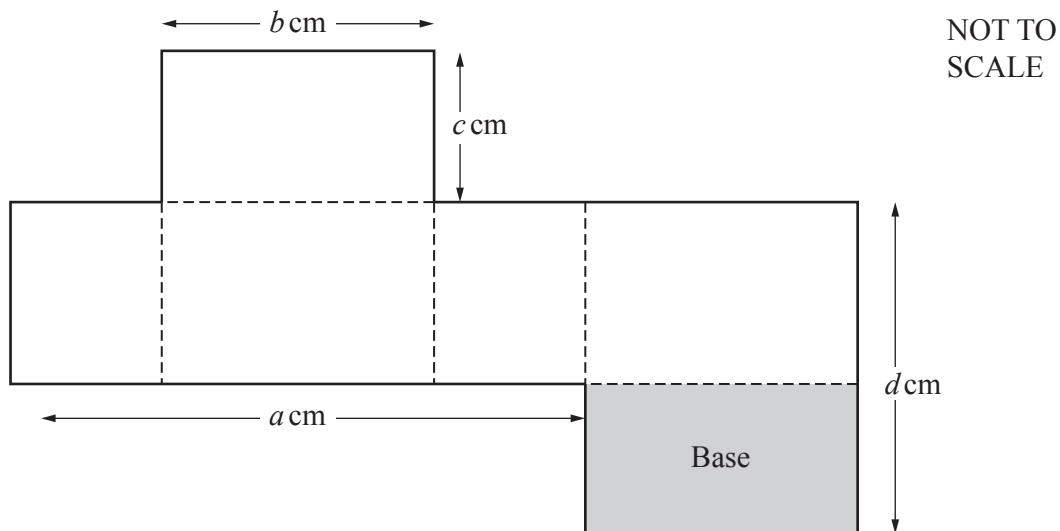
- 2 Calculate $\sqrt{5.76} + 2.8^3$.

..... [1]

- 3 Simplify $4m + 7k - m + 3k$.

..... [2]

4



The diagram shows the net of a cuboid with its base shaded.
The length of the cuboid is 10 cm, its width is 4 cm and its height is 5 cm.

Write down the values of each of a , b , c and d .

$a =$, $b =$, $c =$, $d =$ [4]

3

5 There are 20 cars in a car park and 3 of the cars are blue.

(a) James wants to draw a pie chart to show this information.

Find the angle of the sector for the blue cars in this pie chart.

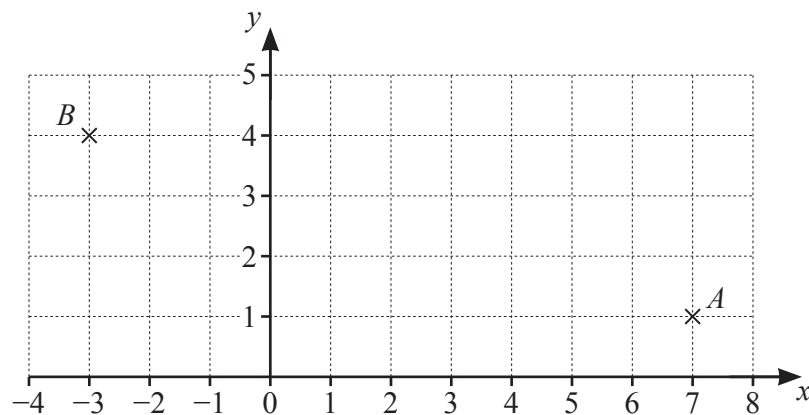
..... [2]

(b) One of the 20 cars is picked at random.

Find the probability that this car is **not** blue.

..... [1]

6



Write $\overrightarrow{AB}$ as a column vector.

$$\overrightarrow{AB} = \begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

7 As the temperature increases, the number of people who go swimming increases.

Write down the type of correlation that this statement describes.

..... [1]

- 8 (a) The n th term of a sequence is $n^2 - 3$.

Find the first three terms of this sequence.

....., ..., ... [2]

- (b) These are the first five terms of a different sequence.

1 3 9 27 81

Find the n th term of this sequence.

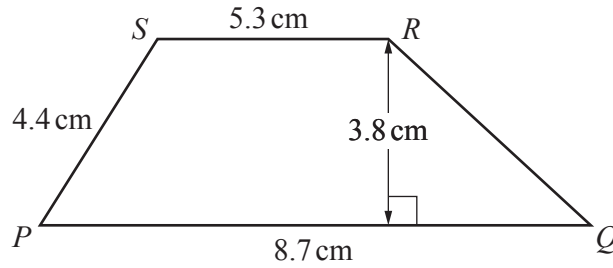
..... [2]

- 9 The line $y = 2x - 5$ intersects the line $y = 3$ at the point P .

Find the coordinates of the point P .

(..... , ...) [2]

10

NOT TO
SCALE

The diagram shows a trapezium $PQRS$.

Calculate the area of the trapezium.

..... cm^2 [2]

11 Without using a calculator, work out $1\frac{1}{4} - \frac{5}{6}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

6

- 12** Farid spins a three-sided spinner with sides labelled A , B and C .
The probability that the spinner lands on C is 0.35 .
Farid spins the spinner 40 times.

Calculate the number of times he expects the spinner to land on C .

..... [1]

- 13** The bearing of B from A is 107° .

Calculate the bearing of A from B .

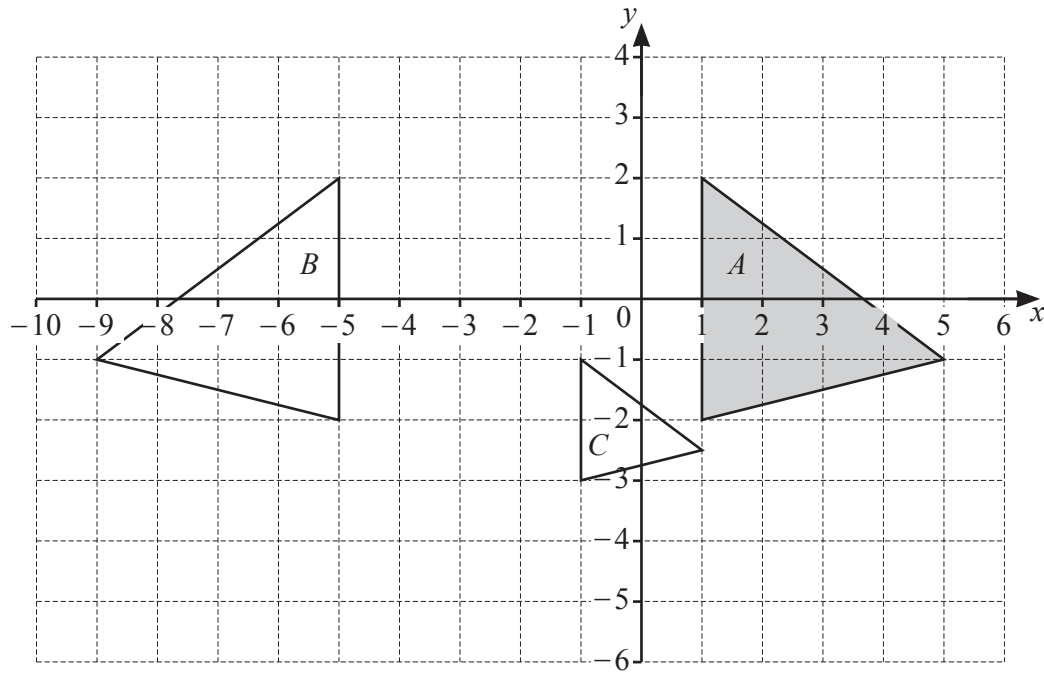
..... [2]

- 14** A train, 1750 metres long, is travelling at 55 km/h.

Calculate how long it will take for the whole train to completely cross a bridge that is 480 metres long.
Give your answer in seconds, correct to the nearest second.

..... s [3]

15



(a) Describe fully the **single** transformation that maps

(i) triangle A onto triangle B

.....
 [2]

(ii) triangle A onto triangle C .

.....
 [3]

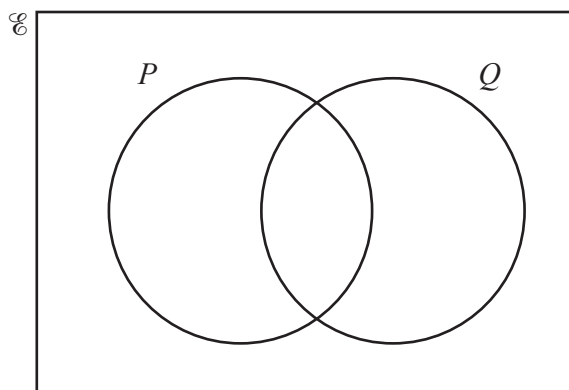
(b) Draw the image of triangle A after a rotation, 90° clockwise, about $(1, 3)$. [2]

- 16 x is an integer.

$$\mathcal{E} = \{x : 1 \leq x \leq 10\}$$

$$P = \{x : x \text{ is an even number}\}$$

$$Q = \{x : x \text{ is a multiple of } 5\}$$



Complete the Venn diagram.

[2]

- 17 The height of each of 200 people is measured.
The table shows the results.

Height (h cm)	$100 < h \leq 120$	$120 < h \leq 130$	$130 < h \leq 150$	$150 < h \leq 190$
Frequency	32	55	64	49

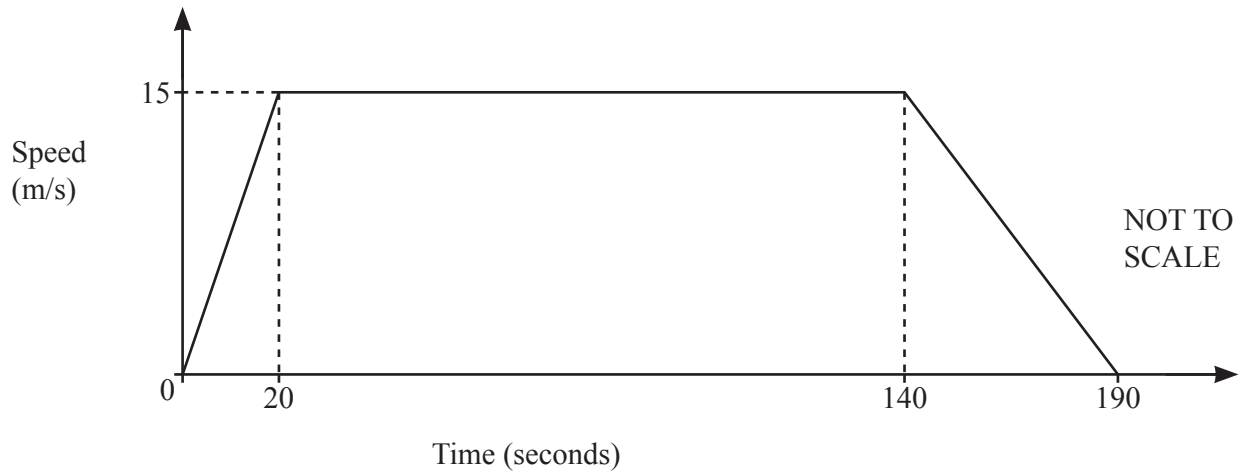
Calculate an estimate of the mean height.

..... cm [4]

- 18 Find the highest common factor (HCF) of $28x^5$ and $98x^3$.

..... [2]

19

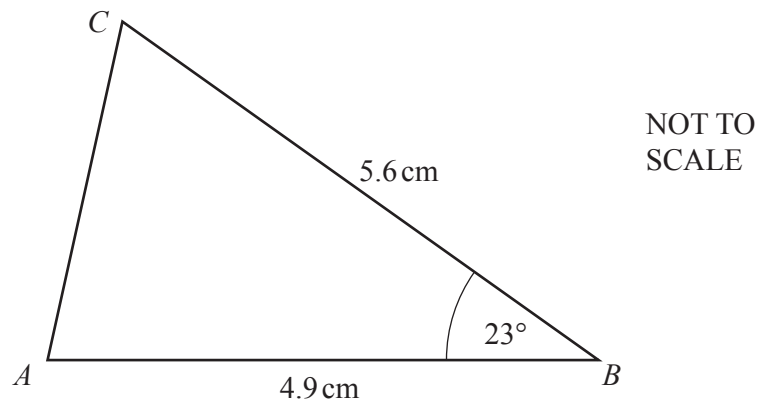


The speed–time graph shows information about a bus journey.

Calculate the total distance travelled by the bus.

..... m [3]

20



Calculate the area of triangle ABC .

..... cm^2 [2]

21 (a) $\sqrt[5]{3} = 3^h$

Write down the value of h .

$h = \dots\dots\dots$ [1]

(b) Simplify $(4x^3)^3$.

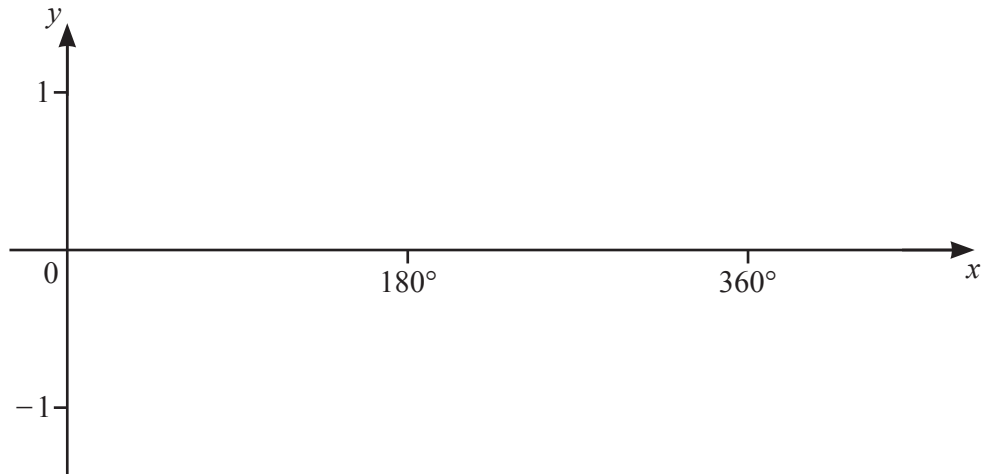
$\dots\dots\dots$ [2]

- 22 y is inversely proportional to the square of $(x + 3)$.
When $x = 5$, $y = 0.375$.

Find y in terms of x .

$y = \dots\dots\dots$ [2]

- 23 (a) On the axes, sketch the graph of $y = \cos x$, for $0^\circ \leq x \leq 360^\circ$.



[2]

- (b) Solve the equation $\cos x = 0.294$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

- 24 $x^2 - 16x + a$ can be written in the form $(x + b)^2$.

Find the value of a and the value of b .

$a = \dots\dots\dots$

$b = \dots\dots\dots$ [2]

Questions 25 and 26 are printed on the next page.

- 25 A bag contains 2 green buttons, 5 red buttons and 6 blue buttons.
Two buttons are taken at random from the bag without replacement.

Calculate the probability that the two buttons are different colours.

..... [4]

- 26 A is the point $(6, 1)$ and B is the point $(2, 7)$.

Find the equation of the perpendicular bisector of AB .
Give your answer in the form $y = mx + c$.

$y =$ [5]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

February/March 2024

MARK SCHEME

Maximum Mark: 70

Published

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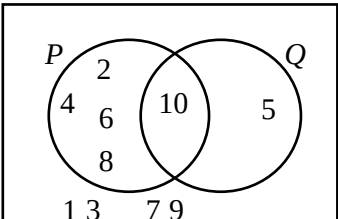
Mathematics-Specific Marking Principles

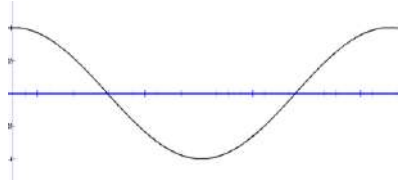
- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
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- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
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Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	7h 28min	1	
2	24.352	1	
3	$3m+10k$ final answer	2	B1 for $3m$ or $10k$ in final answer or for $3m+10k$ seen and spoilt
4	$a = 18 \quad b = 10 \quad c = 4 \quad d = 9$	4	B1 for each If 0 scored, SC1 for b or $c = 4, 5$ or 10
5(a)	54	2	M1 for $\frac{3}{20}[\times 360]$ oe or $\frac{360}{20}[\times 3]$ oe
5(b)	$\frac{17}{20}$ oe	1	
6	$\begin{pmatrix} -10 \\ 3 \end{pmatrix}$ final answer	1	
7	Positive	1	
8(a)	$-2 \quad 1 \quad 6$	2	B1 for any 2 correct in correct position If 0 scored SC1 for $-3 - 2 \quad 1$
8(b)	3^{n-1}	2	B1 for 3^{an+k} , $a \neq 0$ or 3^c for any integer $c > 1$
9	$(4, 3)$	2	B1 for each or M1 for $3 = 2x - 5$ or better
10	26.6	2	M1 for $\frac{1}{2} \times (5.3 + 8.7) \times 3.8$ oe

Question	Answer	Marks	Partial Marks
11	$\frac{5}{4}$ or $\frac{1}{4} + \frac{1}{6}$	B1	Correct method for dealing with mixed number Allow $\frac{5k}{4k}$
	$\frac{15}{12}$ and $\frac{10}{12}$	M1	Correct method to find common denominator e.g. $[1]\frac{3}{12}$ and $\frac{10}{12}$
	$\frac{5}{12}$ cao	A1	
12	14	1	
13	287	2	M1 for $360 - (180 - 107)$ oe or indicates correct angle on a diagram
14	146 cao	3	M2 for $\frac{1750 + 480}{55 \times 1000} \times 60 \times 60$ oe or M1 for distance = $1750 + 480$ oe or $\frac{55 \times 1000}{60 \times 60}$ oe soi or correctly writing <i>their</i> whole number of seconds from a more accurate answer seen
15(a)(i)	reflection $x = -2$	2	B1 for each
15(a)(ii)	enlargement [sf] $\frac{1}{2}$ $(-3, -4)$	3	B1 for each
15(b)	Image at $(0,3)$, $(-4,3)$, $(-3,-1)$	2	B1 for correct size and orientation, wrong centre
16		2	B1 for two sections correct out of four

Question	Answer	Marks	Partial Marks
17	138.425	4	M1 for mid-points soi (110, 125, 140, 170) M1 for use of Σfh with h in correct interval including both boundaries M1 for (dep on 2nd M1) for Σfh , 200
18	$14x^3$	2	B1 for $14x^k$ or $7x^3$ or $2x^3$
19	2325	3	M2 for correct method for total area e.g. $\frac{1}{2} \times 15 \times (190 + 120)$ or M1 for correct method for one area e.g. $\frac{1}{2} \times 20 \times 15$, $(140 - 20) \times 15$ or $\frac{1}{2} \times (190 - 140) \times 15$ oe
20	5.36 or 5.360 to 5.361	2	M1 for $\frac{1}{2} \times 5.6 \times 4.9 \times \sin 23$ oe
21(a)	$\frac{1}{5}$ oe	1	
21(b)	$64x^9$	2	B1 for $64x^k$ or kx^9 as final answer or correct answer spoiled
22	$[y =] \frac{24}{(x+3)^2}$ oe final answer	2	M1 for $y = \frac{k}{(x+3)^2}$
23(a)	 Correct sketch to go through (0, 1), close to (360, 1) and reasonably close to (180, -1)	2	M1 for correct cosine curve shape through (0, 1)
23(b)	72.9 and 287.1	2	B1 for one correct If 0 scored, SC1 for two angles with a sum of 360

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Question	Answer	Marks	Partial Marks
24	$[a =] 64$ $[b =] -8$	2	B1 for each or for both $(x - 8)^2$ and $x^2 - 16x + 64$
25	$\frac{2}{3}$ oe nfww	4	M3 for $\frac{2}{13} \times \frac{11}{12} + \frac{5}{13} \times \frac{8}{12} + \frac{6}{13} \times \frac{7}{12}$ oe or $1 - \left(\frac{2}{13} \times \frac{1}{12} + \frac{5}{13} \times \frac{4}{12} + \frac{6}{13} \times \frac{5}{12} \right)$ oe or M2 for sum of three or more correct product pairs and no incorrect pairs or for $\frac{2}{13} \times \frac{1}{12} + \frac{5}{13} \times \frac{4}{12} + \frac{6}{13} \times \frac{5}{12}$ and no other pairs or M1 for $\frac{j}{13} \times \frac{k}{12}$ If 0 scored SC1 for answer $\frac{104}{169}$ oe
26	$y = \frac{2}{3}x + \frac{4}{3}$ final answer	5	B1 for midpoint (4,4) soi M1 for [gradient AB =] $\frac{7-1}{2-6}$ oe M1 for [$m =$] $\frac{-1}{\text{their gradient of AB}}$ M1 for substituting <i>their</i> midpoint into $y = (\text{their } m)x + c$ dep on at least M1 earned



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MATHEMATICS**0580/42**

Paper 4 (Extended)

February/March 2024**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1 A grocer sells potatoes, mushrooms and carrots.

(a) A customer buys 3 kg of mushrooms at \$1.04 per kg and 4 kg of carrots at \$1.28 per kg.

Calculate the total cost.

\$ [2]

(b) In one week, the ratio of the masses of vegetables sold by the grocer is

potatoes : mushrooms : carrots = 11 : 8 : 6.

(i) Work out the mass of mushrooms sold as a percentage of the total mass.

..... % [2]

(ii) The total mass of potatoes, mushrooms and carrots sold is 1500 kg.

Find the mass of carrots the grocer sells this week.

..... kg [2]

(iii) The profit the grocer makes selling 1 kg of carrots is \$0.75 .

Find the total profit the grocer makes selling carrots this week.

\$ [1]

- (iv) On the last day of the week, the grocer reduces the price of 1 kg of potatoes by 8% to \$1.15 .

Calculate the original price of 1 kg of potatoes.

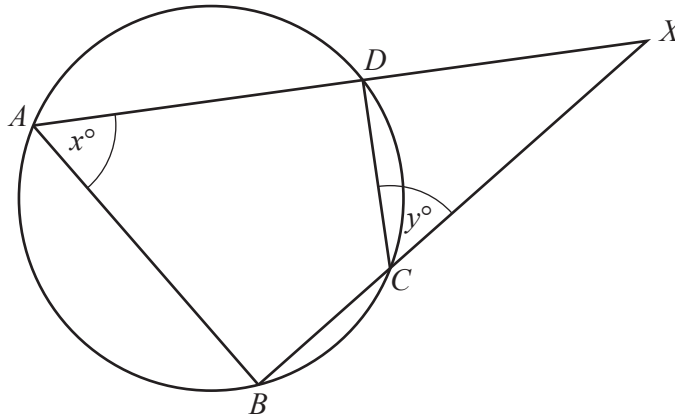
\$ [2]

- (c) The grocer buys 620 kg of onions, correct to the nearest 20 kg.
He packs them into bags each containing 5 kg of onions, correct to the nearest 1 kg.

Calculate the upper bound for the number of bags of onions that he packs.

..... [3]

2

NOT TO
SCALE

A , B , C and D are points on a circle.
 ADX and BCX are straight lines.
Angle $BAD = x^\circ$ and angle $DCX = y^\circ$.

- (a) Explain why $x = y$.
Give a geometrical reason for each statement you make.

[2]

- (b) Show that triangle ABX is similar to triangle CDX .

[2]

5

(c) $AD = 15$ cm, $DX = 9$ cm and $CX = 12$ cm.

(i) Find BC .

$BC = \dots\dots\dots$ cm [3]

(ii) Complete the statement.

The ratio area of triangle ABX : area of triangle $CDX = \dots\dots\dots : 1$. [1]

- 3 (a) The table shows information about the marks gained by each of 10 students in a test.

Mark	15	16	17	18	19	20
Frequency	4	1	2	1	0	2

- (i) Calculate the range.

..... [1]

- (ii) Calculate the mean.

..... [3]

- (iii) Find the median.

..... [1]

- (iv) Write down the mode.

..... [1]

- (b) Paulo's mean mark for 7 homework tasks is 17.
After completing the 8th task, his mean mark is 17.5 .

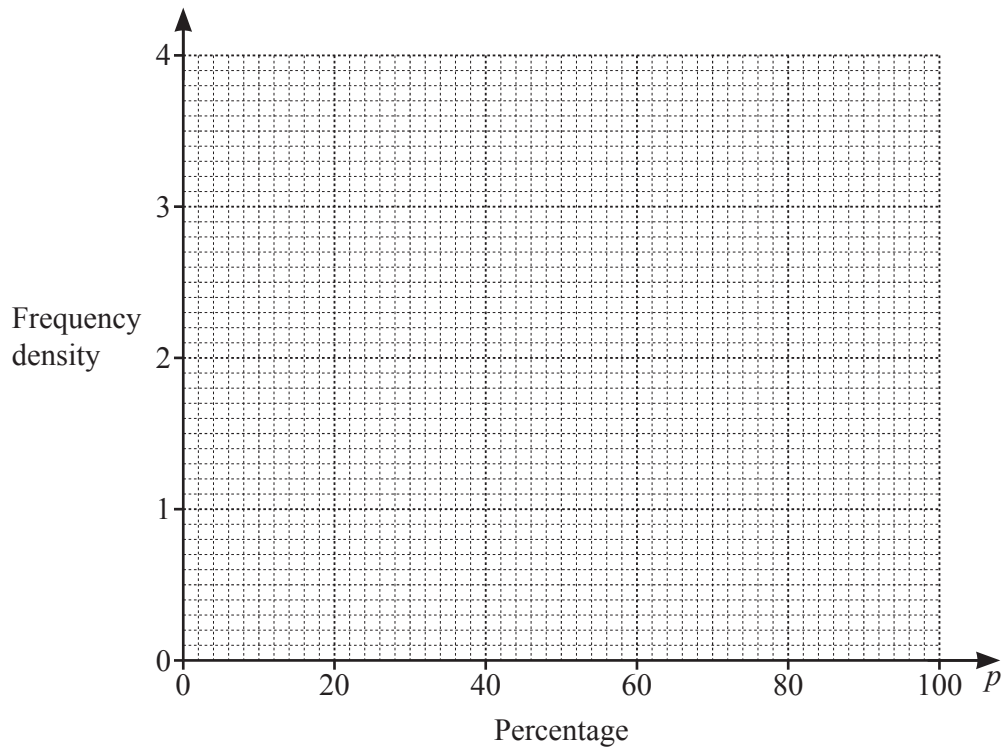
Calculate Paulo's mark for the 8th task.

..... [3]

- (c) The table shows the percentage scored by each of 100 students in their final exam.

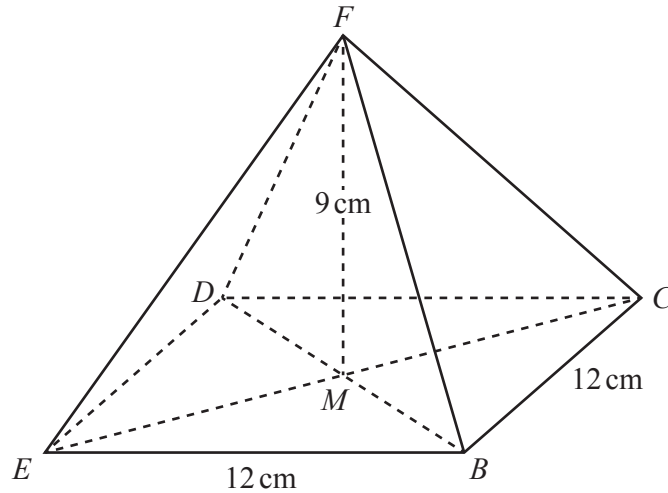
Percentage (p)	$0 < p \leq 30$	$30 < p \leq 50$	$50 < p \leq 60$	$60 < p \leq 70$	$70 < p \leq 100$
Frequency	12	18	35	20	15

On the grid, draw a histogram to show this information.



[4]

4 (a)

NOT TO
SCALE

The diagram shows a pyramid with a square base $BCDE$.
The diagonals CE and BD intersect at M , and the vertex F is directly above M .
 $BE = 12$ cm and $FM = 9$ cm.

(i) Calculate the volume of the pyramid.

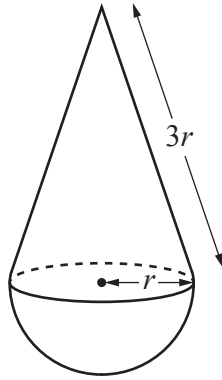
[The volume, V , of a pyramid with base area A and height h is $V = \frac{1}{3}Ah$.]

..... cm^3 [2]

(ii) Calculate the total surface area of the pyramid.

..... cm^2 [5]

(b)

NOT TO
SCALE

The diagram shows a toy made from a cone and a hemisphere.
 The base radius of the cone and the radius of the hemisphere are both r cm.
 The slant height of the cone is $3r$ cm.

The total surface area of the toy is 304 cm^2 .

Calculate the value of r .

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

[The curved surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

$r = \dots\dots\dots$ [4]

5 (a) (i) Factorise.

$$x^2 - x - 12$$

..... [2]

(ii) Simplify.

$$\frac{x^2 - 16}{x^2 - x - 12}$$

..... [2]

(b) Simplify.

$$(2x - 3)^2 - (x + 1)^2$$

..... [3]

(c) Write as a single fraction in its simplest form.

$$\frac{2x + 4}{x + 1} - \frac{x}{x - 3}$$

..... [4]

(d) Expand and simplify.

$$(x-3)(x-5)(2x+1)$$

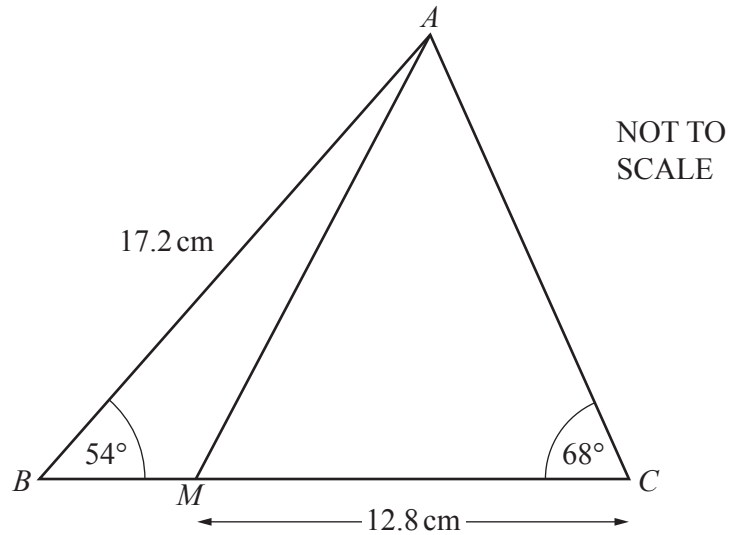
..... [3]

(e) Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}x-3y &= 13 \\ 2x^2-9y &= 116\end{aligned}$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [6]$$



The diagram shows triangle ABC with $AB = 17.2 \text{ cm}$.
Angle $ABC = 54^\circ$ and angle $ACB = 68^\circ$.

(a) Calculate AC .

$AC = \dots\dots\dots \text{ cm}$ [3]

(b) M lies on BC and $MC = 12.8 \text{ cm}$.

Calculate AM .

$AM = \dots\dots\dots \text{ cm}$ [3]

(c) Calculate the shortest distance from A to BC .

$\dots\dots\dots \text{ cm}$ [3]

7 (a) $\mathbf{p} = \begin{pmatrix} 8 \\ -5 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$

(i) Find $3\mathbf{q}$.

$$\begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

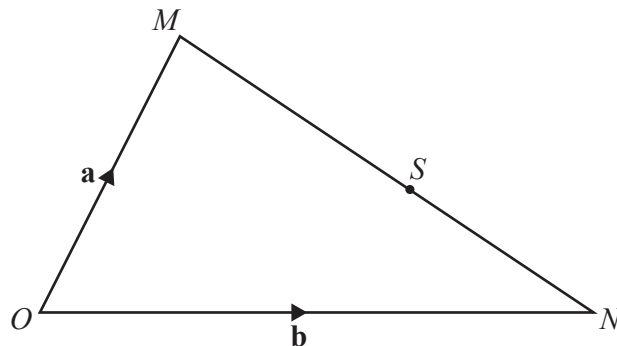
(ii) (a) Find $\mathbf{p} - \mathbf{q}$.

$$\begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(b) Find $|\mathbf{p} - \mathbf{q}|$.

..... [2]

(b)



NOT TO
SCALE

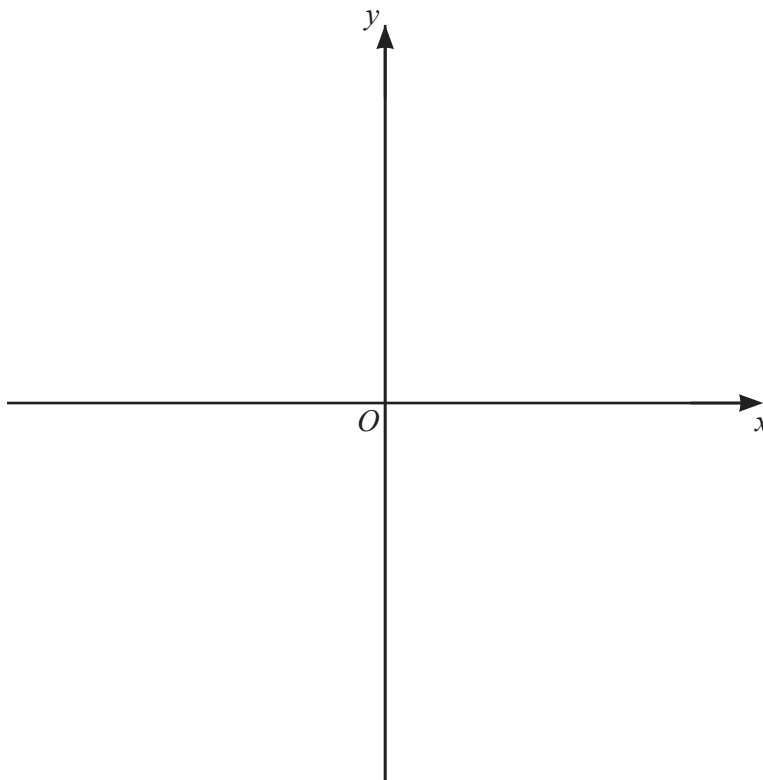
In triangle OMN , O is the origin, $\overrightarrow{OM} = \mathbf{a}$ and $\overrightarrow{ON} = \mathbf{b}$.
 S is a point on MN such that $MS : SN = 5 : 3$.

Find, in terms of $\mathbf{a}$ and/or $\mathbf{b}$, the position vector of S .
 Give your answer in its simplest form.

..... [3]

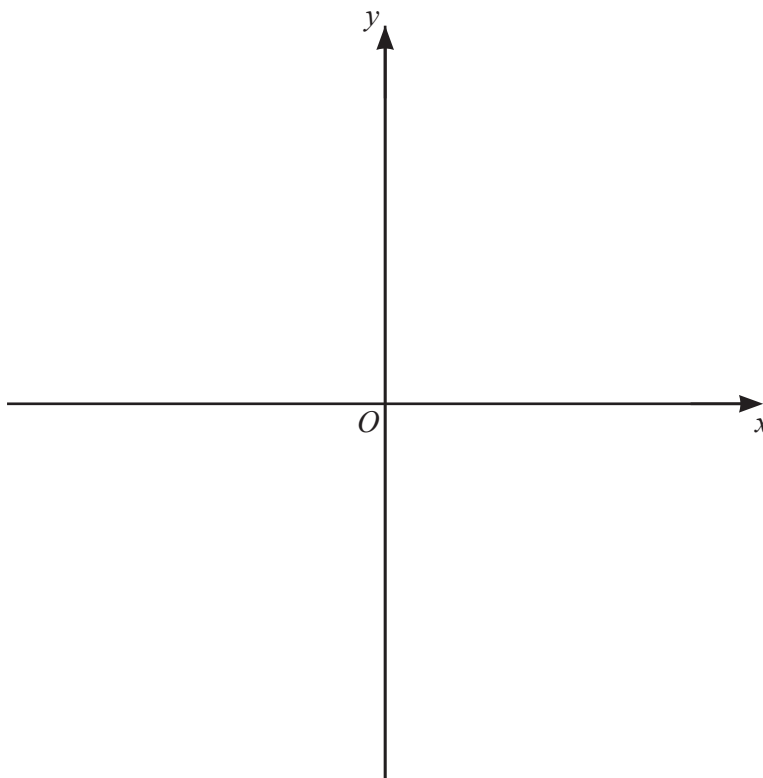
14

- 8 (a) On the axes, sketch the graph of $y = 4 - 3x$.



[2]

- (b) On the axes, sketch the graph of $y = -x^2$.



[2]

- (c) (i) Find the coordinates of the turning points of the graph of $y = 10 + 9x^2 - 2x^3$.
You must show all your working.

(..... , ...) and (..... , ...) [5]

- (ii) Determine whether each turning point is a maximum or a minimum.
Show how you decide.

[3]

- 9 (a) Janna and Kamal each invest \$8000.
At the end of 12 years, they each have \$12 800.

- (i) Janna invests in an account that pays simple interest at a rate of $r\%$ per year.

Calculate the value of r .

$$r = \dots\dots\dots [3]$$

- (ii) Kamal invests in an account that pays compound interest at a rate of $R\%$ per year.

Calculate the value of R .

$$R = \dots\dots\dots [3]$$

- (b) The population of a city is growing exponentially at a rate of 1.8% per year.
The population now is 260 000.

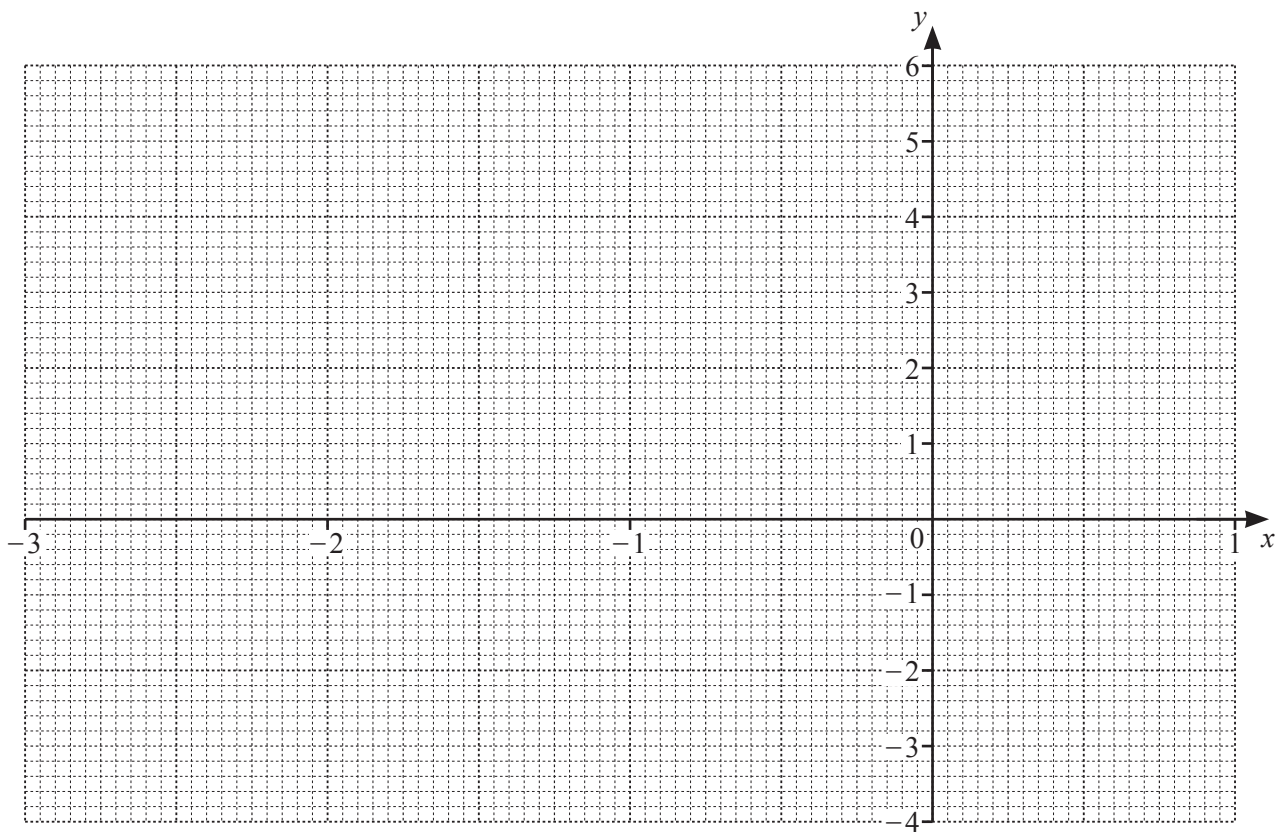
Find the number of complete years from now when the population will first be more than 300 000.

$$\dots\dots\dots \text{ years } [3]$$

- 10 The table shows some values for $y = 2x^3 + 6x^2 - 2.5$.

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1
y		3.75	5.5	4.25	1.5		-2.5	-0.75	

- (a) Complete the table. [3]
- (b) On the grid, draw the graph of $y = 2x^3 + 6x^2 - 2.5$ for $-3 \leq x \leq 1$.



[4]

- (c) By drawing a suitable line on the graph, solve the equation $2x^3 + 6x^2 = 4.5$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- (d) The equation $2x^3 + 6x^2 - 2.5 = k$ has exactly two solutions.

Write down the two possible values of k .

$k = \dots\dots\dots$ or $k = \dots\dots\dots$ [2]

11 $f(x) = \frac{1}{x}, x \neq 0$ $g(x) = 3x - 5$ $h(x) = 2^x$

(a) Find.

(i) $gf(2)$

..... [2]

(ii) $g^{-1}(x)$

$g^{-1}(x) =$ [2]

(b) Find in its simplest form $g(x-2)$.

..... [2]

(c) Find the value of x when

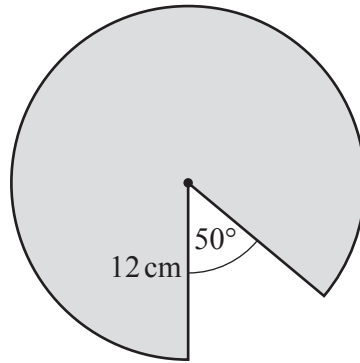
(i) $fg(x) = 0.1$

$x =$ [2]

(ii) $h(x) - g(7) = 0.$

$x =$ [2]

12 (a)

NOT TO
SCALE

The diagram shows a circle of radius 12 cm, with a sector removed.

Calculate the perimeter of the remaining shaded shape.

..... cm [4]

- (b) The diagram in **part(a)** shows the top of a cylindrical cake with a slice removed.
The volume of cake that remains is 3510 cm^3 .

Calculate the height of the cake.

..... cm [3]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

February/March 2024

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the February/March 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	8.24 cao	2	M1 for $3 \times 1.04 + 4 \times 1.28$
1(b)(i)	32	2	M1 for $\frac{8}{11+8+6} [\times 100]$ oe
1(b)(ii)	360	2	M1 for $\frac{1500}{11+8+6} \times k$ where $k = 1, 11, 8$ or 6
1(b)(iii)	270	1	FT $0.75 \times \text{their } 360$
1(b)(iv)	1.25 cao	2	M1 for $x \times \left(1 - \frac{8}{100}\right) = 1.15$ oe or better
1(c)	140 nfww	3	M2 for $\frac{620 \text{ to } 640}{5 - 0.5}$ or $\frac{620 + 10}{4 \text{ to } 5}$ oe or M1 for $620 + 10$ oe or $620 - 10$ oe or $5 + 0.5$ oe or $5 - 0.5$ oe seen
2(a)	$y + \text{angle } BCD = 180$ oe AND angles on a straight line AND $x + \text{angle } BCD = 180$ oe AND opposite angles of a cyclic quadrilateral are supplementary OR angles in opposite segments are supplementary leading to $x = y$ with no errors	B2	B1 for angles on a straight line OR opposite angles of a cyclic quadrilateral are supplementary OR angles in opposite segments are supplementary

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Question	Answer	Marks	Partial Marks
2(b)	Allow any two statements from: CXD is common angle or angle $AXB = \text{angle } CXD$ $x = y$ or angle $BAX = \text{angle } DCX$ angle $ABX = \text{angle } CDX$	M1	
	States all three equal pairs of angles OR 2/all angles equal so triangles similar	A1	
2(c)(i)	6 nfww	3	B2 for $BX = 18$ nfww or M2 for $\frac{24}{12} = \frac{BC+12}{9}$ oe or M1 for $\frac{24}{12} = \frac{BX}{9}$ oe If 0 scored, SC1 for answer 18
2(c)(ii)	4	1	
3(a)(i)	5	1	
3(a)(ii)	16.8	3	M1 for $15 \times 4 + 16 [\times 1] + 17 \times 2 + 18 [\times 1]$ [+ 19×0] + 20×2 oe M1 dep on previous M1 for <i>their</i> $\Sigma fx \div 10$
3(a)(iii)	16.5	1	
3(a)(iv)	15	1	
3(b)	21	3	M2 for 8×17.5 and 7×17 oe or M1 for 7×17 or 8×17.5 oe seen
3(c)	5 correct blocks, with correct widths, heights 0.8cm, 1.8cm 7cm, 4cm, 1cm	4	B3 for 4 correct blocks or B2 for 3 correct blocks or B1 for 2 correct blocks If 0 scored SC1 for correct frequency densities (0.4 0.9 3.5 2 0.5) soi
4(a)(i)	432	2	M1 for $12 \times 12 \times 9 \div 3$ oe

Question	Answer	Marks	Partial Marks
4(a)(ii)	404 or 403.5 to 403.7	5	M4 for $12^2 + 4 \times \frac{1}{2} \times 12 \times \sqrt{6^2 + 9^2}$ oe or M3 for $\frac{1}{2} \times 12 \times \sqrt{6^2 + 9^2}$ oe or M2 for explicit method to find height of triangular face e.g. $\sqrt{6^2 + 9^2}$ oe or M1 for implicit method to find height of triangular face or for $6^2 + 9^2$ oe seen or B1 for slant height of triangle FC $\sqrt{153}$ or $3\sqrt{17}$ or 12.4 or 12.36 to 12.37 soi
4(b)	4.4[0] or 4.398 to 4.399... nfw	4	M3 for $\sqrt{\frac{304}{(2+3) \times \pi}}$ oe or M2 for $\frac{4\pi r^2}{2} + \pi r \times 3r = 304$ oe or M1 for $\frac{4\pi r^2}{2}$ oe seen or $\pi r \times 3r$ oe seen
5(a)(i)	$(x-4)(x+3)$ final answer	2	M1 for $(x+a)(x+b)$ where $ab = -12$ or $a + b = -1$ or for $x(x+3) - 4(x+3)$ or $x(x-4) + 3(x-4)$
5(a)(ii)	$\frac{x+4}{x+3}$ final answer	2	M1 for $(x-4)(x+4)$ seen
5(b)	$3x^2 - 14x + 8$ or $(x-4)(3x-2)$ final answer	3	M2 for $((2x-3)-(x+1))((2x-3)+(x+1))$ or $(4x^2 - 6x - 6x + 9) - (x^2 + x + x + 1)$ or better or correct answer seen or M1 for $(x-4)(ax+b)$ or $(3x-2)(x+c)$ or $(4x^2 - 6x - 6x + 9)$ or $\pm(x^2 + x + x + 1)$ oe
5(c)	$\frac{x^2 - 3x - 12}{(x+1)(x-3)}$ or $\frac{x^2 - 3x - 12}{x^2 - 2x - 3}$ final answer	4	B1 for common denominator $(x+1)(x-3)$ oe isw B1 for $(2x+4)(x-3) - x(x+1)$ or better seen B1 for $2x^2 - 6x + 4x - 12$ or $-x^2 - x$ seen

Question	Answer	Marks	Partial Marks
5(d)	$2x^3 - 15x^2 + 22x + 15$ final answer	3	B2 for correct expansion of three brackets unsimplified or for simplified four-term expression of correct form with 3 terms correct in final answer or B1 for correct expansion of two brackets with at least 3 terms out of 4 correct
5(e)	$2x^2 - 3x - 77 [= 0]$ oe $(6x^2 - 9x - 231 [= 0])$ or $18y^2 + 147y + 222 [= 0]$ oe $(6y^2 + 49y + 74 [= 0])$	M2	M1 for correct method to eliminate one variable e.g. $2(13 + 3y)^2 - 9y = 116$ or $2x^2 - 3(x - 13) = 116$ oe
	$(2x + 11)(x - 7) [= 0]$ oe or $\frac{[- -]3 \pm \sqrt{([-]3)^2 - 4 \times 2 \times -77}}{2 \times 2}$ oe or $(6y + 37)(3y + 6) [= 0]$ or $\frac{-147 \pm \sqrt{147^2 - 4 \times 18 \times 222}}{2 \times 18}$ oe	M2	FT <i>their</i> 3-term quadratic in x or y, correct factors, correct substitution into formula or for correctly completing square M1 for a pair of factors giving 2 correct terms when expanded <i>their</i> quadratic or for e.g. $\sqrt{([-]3)^2 - 4 \times 2 \times -77}$ oe or $\frac{[- -]3 \pm \sqrt{p}}{2 \times 2}$ oe
	$x = 7$ and $y = -2$ $x = -5\frac{1}{2}$ oe and $y = -6\frac{1}{6}$ oe	B2	B1 for both x-values or both y-values or for 1 correct pair
6(a)	15[.0] or 15.00 to 15.01	3	M2 for $\frac{17.2}{\sin 68} \times \sin 54$ oe or M1 for $\frac{\sin 54}{AC} = \frac{\sin 68}{17.2}$ oe
6(b)	15.7 or 15.65 to 15.66	3	M2 for $\sqrt{\text{their}15^2 + 12.8^2 - 2 \times \text{their}15 \times 12.8 \times \cos 68}$ OR M1 for $\text{their}15^2 + 12.8^2 - 2 \times \text{their}15 \times 12.8 \times \cos 68$ A1 for 244.9 to 245.2

Question	Answer	Marks	Partial Marks
6(c)	13.9 or 13.90 to 13.92	3	M2 for $\frac{x}{17.2} = \sin 54$ oe or $\frac{x}{\text{their } 15} = \sin 68$ oe or M1 for distance required is the perpendicular from A to BC soi
7(a)(i)	$\begin{pmatrix} -12 \\ 15 \end{pmatrix}$	1	
7(a)(ii)(a)	$\begin{pmatrix} 12 \\ -10 \end{pmatrix}$	1	
7(a)(ii)(b)	15.6 or 15.62...	2	M1dep for $\text{their } 12^2 + (\text{their } [-]10)^2$ oe, dep $\text{their } 12 \neq 0$ and $\text{their } -10 \neq 0$
7(b)	$\frac{3}{8}a + \frac{5}{8}b$ final answer	3	B2 for an unsimplified correct answer or $MS = \frac{5}{8}(b - a)$ soi or $NS = \frac{3}{8}(-b + a)$ soi or B1 for correct route for $\overrightarrow{OS}$ or for $MN = \mathbf{b} - \mathbf{a}$ or $NM = \mathbf{a} - \mathbf{b}$
8(a)	Ruled line with negative gradient and positive y-intercept	2	B1 for ruled line with negative gradient or for ruled line with positive y-intercept or straight line with negative gradient and positive y-intercept
8(b)	Negative quadratic, with vertex at origin	2	B1 for negative quadratic in other position or for sketch in 3rd and 4th quadrants only with single maximum at (0, 0) and no other turning point or for positive quadratic, with vertex at origin
8(c)(i)	$18x - 6x^2$ isw	B2	B1 for one correct term $18x$ or $-6x^2$ seen
	setting $\text{their derivative} = 0$ or $\frac{dy}{dx} = 0$	M1	Dep on at least B1 earned or $\text{their derivative} = \pm 18x \pm 6x^2$
	(0, 10) and (3, 37)	B2	B1 for $x = 0$ and $x = 3$ or for (0, 10) or (3, 37)

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Question	Answer	Marks	Partial Marks
8(c)(ii)	(0, 10) minimum with correct reason AND (3, 37) maximum with correct reason	3	Reasons could be e.g. 1 A reasonable sketch of a negative cubic 2 Correct use of 2nd derivative = $-12(0) + 18 = 18$, $18 > 0$, so (0, 10) is a minimum oe. 2nd derivative = $-12(3) + 18 = -18$, $-18 < 0$ so (3, 37) is a maximum oe. 3 Evaluates correctly values of y on both sides of both correct stationary points 4 Finds gradient on each side of both correct stationary points. B2 for 1 correct with correct reason for that stationary point or for both x-values correct and reasonable sketch of a negative cubic, or for correct substitution and evaluation of both of <i>their</i> x-values into <i>their</i> second derivative or substitution and evaluation for one x-value on both sides of both of <i>their</i> stationary points to find the gradients soi or M1 for showing [2nd derivative =] $-12x + 18$ or correct FT <i>their</i> 2nd derivative or substitution and evaluation shown for one x-value on both sides of one of <i>their</i> stationary points to find the gradients soi or for sketch of any negative cubic.
9(a)(i)	5	3	M2 for $\frac{(12800 - 8000) \times 100}{8000 \times 12}$ or M1 for $[12800 - 8000 =] \frac{8000 \times 12 \times r}{100}$ or 400 seen If 0 scored, SC1 for answer 13.3 or 13.33...
9(a)(ii)	4[.0] or 3.99...	3	M2 for $\sqrt[12]{\frac{12800}{8000}}$ or M1 for $12800 = 8000 \times k^{12}$ for any k

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Question	Answer	Marks	Partial Marks
9(b)	9 nfww	3	M2 for $260\,000 \times \left(1 + \frac{1.8}{100}\right)^8$ oe evaluated to 4 sf or better or $260\,000 \times \left(1 + \frac{1.8}{100}\right)^9$ oe evaluated to 2 sf or better or M1 for $[300\,000 =] 260\,000 \times \left(1 + \frac{1.8}{100}\right)^n$ oe soi (Accept any inequality sign in $[300\,000 =]$)
10(a)	-2.5 -1.25 5.5	3	B1 for each
10(b)	Correct graph	4	B3FT for 8 or 9 correct points or B2FT for 6 or 7 correct points or B1FT for 4 or 5 correct points
10(c)	$y = 2$ drawn	M1	
	-2.75 to -2.65	A2	A1 for 1 solution
	-1.1 to -1.05		
	0.75 to 0.85		
10(d)	-2.5 5.5	2	B1 for each
11(a)(i)	-3.5 oe	2	M1 for $g\left(\frac{1}{2}\right)$ seen or $3\left(\frac{1}{x}\right) - 5$ or better
11(a)(ii)	$\frac{x+5}{3}$ oe final answer	2	M1 for correct first step $y + 5 = 3x$, $\frac{y}{3} = x - \frac{5}{3}$ or $x = 3y - 5$
11(b)	$3x - 11$ final answer	2	M1 for $3(x - 2) - 5$
11(c)(i)	5	2	M1 for $\frac{1}{3x-5} [= 0.1]$
11(c)(ii)	4 nfww	2	M1 for $2^x - (3 \times 7 - 5) [= 0]$ or better

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Question	Answer	Marks	Partial Marks
12(a)	88.9 or 88.92 to 88.93...	4	M3 for $2 \times 12 + \frac{360 - 50}{360} \times 2 \times \pi \times 12$ oe or M2 for $\frac{(360 - 50)}{360} \times 2 \times \pi \times 12$ oe isw or M1 for $\frac{50}{360} \times 2 \times \pi \times 12$ oe isw
12(b)	9.01 or 9.009 to 9.010...	3	M2 for $\frac{(360 - 50)}{360} \times \pi \times 12^2 \times h = 3510$ or M1 for $\frac{k}{360} \times \pi \times 12^2 \times h$ oe seen with $k = 50$ or $360 - 50$



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MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2023

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

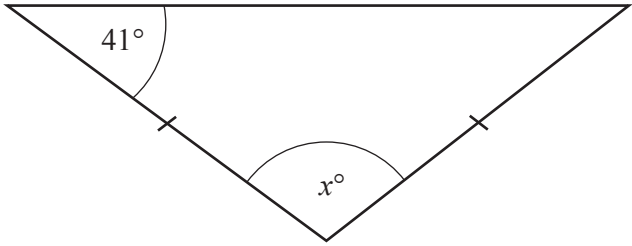
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 The diagram shows an isosceles triangle.



NOT TO
SCALE

Find the value of x .

$x =$ [2]

- 2 The stem-and-leaf diagram shows the time, in minutes, it takes each of 15 people to complete a race.

1	6 6 7
2	1 3 3 4 5 6 7 7 7
3	0 1 1

Key: 1|6 represents 16 minutes

Find

- (a) the mode

..... min [1]

- (b) the range

..... min [1]

- (c) the median.

..... min [1]

3 Complete these statements.

(a) When $x = \dots\dots\dots$, $x + 3 = 8$. [1]

(b) When $7y = 63$, $10y = \dots\dots\dots$ [1]

4 The table shows some information about Amir's shopping.

Fruit	Cost per kilogram	Number of kilograms Amir buys	Cost
Oranges	\$2.35	3.2	\$.....
Bananas	\$.....	2.8	\$.....
Total			\$13.54

Complete the table.

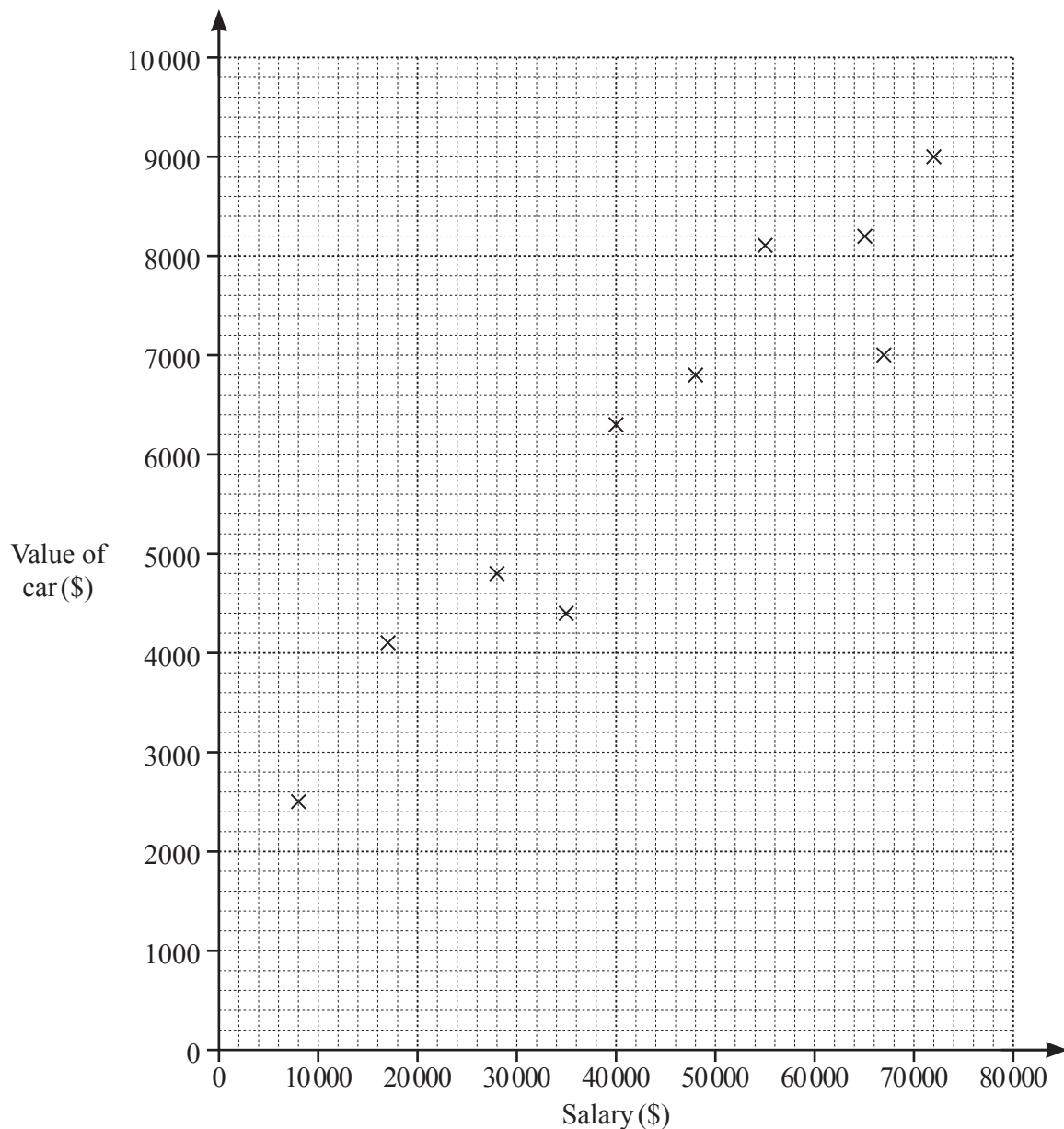
[3]

5 Factorise completely.

(a) $42mk - 35m$
 [2]

(b) $h^2 - 144$
 [1]

- 6 For each of 10 people working in an office, the scatter diagram shows their salary and the value of their car.



- (a) One of these people has a salary of \$28 000.

Find the value of their car.

\$ [1]

- (b) Another person starts to work in the office.
Their salary is \$54 000 and the value of their car is \$6100.

Plot this information on the scatter diagram.

[1]

- (c) What type of correlation is shown in the scatter diagram?

..... [1]

- 7 The exchange rate between Singapore dollars and euros is 1 Singapore dollar = 0.62 euros.

Find the value of 161.20 euros in Singapore dollars.

..... Singapore dollars [1]

- 8 Calculate.

$$7\frac{3}{11} \times 3\frac{3}{10}$$

..... [1]

- 9 Find the highest common factor (HCF) of 140 and 126.

..... [2]

- 10 Simplify.

(a) $n^5 \times n$

..... [1]

(b) $8x^6 \div 2x^2$

..... [2]

(c) $(243y^{20})^{\frac{2}{5}}$

..... [2]

11 Solve.

$$4(2x - 3) \geq 43 + 3x$$

..... [3]

12 Write $0.\dot{4}2$ as a fraction in its simplest form.
You must show all your working.

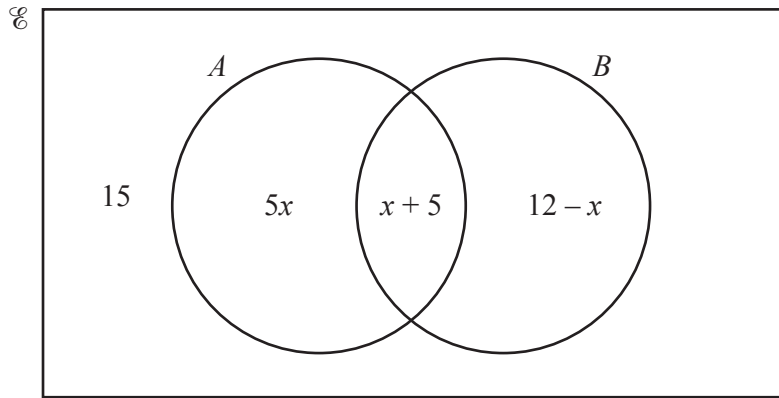
..... [3]

13 At the end of 2021 there were 27 000 rhinos living in the wild.
The number of rhinos is expected to decrease exponentially by 3% each year.

Work out the number of rhinos expected to be living in the wild 4 years later, at the end of 2025.
Give your answer correct to the nearest whole number.

..... [3]

14 (a)

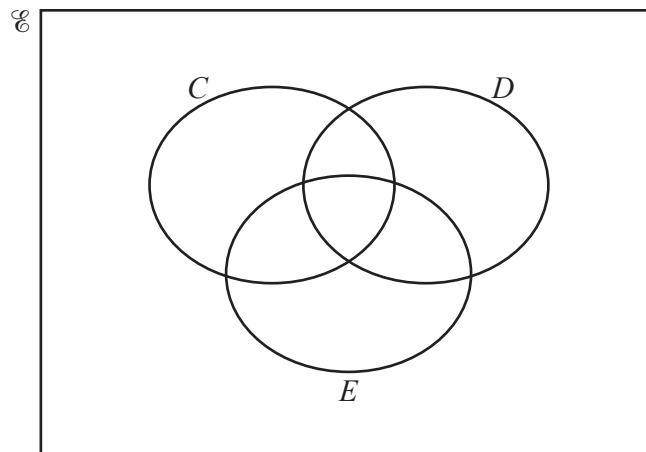


The Venn diagram shows information about the number of elements in sets A , B and $\mathcal{E}$.
 $n(\mathcal{E}) = 52$.

Find $n(A \cap B)$.

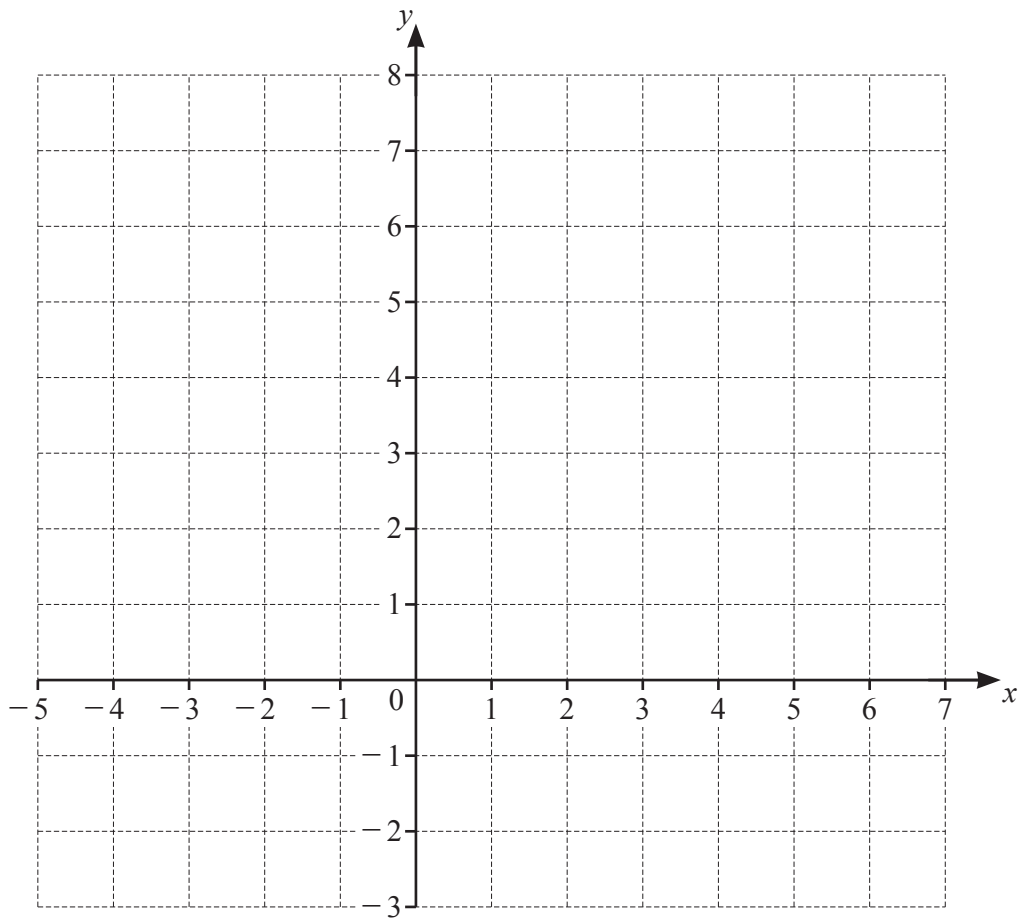
..... [3]

(b) In this Venn diagram, shade the region $C \cap D \cap E$.



[1]

15



By shading the **unwanted** regions of the grid, draw and label the region R which satisfies these inequalities.

$$y > 1$$

$$x \leq 2$$

$$y \geq x + 2$$

[5]

16 $P = 2w + 2h$

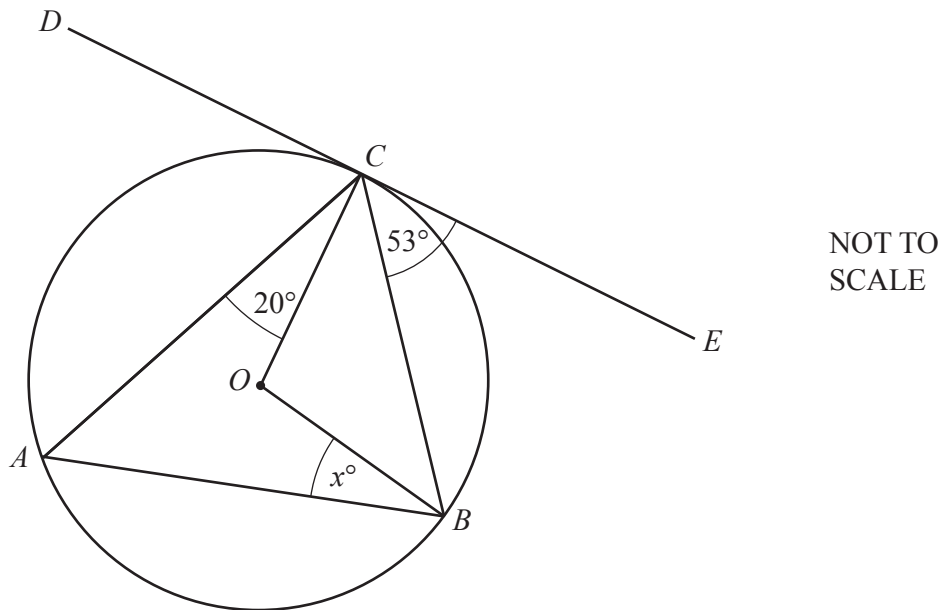
$w = 11$ and $h = 9.5$, both correct to 2 significant figures.

Find the lower bound and the upper bound for P .

Lower bound = ...

Upper bound = ... [3]

17

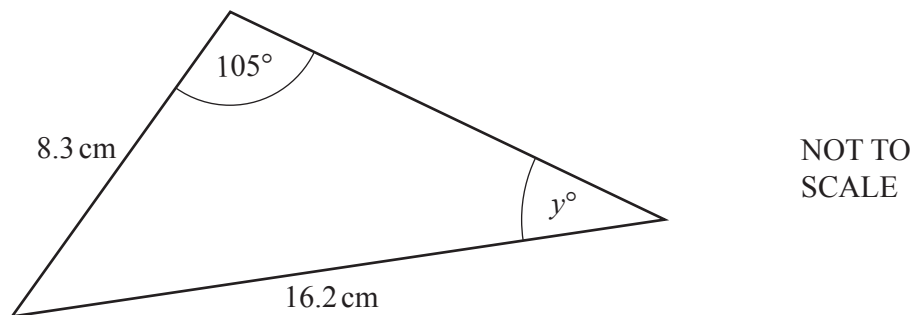


A , B and C are points on the circumference of a circle, centre O .
Tangent DE touches the circle at C .
Angle $BCE = 53^\circ$ and angle $ACO = 20^\circ$.

Find the value of x .

$x = \dots\dots\dots$ [3]

18



Calculate the value of y .

$y = \dots\dots\dots$ [3]

19 (a)



Sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$.

[2]

(b) When $\cos x = 0.21$, find the **reflex** angle x .

..... [2]

20 Write as a single fraction in its simplest form.

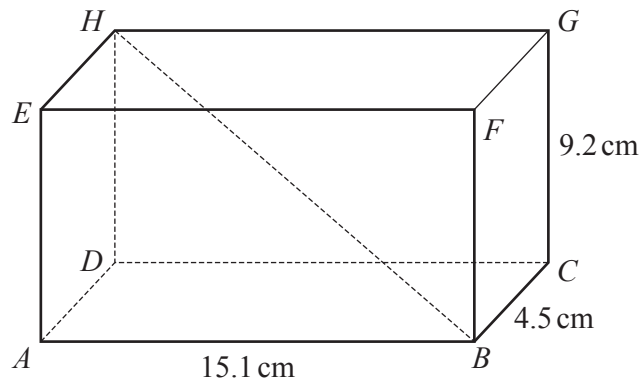
(a) $\frac{10x^2 - 60x}{x^2 - x - 30}$

..... [3]

(b) $\frac{7}{x+3} + \frac{5}{8x-1}$

..... [3]

21



NOT TO
SCALE

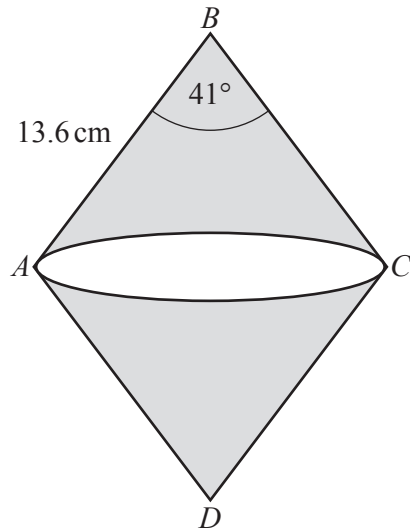
The diagram shows a cuboid $ABCDEFGH$.
 $AB = 15.1$ cm, $BC = 4.5$ cm and $CG = 9.2$ cm.

Calculate the angle that the diagonal BH makes with the face $ADHE$.

..... [4]

Question 22 is printed on the next page.

22

NOT TO
SCALE

$ABCD$ is a rhombus with side length 13.6 cm.

Angle $ABC = 41^\circ$.

BAC is a sector of a circle with centre B .

DAC is a sector of a circle with centre D .

Calculate the shaded area.

..... cm^2 [4]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2023

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao – correct answer only

dep – dependent

FT – follow through after error

isw – ignore subsequent working

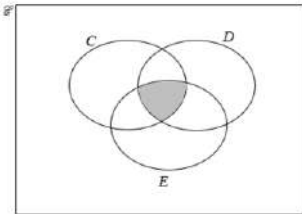
oe – or equivalent

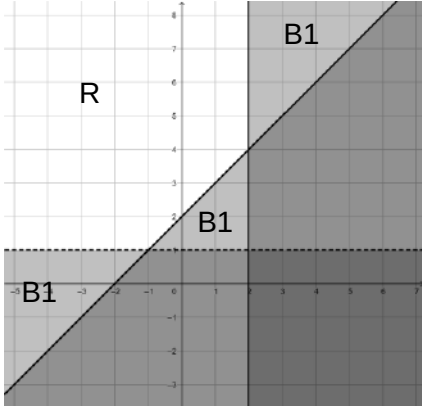
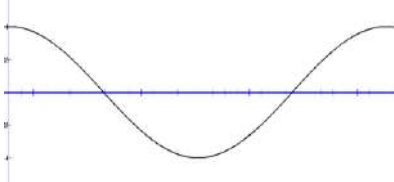
SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks									
1	98	2	M1 for $x + 41 + 41 = 180$ oe or better									
2(a)	27	1										
2(b)	15	1										
2(c)	25	1										
3(a)	5	1										
3(b)	90	1										
4	<table border="1"><tr><td>Fruit</td><td>Cost per kg</td><td>Cost</td></tr><tr><td>Oranges</td><td></td><td>\$7.52</td></tr><tr><td>Bananas</td><td>\$2.15</td><td>\$6.02</td></tr></table>	Fruit	Cost per kg	Cost	Oranges		\$7.52	Bananas	\$2.15	\$6.02	3	B1 for 7.52 B1 for 6.02 or B1FT for $13.54 - \text{their } 7.52$ correctly evaluated provided $\text{their } 7.52 < 13.54$ B1FT for $\text{their } 6.02 \div 2.8$ correctly evaluated
Fruit	Cost per kg	Cost										
Oranges		\$7.52										
Bananas	\$2.15	\$6.02										
5(a)	$7m(6k - 5)$ final answer	2	B1 for $7(6mk - 5m)$ or $m(42k - 35)$ as final answer or $7m(6k - 5)$ seen and then spoiled									
5(b)	$(h + 12)(h - 12)$ final answer	1										
6(a)	4800	1										
6(b)	Point plotted at (54 000, 6100)	1										
6(c)	Positive	1										
7	260	1										
8	24 cao	1										
9	14	2	B1 for answer 2 or 7 or M1 for 2×7 as final answer or $[140 =] 2 \times 2 \times 5 \times 7$ and $[126 =] 2 \times 3 \times 3 \times 7$ or 2 correct factor trees or tables									
10(a)	n^6 final answer	1										
10(b)	$4x^4$ final answer	2	B1 for kx^4 or $4x^k$ as final answer or correct answer seen and then spoiled									
10(c)	$9y^8$ final answer	2	B1 for ky^8 or $9y^k$ final answer or correct answer seen and spoiled									

Question	Answer	Marks	Partial Marks
11	$x \geq 11$ final answer	3	M1 for $8x - 12 \geq 43 + 3x$ or better M1 for e.g. $8x - 3x \geq 43 + 12$ oe OR M1 for $2x - 3 \geq \frac{43}{4} + \frac{3x}{4}$ M1 for $2x - \frac{3x}{4} \geq \frac{43}{4} + 3$
12	42.22... – 4.22... oe	M1	M1 for correct working shown
	$\frac{19}{45}$ cao	A2	A1 for $\frac{38}{90}$ oe seen If M0 scored SC1 for $\frac{k}{90}$ or for answer $\frac{19}{45}$ with insufficient working.
13	23 903 cao	3	B2 for answer 23900, 23902, 23902.9... or 23 903 seen then rounded OR M1 for $27\,000 \times \left(1 - \frac{3}{100}\right)^4$ oe B1 for <i>their</i> more accurate value seen and correctly rounded to the nearest whole number
14(a)	9	3	B2 for $x = 4$ or B1 for answer 4 (without $x = 4$ in working) OR M1 for $5x + x + 5 + 12 - x + 15 = 52$ oe or better B1FT for identifying the correct region $A \cap B$
14(b)		1	

Question	Answer	Marks	Partial Marks
15		5	B1 for $y = 1$ dashed line B1 for $x = 2$ solid line B1 for $y = x + 2$ solid line B2 for region identified satisfying all 3 inequalities or B1 for region identified satisfying only 2 of these inequalities with $y = 1$, $x = 2$ and $y = x + 2$ all drawn
16	[Lower bound =] 39.9 nfw [Upper bound =] 42.1 nfw	3	B2 for one correct or M1 for $11 + 0.5$ or $9.5 + 0.05$ or $11 - 0.5$ or $9.5 - 0.05$
17	33	3	B2 for $254 + 20 + x + 53 = 360$ oe or better or $53 + 20 + x + 37 + 37 = 180$ oe or better or $OAB = 33$ or $AOB = 114$ or 70 and 37 correctly identified or 53 and 20 correctly identified or B1 for any correct relevant angle identified
18	29.7 or 29.66[...]	3	M2 for $[\sin y =] \frac{8.3 \sin 105}{16.2}$ or M1 for $\frac{16.2}{\sin 105} = \frac{8.3}{\sin y}$ oe
19(a)	 Correct sketch to go through (0, 1), close to (360, 1) and reasonably close to (180, -1)	2	B1 for correct cosine curve shape through (0,1)
19(b)	282.1 or 282.12...	2	B1 implied by 77.9 or 77.87 to 77.88 or 282.13 or M1 for $360 - \text{their acute angle}$
20(a)	$\frac{10x}{x+5}$ final answer	3	B1 for $10x(x-6)$ B1 for $(x-6)(x+5)$

Question	Answer	Marks	Partial Marks
20(b)	$\frac{61x+8}{(x+3)(8x-1)}$ final answer	3	B1 for common denominator of $(x+3)(8x-1)$ isw B1 for $7(8x-1) + 5(x+3)$ or better isw
21	55.9 or 55.85...	4	M3 for $\tan[\dots] = \frac{15.1}{\sqrt{4.5^2 + 9.2^2}}$ oe or M2 for $[AH^2 =] 4.5^2 + 9.2^2$ or $[BH^2 =] 4.5^2 + 9.2^2 + 15.1^2$ or M1 for recognising angle BHA if 0 scored SC1 for $[\text{angle } BHD =] 59.7[1\dots]$ or 59.72
22	110 or 110.3...	4	M3 for $[2 \times] (2(\frac{1}{2} \times 13.6^2 \times \sin 41) - (\frac{41}{360} \times \pi \times 13.6^2))$ oe OR M1 for $[\frac{1}{2} \times] 13.6^2 \times \sin 41$ oe M1 for $[2 \times] \frac{41}{360} \times \pi \times 13.6^2$ oe



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MATHEMATICS

0580/22

Paper 2 (Extended)

October/November 2023

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

1 Write 24.07839

(a) correct to 2 decimal places

..... [1]

(b) correct to the nearest 10.

..... [1]

2 Write down the number that is 9 greater than -23 .

..... [1]

3 $v = u + at$

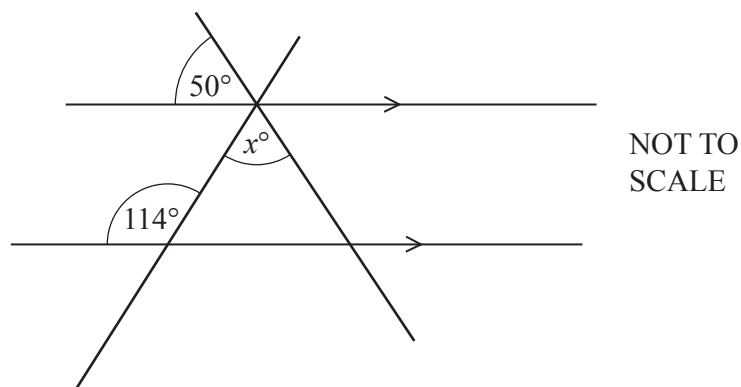
Find the value of v when $u = 30$, $a = -2$ and $t = 7$.

$v =$ [2]

4 Change 62 000 millimetres into kilometres.

..... km [1]

5



The diagram shows two intersecting straight lines crossing two parallel lines.

Find the value of x .

$x =$ [2]

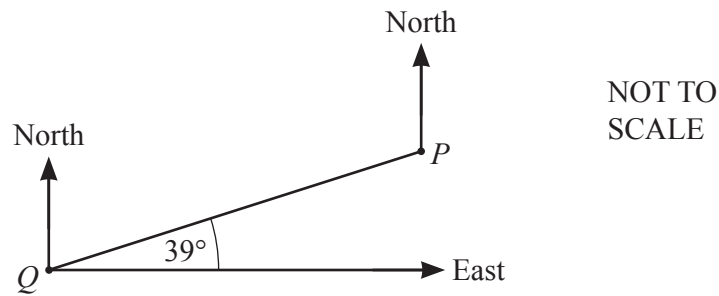
- 6 (a) Explain why 111 is not a prime number.

..... [1]

- (b) Find a prime number between 110 and 120.

..... [1]

7



Find the bearing of Q from P .

..... [2]

- 8 **Without using a calculator**, work out $3\frac{1}{8} - 1\frac{3}{4}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

- 9 Write 90 as a product of its prime factors.

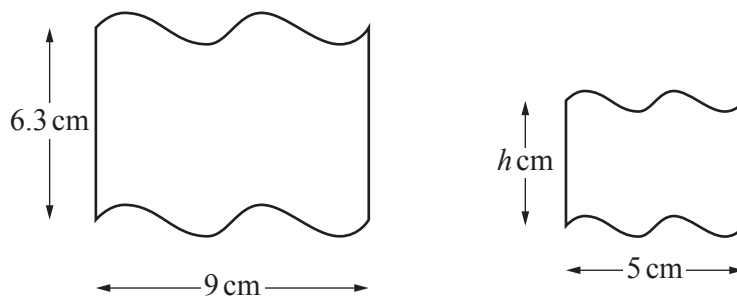
..... [2]

- 10 Expand and simplify.

$$2(t + w) + 3(w - t)$$

..... [2]

11



NOT TO
SCALE

The two shapes are mathematically similar.

- (a) Find the value of h .

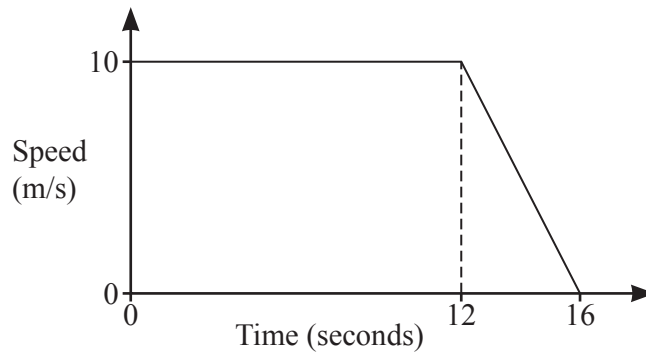
$h =$ [2]

- (b) The area of the smaller shape is 16 cm^2 .

Calculate the area of the larger shape.

..... cm^2 [2]

12



NOT TO
SCALE

The diagram shows a speed–time graph for 16 seconds of a car journey.

(a) Find the deceleration of the car in the final 4 seconds.

..... m/s^2 [1]

(b) Find the total distance travelled during the 16 seconds.

..... m [2]

13 (a) $3^{3p} \times 3^{2p} = 729$

Find the value of p .

$p =$ [2]

(b) Simplify.

$$(32x^{10})^{\frac{1}{5}}$$

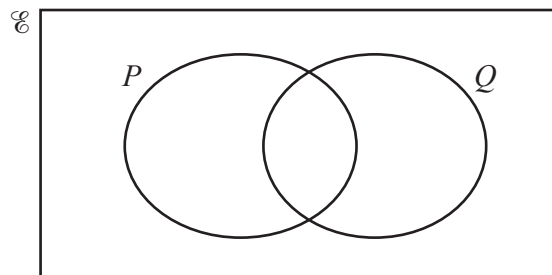
..... [2]

14 $y = 2w^2 - x$

Rearrange the formula to make w the subject.

$w = \dots\dots\dots$ [3]

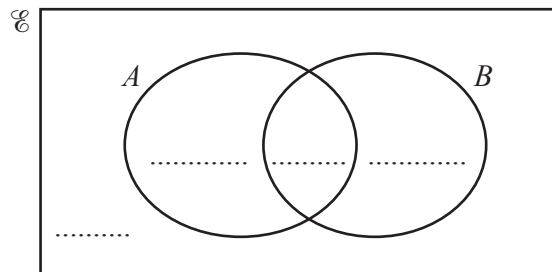
15 (a) On the Venn diagram, shade the region $P \cup Q'$.



[1]

(b) $n(E) = 20$ $n(A \cup B)' = 1$ $n(A) = 12$ $n(B) = 10$

Complete the Venn diagram.

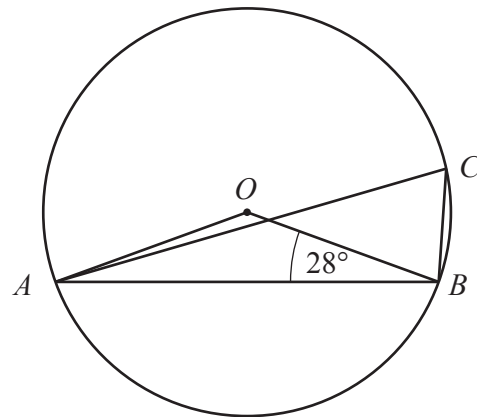


[2]

16 Find the lowest common multiple (LCM) of $12x^8$ and $8x^{12}$.

$\dots\dots\dots$ [2]

17 (a)



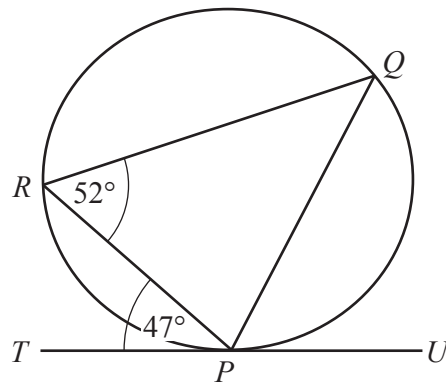
NOT TO
SCALE

A , B and C are points on a circle, centre O .
Angle $OBA = 28^\circ$.

Find angle ACB .

Angle $ACB = \dots\dots\dots$ [2]

(b)



NOT TO
SCALE

P , Q and R are points on a circle.
 TU is a tangent to the circle at P .
Angle $TPR = 47^\circ$ and angle $PRQ = 52^\circ$.

Find angle RPQ .

Angle $RPQ = \dots\dots\dots$ [2]

- 18** A solid cylinder has radius 5 cm and height 8 cm.

Calculate the total surface area of the cylinder.

..... cm^2 [4]

- 19** Find the n th term of each sequence.

(a) 11, 8, 5, 2, -1, ...

..... [2]

(b) 1, 5, 25, 125, 625, ...

..... [2]

- 20 The area of a rectangle is 55.2 cm^2 , correct to 1 decimal place.
The length of the rectangle is 9 cm, correct to the nearest cm.

Calculate the upper bound of the width of the rectangle.

..... cm [3]

- 21 The line $y = x + 1$ intersects the curve $y = x^2 + x - 3$ at two points.

Find the coordinates of the two points.

(..... , ...)

(..... , ...) [4]

10

- 22 x is inversely proportional to the square root of w .
When $w = 16$, $x = 3$.

Find x in terms of w .

$x = \dots\dots\dots$ [2]

- 23 Some students record their reaction times.
The table shows the results.

Reaction time (t seconds)	$0 < t \leq 6$	$6 < t \leq 10$
Frequency	18	16

On a histogram, the height of the block for the $0 < t \leq 6$ interval is 7.5 cm.

Calculate the height of the block for the $6 < t \leq 10$ interval.

$\dots\dots\dots$ cm [2]

24 Simplify.

$$\frac{ax - 2a - x + 2}{a^2 - 1}$$

..... [4]

25 The derivative of $2ax^7 + 3x^k$ is $42x^6 + 15x^{k-1}$.

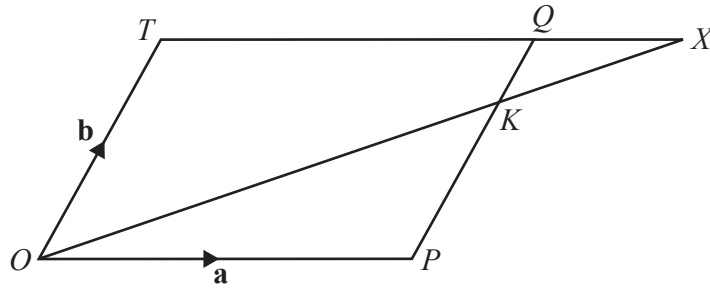
Find the value of a and the value of k .

$a =$

$k =$ [2]

Question 26 is printed on the next page.

26

NOT TO
SCALE

The diagram shows a parallelogram $OPQT$.

The position vector of P is $\mathbf{a}$ and the position vector of T is $\mathbf{b}$.

K is on PQ so that $PK : KQ = 3 : 1$.

The lines OK and TQ are extended to meet at X .

Find the position vector of X in terms of $\mathbf{a}$ and $\mathbf{b}$.

Give your answer in its simplest form.

..... [3]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

October/November 2023

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

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- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

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- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
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- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

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GENERIC MARKING PRINCIPLE 5:

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Mathematics-Specific Marking Principles

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- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao – correct answer only

dep – dependent

FT – follow through after error

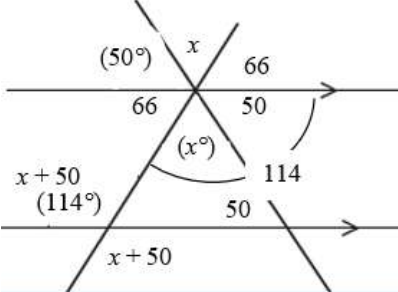
isw – ignore subsequent working

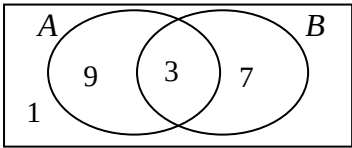
oe – or equivalent

SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1(a)	24.08 cao	1	
1(b)	20 cao	1	
2	–14	1	
3	16	2	B1 for –14 or M1 for $30 - 2 \times 7$
4	0.062	1	
5	64	2	B1 for any of these angles labelled on the diagram  or M1 for $x + 50 = 114$ or better
6(a)	Multiple of 3 or multiple of 37	1	
6(b)	113	1	
7	231	2	B1 for any of these angles in correct place on diagram 51 or 129 or 141 between east line drawn from <i>P</i> and <i>QP</i> or 39 between west line drawn from <i>P</i> and <i>QP</i> or indicating the correct bearing of <i>Q</i> from <i>P</i> on the diagram or M1 for $180 + (90 - 39)$ oe or $360 - (90 + 39)$ oe
8	$\frac{25}{8}$ or $\frac{7}{4}$ $2\frac{1}{8} - \frac{3}{4}$	B1	Correct step for dealing with mixed numbers Allow $\frac{25k}{8k}$ or $\frac{7k}{4k}$
	$\frac{25}{8}$ and $\frac{14}{8}$ $2\frac{1}{8}$ and $\frac{6}{8}$ oe	M1	Correct method to find common denominator e.g. $3\frac{1}{8} - 1\frac{6}{8}$, $\frac{100-56}{32}$

Question	Answer	Marks	Partial Marks
	$1\frac{3}{8}$ cao	A1	
9	$2 \times 3 \times 3 \times 5$ or $2 \times 3^2 \times 5$	2	B1 for 2, 3, 3, 5 or M1 for correct factor tree/diagram/list/table.
10	$5w - t$ final answer	2	B1 for $2t + 2w$ or $3w - 3t$ or for $5w - t$ seen then spoiled or for $5w$ or $-t$ in the final answer
11(a)	3.5	2	M1 for $\frac{9}{5} = \frac{6.3}{h}$ oe
11(b)	51.84	2	M1 for $\left(\frac{9}{5}\right)^2$ or $\left(\frac{5}{9}\right)^2$ oe or $\left(\frac{6.3}{their(a)}\right)^2$ or $\left(\frac{their(a)}{6.3}\right)^2$ oe
12(a)	2.5 oe	1	
12(b)	140	2	M1 for a correct area e.g. 10×12 , $\frac{1}{2} \times 4 \times 10$, $0.5 \times (16 + 12) \times 10$
13(a)	1.2 oe	2	B1 for 3^{2p+3p} or 3^6 soi
13(b)	$2x^2$ final answer	2	B1 for kx^2 or $2x^k$ as final answer or correct answer spoiled
14	$[\pm]\sqrt{\frac{y+x}{2}}$ oe final answer	3	M1 for isolating term in w M1 for division by 2 M1 for square root Max 2 marks if answer incorrect
15(a)		1	
15(b)	$\mathcal{E}$ 	2	B1 for two correct or for $n(A) = 12$ and $n(B) = 10$ and $n(A \cap B) \neq 0$
16	$24x^{12}$ final answer	2	B1 for $24x^k$ or kx^{12} in final answer

Question	Answer	Marks	Partial Marks
17(a)	62	2	B1 for angle $AOB = 124$ or M1 for $\frac{180-28-28}{2}$ oe
17(b)	81	2	B1 for angle $RQP = 47$ or $QPU = 52$ or M1 for $180 - 52 - 47$
18	408 or 408.4 to 408.5	4	M3 for $2 \times \pi \times 5 \times 8 + 2 \times \pi \times 5^2$ oe OR M1 for $2 \times \pi \times 5 \times 8$ M1 for $[2] \times \pi \times 5^2$
19(a)	$14 - 3n$ oe final answer	2	B1 for $14 - kn$ or $c - 3n$ or $14 - 3n$ seen then spoiled
19(b)	5^{n-1} oe	2	B1 for 5^{an+b} where $a > 0$ or 5^k for any integer $k > 1$
20	6.5 nfw	3	M2 for $\frac{55.2+0.05}{8 \text{ to } 9}$ or $\frac{55.2 \text{ to } 55.3}{9-0.5}$ or M1 for $9 + 0.5$ or $9 - 0.5$ or $55.2 + 0.05$ or $55.2 - 0.05$
21	(2, 3) and (-2, -1)	4	B3 for $x = 2$ and $x = -2$ or B2 for $x^2 - 4 [= 0]$ or better or for (2, 3) or (-2, -1) or M1 for $x+1 = x^2 + x - 3$ oe
22	$\frac{12}{\sqrt{w}}$ oe final answer	2	M1 for $x = \frac{k}{\sqrt{w}}$ oe
23	10	2	M1 for $\frac{7.5}{18 \div 6}$ oe or better or [frequency densities] 3 and 4 or 45 and $4h$ or 45 and 40
24	$\frac{x-2}{a+1}$ final answer	4	B2 for $(x-2)(a-1)$ or M1 for $a(x-2) - (x-2)$ or $x(a-1) - 2(a-1)$ B1 for $(a-1)(a+1)$

Question	Answer	Marks	Partial Marks
25	$a = 3$ $k = 5$	2	B1 for each or M1 for $2 \times 7ax^6 + 3kx^{k-1}$ or better
26	$\mathbf{b} + \frac{4}{3}\mathbf{a}$	3	B2 for correct unsimplified answer or $\overrightarrow{QX} = \frac{1}{3}\mathbf{a}$ seen or B1 for a correct route for $\overrightarrow{OX}$ or answer $\mathbf{b} + k\mathbf{a}$ where $k > 1$ or $\overrightarrow{OK} = \mathbf{a} + \frac{3}{4}\mathbf{b}$ seen or $\overrightarrow{QX} = \frac{1}{3}\overrightarrow{OP}$ or $\overrightarrow{OX} = \frac{4}{3} \times \overrightarrow{OK}$



Cambridge IGCSE™

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MATHEMATICS

0580/23

Paper 2 (Extended)

October/November 2023

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 Tara goes on a journey by train.
The train leaves at 06 48.
The journey takes 12 hours and 35 minutes.

Find the time when Tara arrives.

..... [1]

2

61	63	64	66	68	69

From this list, write down

(a) a cube number

..... [1]

(b) a prime number.

..... [1]

- 3 The stem-and-leaf diagram shows the heights, in centimetres, of some plants.

10	4	8		
11	1	3	4	6
12	2	3	6	9
13	2	6	9	

Key: 10|4 represents 10.4 cm

(a) Find the median height.

..... cm [1]

(b) Work out the mean height.

..... cm [2]

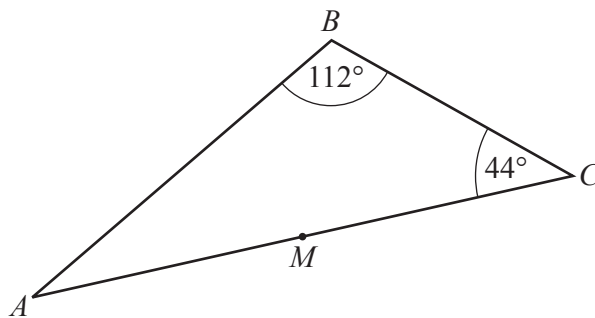
3

- 4 Shubhu invests \$750 in a savings account for 5 years.
The account pays simple interest at a rate of 1.8% per year.

Calculate the total interest she earns during the 5 years.

\$ [2]

5



NOT TO
SCALE

The diagram shows triangle ABC .
 M is the midpoint of AC .

Triangle ABC is rotated 180° about centre M .
The image and the original triangle together form a quadrilateral $ABCD$.

- (a) Write down the mathematical name of the quadrilateral $ABCD$.

..... [1]

- (b) Find angle BAD .

Angle $BAD =$ [2]

- 6 Rama asks a group of students how they travel to school.
The table shows the probability of how a student, chosen at random, travels to school.

	Bus	Walk	Car	Other
Probability	0.4	0.32	0.17	

- (a) Complete the table.

[2]

- (b) There are 1800 students at the school.

Find the expected number of students that walk to school.

..... [1]

- 7 **Without using a calculator**, work out $1\frac{5}{6} \div \frac{11}{15}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

- 8 Find the highest common factor (HCF) of 48 and 80.

..... [2]

9 $P = \frac{2wy^2}{3}$

Find the positive value of y when $P = 108$ and $w = 8$.

$y =$ [3]

10 $\vec{AB} = \begin{pmatrix} 7 \\ -3 \end{pmatrix}$

(a) Find $3\vec{AB}$.

$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) Find $|\vec{AB}|$.

$|\vec{AB}| =$ [2]

- 11 A bronze sphere has radius 3.6 cm.
The density of bronze is 8.05 g/cm^3 .

Find the mass of the sphere.

Give your answer **in kilograms**, correct to the nearest gram.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

[Density = mass $\div$ volume.]

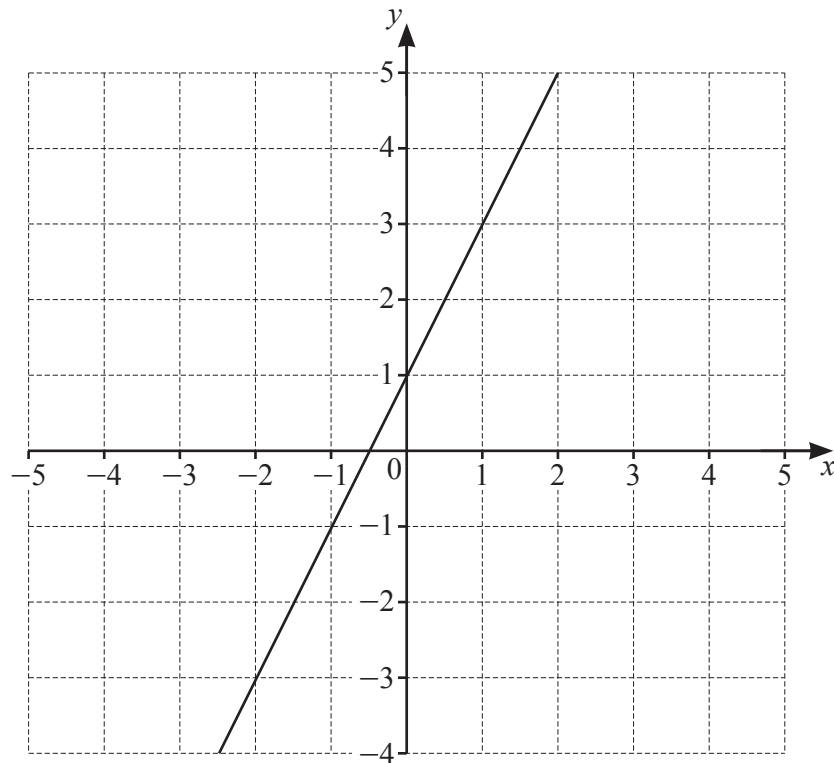
..... kg [4]

- 12 Oliver sent 22% more messages in June than in May.
He sent 305 messages in June.

Find how many more messages he sent in June than in May.

..... [3]

- 13 The graph of $y = 2x + 1$ is drawn on the grid.



By shading the **unwanted** regions of the grid, find and label the region R which satisfies these inequalities.

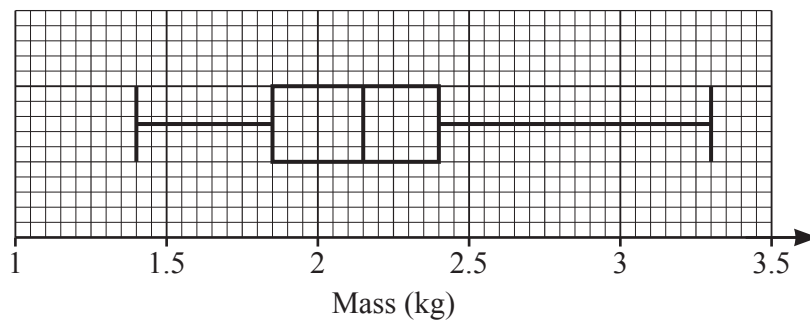
$$y \geq 2x + 1$$

$$y \geq 1$$

$$4x + 3y < 12$$

[4]

- 14 The box-and-whisker plot shows information about the mass, in kg, of some parcels.



- (a) Find the mass of the heaviest parcel.

..... kg [1]

- (b) Find the interquartile range.

..... kg [1]

15 $T = \sqrt{3d - e}$

Rearrange the formula to make d the subject.

$$d = \dots\dots\dots [3]$$

16 A cylinder with height 12.5 cm has a curved surface area of $105\pi \text{ cm}^2$.

Calculate the volume of the cylinder.

$$\dots\dots\dots \text{ cm}^3 [4]$$

17 (a) Simplify.

$$(64y^{27})^{\frac{2}{3}}$$

$$\dots\dots\dots [2]$$

(b) Simplify.

$$\frac{x-5}{x^2-25}$$

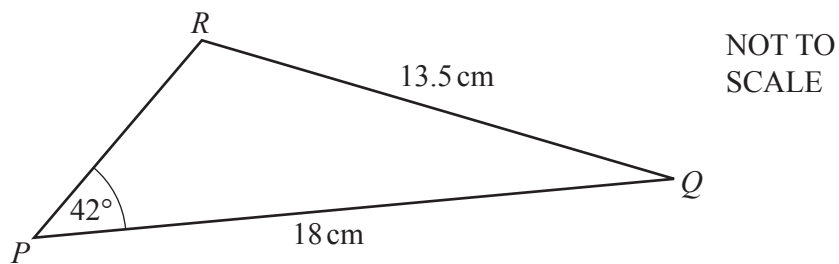
$$\dots\dots\dots [2]$$

- 18 F is proportional to the product of m and a .

Calculate the percentage change in F when m is increased by 40% and a is decreased by 15%.

..... % [3]

- 19



Calculate the obtuse angle PRQ .

Angle $PRQ = \dots\dots\dots$ [4]

10

20 $(x+a)(x+2)(2x+3)$ is equivalent to $2x^3 + bx^2 + cx - 18$.

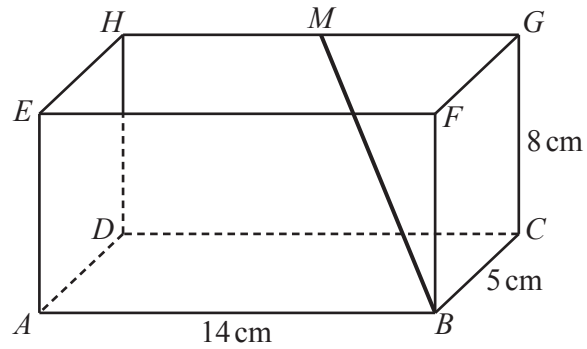
Find the value of each of a , b and c .

$a =$

$b =$

$c =$ [3]

21



NOT TO
SCALE

The diagram shows a cuboid $ABCDEFGH$.
 $AB = 14$ cm, $BC = 5$ cm and $CG = 8$ cm.
 M is the midpoint of HG .

(a) Calculate BM .

..... cm [3]

(b) Calculate the angle that BM makes with the base $ABCD$.

..... [3]

Question 22 is printed on the next page.

- 22 Find the coordinates of the point where the line $4x + y = 9$ intersects the curve $y + x^2 = 5$.
You must show all your working.

(..... , ...) [5]

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MATHEMATICS

0580/23

Paper 2 (Extended)

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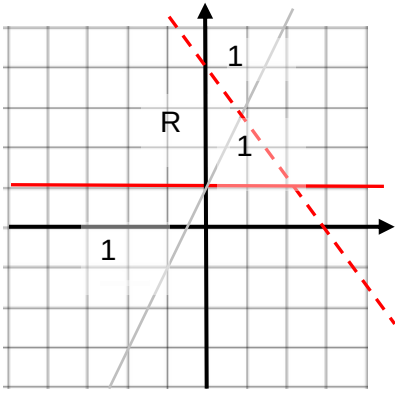
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soi – seen or implied

PUBLISHED

Question	Answer	Marks	Partial Marks
1	19 23 or 7 23 pm	1	
2(a)	64	1	
2(b)	61	1	
3(a)	12.2	1	
3(b)	12.1	2	B1 for 157.3 oe or M1 for <i>their</i> total $\div 13$
4	67.5[0]	2	M1 for $\frac{750 \times 1.8 [\times 5]}{100}$ oe
5(a)	Parallelogram	1	
5(b)	68	2	M1 for $180 - 112$ oe or for $180 - 112 - 44$
6(a)	0.11 oe	2	M1 for $1 - (0.4 + 0.32 + 0.17)$ oe
6(b)	576	1	
7	$\frac{11}{6} \times \frac{15}{11}$ or $\frac{55k}{30k} \div \frac{22k}{30k}$ oe with common denominator	M2	B1 for $\frac{11}{6}$ oe or M1 for <i>their</i> $\frac{11}{6} \times \frac{15}{11}$
	$2\frac{1}{2}$ cao	A1	
8	16	2	B1 for answer 2 or 4 or 8 or M1 for $2 \times 2 \times 2 \times 2$ oe as final answer or $[48 =] 2 \times 2 \times 2 \times 2 \times 3$ and $[80 =] 2 \times 2 \times 2 \times 2 \times 5$ or for 2 correct factor trees or tables
9	4.5, $4\frac{1}{2}$ or $\frac{9}{2}$	3	M2 for $y^2 = \frac{3P}{2w}$ or $y^2 = \frac{3 \times 108}{2 \times 8}$ or better or M1 for $108 = \frac{2 \times 8 \times y^2}{3}$ or better
10(a)	$\begin{pmatrix} 21 \\ -9 \end{pmatrix}$	1	
10(b)	7.62 or 7.615 to 7.616	2	M1 for $(7)^2 + (-3)^2$ oe If 0 scored SC1 for 22.8 or 22.84 to 22.85

Question	Answer	Marks	Partial Marks
11	1.573 cao	4	B3 for answer figs 157[0] or 1573... OR M2 for $\frac{4}{3} \times \pi \times 3.6^3 \times 8.05$ oe or better or M1 for $\frac{4}{3} \times \pi \times 3.6^3$ oe M1 for division by 1000 of <i>their</i> mass in g and correct rounding to 3 dp
12	55	3	B2 for 250 or M2 for $(305 \div 122) \times 22$ oe or better or M1 for $\left(1 + \frac{22}{100}\right)m = 305$ oe or better
13	Correct region indicated 	4	B1 for $4x + 3y = 12$ dashed line B1 for $y = 1$ solid line B2 for region identified satisfying all 3 inequalities or B1 for region satisfying only 2 of these inequalities with $4x + 3y = 12$ and $y = 1$ both drawn
14(a)	3.3	1	
14(b)	0.55	1	
15	$[d =] \frac{T^2 + e}{3}$ oe final answer	3	M1 for $T^2 = 3d - e$ M1 for isolating term in d M1 for dividing by 3 Max 2 marks if answer incorrect
16	693 or 692.7 to 692.8...	4	M2 for $\frac{105}{2 \times 12.5}$ oe or M1 for $2 \times \pi \times r \times 12.5 = 105\pi$ or better M1 for $\pi \times (\text{their } r)^2 \times 12.5$
17(a)	$16y^{18}$ final answer	2	B1 for $16y^k$ or ky^{18} as final answer or correct answer spoiled
17(b)	$\frac{1}{x+5}$ final answer	2	B1 for $(x + 5)(x - 5)$

Question	Answer	Marks	Partial Marks
18	19	3	M2 for $\left(1 + \frac{40}{100}\right)\left(1 - \frac{15}{100}\right)$ [ma] oe or M1 for $F = kma$ or better or $\left(1 + \frac{40}{100}\right)$ and $\left(1 - \frac{15}{100}\right)$ oe seen
19	116.9 or 116.85...	4	M3 for $180 - \sin^{-1}\left(\frac{18\sin 42}{13.5}\right)$ or B3 for 63.1 or 63.14 to 63.15 or M2 for $[\sin PRQ =] \frac{18\sin 42}{13.5}$ or M1 for $\frac{18}{\sin PRQ} = \frac{13.5}{\sin 42}$ oe
20	$[a =] - 3$ $[b =] 1$ $[c =] - 15$	3	B1 for $a = - 3$ B1FT for $b = 7 + 2 \times \text{their } a$ B1FT for $c = 6 + 7 \times \text{their } a$ If B0 scored B1 for correct expansion of a pair of brackets or of three brackets $(x^2 + ax + 2x + 2a)[2x + 3]$ or $[x + a](2x^2 + 4x + 3x + 6)$ or $2x^3 + (2a + 7)x^2 + (7a + 6)x + 6a$ oe or for $b = 7 + 2a$ or for $c = 6 + 7a$
21(a)	11.7 or 11.74 to 11.75	3	M2 for $\left(\frac{14}{2}\right)^2 + 5^2 + 8^2$ oe or M1 for $\left(\frac{14}{2}\right)^2 + 5^2, 5^2 + 8^2$ or $\left(\frac{14}{2}\right)^2 + 8^2$
21(b)	42.9 to 43.14	3	M2 for $\sin [\dots] = \frac{8}{\text{their } (a)}$ oe or M1 for recognising angle MBX where X is the midpoint of DC
22	$x^2 - 4x + 4 [= 0]$	M2	M1 for $9 - 4x = 5 - x^2$ oe
	$(x - 2)(x - 2)$	M1	Accept alt methods e.g. use of formula, complete the square for <i>their</i> 3 – term quadratic equation
	(2, 1)	B2	B1 for $x = 2$



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MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2023

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

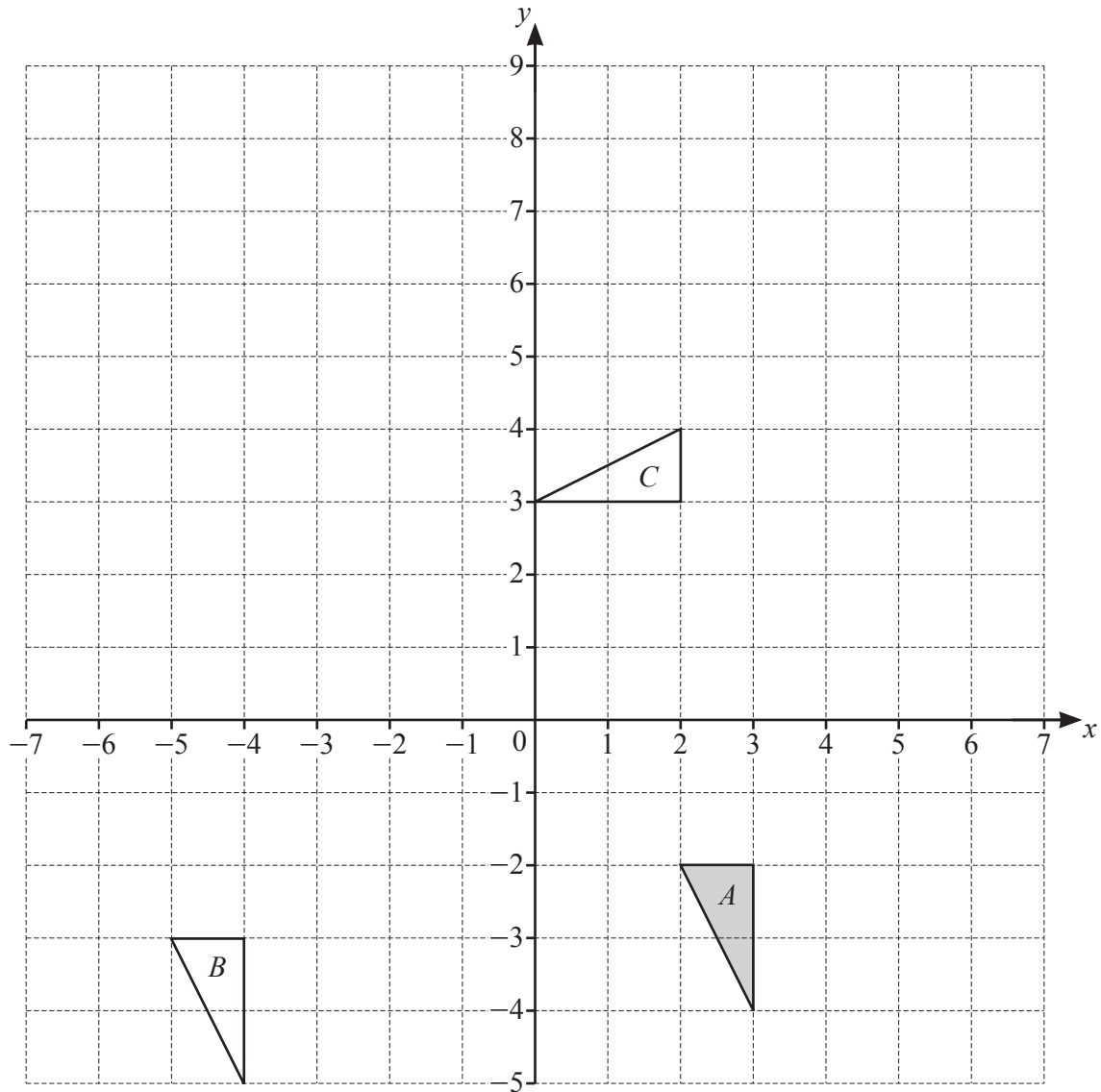
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1



(a) Describe fully the **single** transformation that maps

(i) shape A onto shape B

.....
 [2]

(ii) shape A onto shape C .

.....
 [3]

(b) On the grid, draw the image of

(i) shape A after a reflection in the line $y = 2$ [2]

(ii) shape A after an enlargement, scale factor -2 , centre $(0, 0)$. [2]

2 (a) $s = \frac{1}{2}at^2$

Find the value of s when $a = 9.8$ and $t = 20$.

$s = \dots\dots\dots$ [2]

(b) Solve.

$$5(4y - 3) = 15$$

$y = \dots\dots\dots$ [3]

(c) Expand and simplify.

$$3(5x - 8) - 2(3x - 7)$$

$\dots\dots\dots$ [2]

(d) Rearrange $A = 2b^2 - 3c^3$ to make c the subject.

$c = \dots\dots\dots$ [3]

(e) Factorise completely.

$$6pq - 4q - 3p + 2$$

$\dots\dots\dots$ [2]

- 3 (a) The table shows information about some of the planets in the solar system.

Planet	Diameter (km)	Average distance from the Sun (km)
Earth	12 800	1.496×10^8
Mars	6 800	2.279×10^8
Jupiter	143 000	7.786×10^8
Saturn	120 500	1.434×10^9
Neptune	49 500	4.495×10^9

- (i) The average distance of Mars from the Sun is 2.279×10^8 km.

Write this distance as an ordinary number.

..... km [1]

- (ii) The planet Uranus has a diameter that is 35.8% of the diameter of Jupiter.

Calculate the diameter of Uranus.

..... km [2]

- (iii) The ratio diameter of Neptune : diameter of Saturn can be written in the form $1 : n$.

Find the value of n .

$n =$ [1]

- (iv) Find the average distance of Neptune from the Sun as a percentage of the average distance of the Earth from the Sun.

..... % [2]

- (v) Distances within the solar system are also measured in astronomical units (AU).
The average distance of Jupiter from the Sun is 5.20 AU.

Calculate the average distance of Mars from the Sun in astronomical units.

..... AU [2]

- (vi) The diameter of Mars is 39.2% greater than the diameter of Mercury.

Calculate the diameter of Mercury.

..... km [2]

- (b) One light year is the distance that light travels in a year of 365.25 days.
The speed of light is 2.9979×10^5 kilometres per second.

- (i) Show that one light year is 9.461×10^{12} km, correct to 4 significant figures.

[2]

- (ii) The distance from the Andromeda Galaxy to Earth is 2.40×10^{19} km.

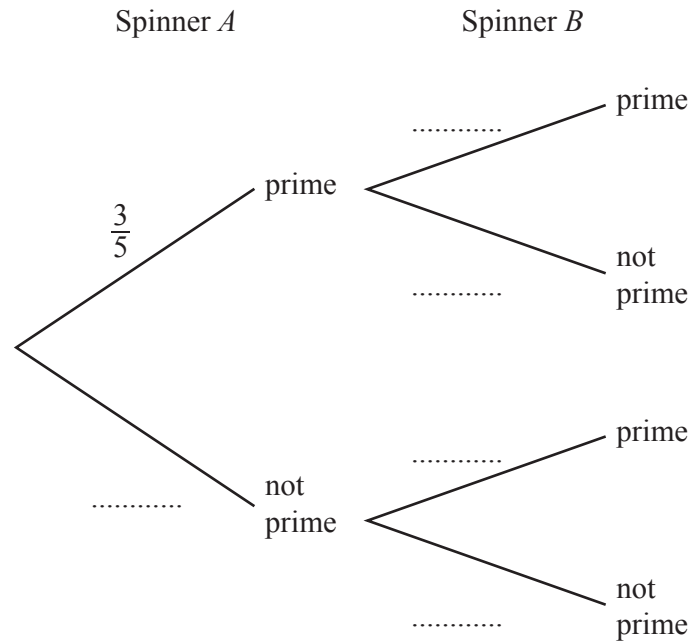
Calculate the time taken for light to travel from this galaxy to Earth.
Give your answer in millions of years.

..... million years [2]

- 4 (a) Lucia has two fair spinners.
 Spinner *A* is five-sided and is numbered 1, 2, 3, 4, 5.
 Spinner *B* is nine-sided and is numbered 3, 3, 3, 4, 4, 4, 4, 5, 5.

Lucia spins the two spinners and records whether they land on a prime number.

- (i) Complete the tree diagram.



[2]

- (ii) Find the probability that

- (a) the two numbers are both prime

..... [2]

- (b) the two numbers are **not** both prime.

..... [1]

- (b) Lucia spins Spinner A 120 times.

Find the expected number of times the spinner lands on a prime number.

..... [1]

- (c) Lucia spins Spinner B twice.

Find the probability that the two numbers it lands on add up to 9 or more.

..... [3]

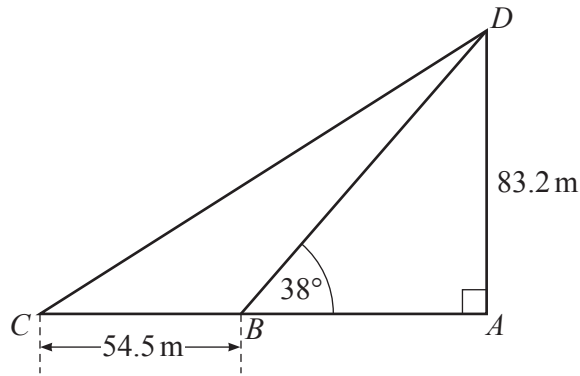
- (d) Lucia keeps spinning Spinner B until it lands on a 4.

Find an expression, in terms of n , for the probability that this happens on the n th spin.

..... [2]

8

5 (a)

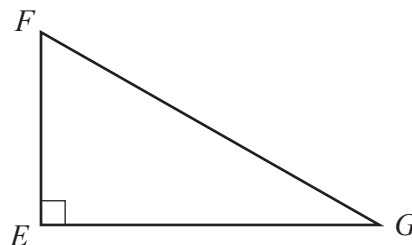


NOT TO
SCALE

ACD is a right-angled triangle.
 B is on AC and $BC = 54.5$ m.
 $AD = 83.2$ m and angle $ABD = 38^\circ$.
 Calculate angle ACD .

Angle $ACD = \dots\dots\dots$ [5]

(b)



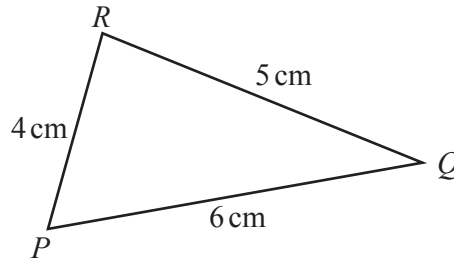
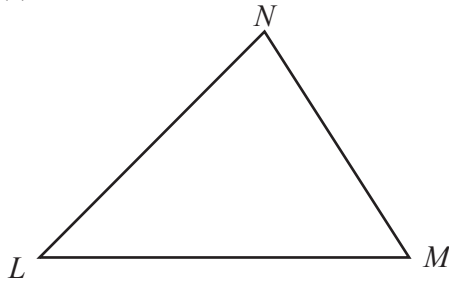
EFG is a right-angled triangle.
 A circle can be drawn that passes through the three vertices of the triangle.

On the diagram, mark the position of the centre of the circle with a cross.
 Explain how you decide.

.....

..... [2]

(c)



NOT TO
SCALE

In triangle LMN , the ratio angle L : angle M : angle $N = 4 : 5 : 6$.

In triangle PQR , $PQ = 6 \text{ cm}$, $PR = 4 \text{ cm}$ and $QR = 5 \text{ cm}$.

Calculate the difference between the largest angle in triangle PQR and the largest angle in triangle LMN .

..... [7]

6 (a)

Sequence	1st term	2nd term	3rd term	4th term	5th term		n th term
A	-7	-3	1	5			
B	7	13	23	37			
C	$\frac{2}{27}$	$\frac{3}{81}$	$\frac{4}{243}$	$\frac{5}{729}$			

Complete the table for the three sequences.

[10]

- (b) In a sequence, the sum of the first 49 terms is 7644.
The sum of the first 50 terms is 7975.

Find the 50th term of this sequence.

..... [1]

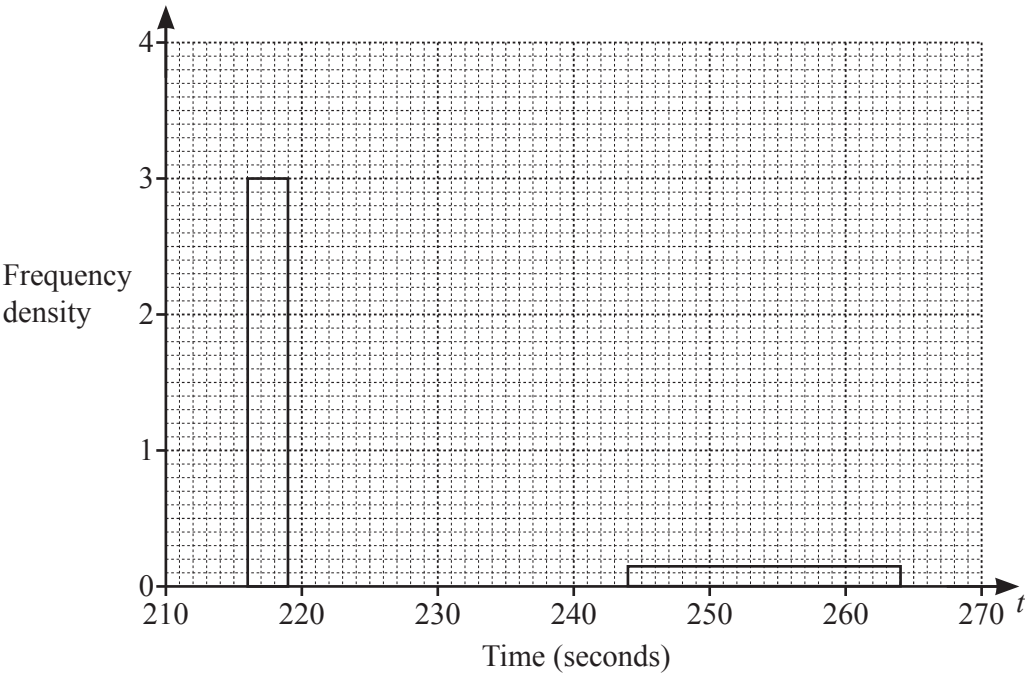
7 The frequency table shows the time of each of 42 athletes in a race.

Time (t seconds)	Number of athletes
$216 < t \leq 219$	9
$219 < t \leq 224$	14
$224 < t \leq 234$	14
$234 < t \leq 244$	2
$244 < t \leq 264$	3

(a) Calculate an estimate of the mean time.

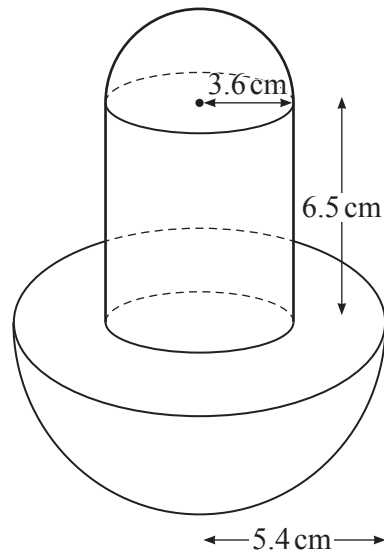
..... seconds [4]

(b) Complete the histogram to show the information in the frequency table.
Two of the blocks have been drawn for you.



[3]

8 (a)

NOT TO
SCALE

The diagram shows a solid formed by joining two hemispheres and a cylinder.
 The radius of the large hemisphere is 5.4 cm.
 The radius of the small hemisphere and the radius of the cylinder are both 3.6 cm.
 The height of the cylinder is 6.5 cm.

- (i) Show that the volume of the solid is 692 cm^3 , correct to the nearest cubic centimetre.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

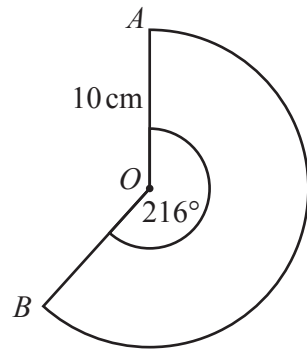
[4]

- (ii) A mathematically similar solid is made of silver.
 In this solid, the cylinder has radius 0.6 cm.
 1 cm^3 of silver has a mass of 10.49 grams.

Calculate the total mass of this silver solid.

..... g [4]

(b)



NOT TO
SCALE

AOB is a sector of a circle, centre O .
 $AO = 10$ cm and the sector angle is 216° .

- (i) Calculate the length of the arc of this sector.
Give your answer as a multiple of π .

.....cm [2]

- (ii) A cone is made from this sector by joining OA to OB .

Calculate the volume of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [4]

9 $f(x) = (3x+1)(x+5)(x-4)$ $g(x) = 2x-3$ $h(x) = 4^{2x-1}$

(a) Find

(i) $f(0)$

..... [1]

(ii) $g^{-1}(x)$

$g^{-1}(x) =$ [2]

(iii) $gh(2)$.

..... [2]

(b) $g(2x) = 7$

Find the value of x .

$x =$ [2]

(c) Simplify $g(x^2) + gg(x) + 1$.

..... [3]

(d) Find $h^{-1}(16)$.

..... [2]

(e) $f(x) = (3x + 1)(x + 5)(x - 4)$

This can be written in the form $f(x) = ax^3 + bx^2 + cx + d$.

Find the value of each of a , b , c and d .

$a = \dots\dots\dots b = \dots\dots\dots c = \dots\dots\dots d = \dots\dots\dots$ [3]

10 (a) ABC is a triangle.

B is the point $(1, -10)$, A is the point $(4, 14)$ and $\overrightarrow{CA} = \begin{pmatrix} -11 \\ 8 \end{pmatrix}$.

(i) Find the coordinates of C .

(....., ...) [2]

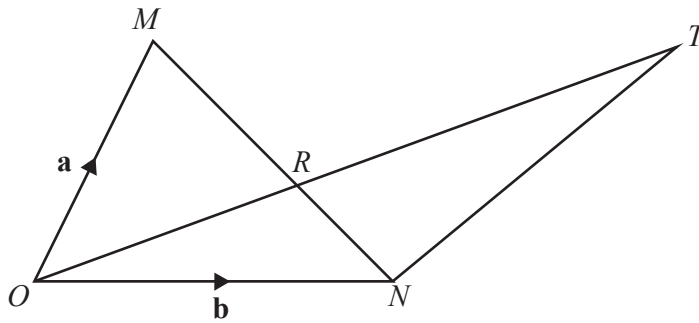
(ii) Find $\overrightarrow{BA}$.

$\overrightarrow{BA} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(iii) Find $|\overrightarrow{CA}|$.

..... [2]

(b)

NOT TO
SCALE OMN is a triangle. $\vec{OM} = \mathbf{a}$ and $\vec{ON} = \mathbf{b}$. R is a point on MN such that $MR : RN = 3 : 2$. ORT is a straight line.(i) Show that $\vec{OR} = \frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$.

[3]

(ii) (a) $\vec{NT} = 4\mathbf{a} + k\mathbf{b}$ and $\vec{OT} = c\vec{OR}$.Find the value of k and the value of c . $k = \dots\dots\dots c = \dots\dots\dots$ [4](b) Find $\vec{MT}$. $\vec{MT} = \dots\dots\dots$ [1]

11 (a) Differentiate $x^3 - 4x^2 - 3x$.

..... [2]

(b) A curve has equation $y = x^3 - 4x^2 - 3x$.

Work out the coordinates of the two stationary points.
Show all your working.

(..... , ...)

(..... , ...) [5]

- (c) Determine whether each stationary point is a maximum or a minimum.
Show all your working.

[3]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2023

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	Translation $\begin{pmatrix} -7 \\ -1 \end{pmatrix}$ oe	2	B1 for each
1(a)(ii)	Rotation 90° clockwise oe (5, 1)	3	B1 for each
1(b)(i)	Image at (2, 6) (3, 6) (3, 8)	2	B1 for reflection in $y = k$, $k \neq 2$ or for reflection in $x = 2$
1(b)(ii)	Image at (-4, 4) (-6, 4) (-6, 8)	2	B1 for an enlargement, sf -2 in the wrong position
2(a)	1960	2	M1 for $\frac{1}{2} \times 9.8 \times 20^2$ oe
2(b)	1.5 or 1½ or $\frac{3}{2}$	3	M1 for a first correct step, e.g. $20y - 15 = 15$ or $4y - 3 = 3$ M1FTdep for a second correct step, e.g. $20y = 30$ or $4y = 6$ or $y - \frac{15}{20} = \frac{15}{20}$ oe
2(c)	$9x - 10$ final answer	2	B1 for $kx - 10$ or $9x + c$ or M1 for $15x - 24$ or $-6x + 14$ or B1 for correct answer seen and then spoiled
2(d)	$\sqrt[3]{\frac{2b^2 - A}{3}}$ oe final answer	3	M1 for isolating $3c^3$, $3c^3 = 2b^2 - A$ oe or for $\frac{A}{3} = \frac{2b^2}{3} - c^3$ or $\frac{A}{-3} = \frac{2b^2}{-3} + c^3$ M1FT for isolating c^3 , follow through their first step dep on a 3-term expression with a kc^3 term M1FT taking the cube root to the final answer, follow through their previous step Maximum of two marks if answer incorrect
2(e)	$(2q - 1)(3p - 2)$ or $(1 - 2q)(2 - 3p)$ final answer	2	M1 for $2q(3p - 2) - [1](3p - 2)$ or $3p(2q - 1) - 2(2q - 1)$ or for correct answer seen then spoiled
3(a)(i)	227 900 000	1	

Question	Answer	Marks	Partial Marks
3(a)(ii)	51 200 or 51 190 or 51 194	2	M1 for $\frac{35.8}{100} \times 143\,000$ After 0 scored SC1 for answer figs 512 or figs 5119 or figs 51194
3(a)(iii)	2.43 or 2.434...	1	
3(a)(iv)	3000 or 3004 to 3005	2	M1 for $\frac{4.495 \times 10^9}{1.496 \times 10^8} [\times 100]$ oe After 0 scored SC1 for answer figs 3 or figs 3004.... or figs 3005
3(a)(v)	1.52 or 1.522...	2	B1 for $1\text{AU} = 1.5[0] \times 10^8$ or $1.497... \times 10^8$ [km] or $1\text{km} = 6.68 \times 10^{-9}$ or $6.678... \times 10^{-9}$ [AU] OR M1 for $\frac{5.2 \times 2.279 [\times 10^8]}{7.786 [\times 10^8]}$ oe After 0 scored SC1 for answer figs 152 or figs 1522.....
3(a)(vi)	4890 or 4885...	2	M1 for $d \times \left(1 + \frac{39.2}{100}\right) = 6800$ oe
3(b)(i)	$2.9979 \times 10^5 \times 60^2 \times 24 \times 365.25$	M1	After M0 SC1 for $2.9979 \times 10^5 \times 31557600$ oe
	$= 9.4606... \times 10^{12}$	A1	
3(b)(ii)	2.54 or 2.536 to 2.537	2	M1 for $\frac{2.4 \times 10^{19}}{9.461 \times 10^{12}}$ oe
4(a)(i)	$\frac{2}{5}, \frac{5}{9}, \frac{4}{9}, \frac{5}{9}, \frac{4}{9}$	2	B1 for $\frac{2}{5}$ and a pair of probabilities for spinner B that sum to 1
4a(ii)(a)	$\frac{1}{3}$ oe	2	FT dep their tree diagram M1 for $\frac{3}{5} \times \text{their } \frac{5}{9}$
4a(ii)(b)	$\frac{2}{3}$ oe	1	FT dep $1 - \text{their } \frac{1}{3}$
4(b)	72	1	

Question	Answer	Marks	Partial Marks
4(c)	$\frac{20}{81}$ oe	3	M2 for $\frac{2}{9} \times \frac{4}{9} [\times 2] + \frac{2}{9} \times \frac{2}{9}$ oe or M1 for $\frac{2}{9} \times \frac{4}{9}$ or $\frac{2}{9} \times \frac{2}{9}$ oe
4(d)	$\left(\frac{5}{9}\right)^{n-1} [\times] \frac{4}{9}$ oe final answer	2	M1 for $\left(\frac{5}{9}\right)^{n-1}$ seen
5(a)	27.3 or 27.32 to 27.33	5	M4 for $\tan[\angle ACD] = \frac{83.2}{\frac{83.2}{\tan 38} + 54.5}$ oe or M3 for $[AC =] \frac{83.2}{\tan 38} + 54.5$ oe or for [CD =] $\sqrt{54.5^2 + \left(\frac{83.2}{\sin 38}\right)^2 - 2(54.5)\left(\frac{83.2}{\sin 38}\right)\cos(180-38)}$ oe or M2 for $[AB =] \frac{83.2}{\tan 38}$ oe or for $[BD =] \frac{83.2}{\sin 38}$ oe or M1 for $\tan 38 = \frac{83.2}{AB}$ oe or $\sin 38 = \frac{83.2}{BD}$ oe
5(b)	Centre marked at midpoint of FG. and Angle in a semi-circle is 90	B2	B1 for marking the centre at mid-point of FG

Question	Answer	Marks	Partial Marks
5(c)	10.8 or 10.81 to 10.82	7	B2 for 72 or M1 for $\frac{180}{4+5+6} [\times 6]$ and, for triangle PQR B4 for [angle R=]82.8 or 82.81 to 82.83 or B3 for $[\cos R =] \frac{5}{40}$ oe or better or M2 for $\frac{4^2 + 5^2 - 6^2}{2 \times 4 \times 5}$ or M1 for $6^2 = 4^2 + 5^2 - 2 \times 4 \times 5 \times \cos R$ After 0 scored for triangle PQR, SC1 for [P =] 55.8 or 55.77 to 55.78 or [Q =] 41.4 or 41.40 to 41.41
6(a)	A 9	B1	
	$4n - 11$ oe final answer	B2	B1 for $4n - k$ or $jn - 11$ oe $j \neq 0$
	B 55	B1	
	$2n^2 + 5$ oe final answer	B2	B1 for any quadratic or second differences = 4
	C $\frac{6}{2187}$ oe	B1	
	$\frac{n+1}{3^{n+2}}$ oe final answer	B3	B2 for 3^{n+2} oe OR B1 for 3^{n+k} seen oe B1 for $n + 1$ as the numerator of a fraction
6(b)	331 cao	1	
7(a)	226 nfw or 226.2 to 226.3[0] nfw	4	M1 for mid-points soi (217.5, 221.5, 229, 239, 254) M1 for use of Σfm with m in correct interval including both boundaries M1 (dep on 2nd M1) for $\Sigma fm \div (9 + 14 + 14 + 2 + 3)$
7(b)	Blocks with heights 2.8, 1.4, 0.2 and with correct widths	3	B1 for each correct block If 0 scored, SC1 for two correct frequency densities soi

Question	Answer	Marks	Partial Marks
8(a)(i)	$\frac{2}{3}\pi(3.6)^3 + \frac{2}{3}\pi(5.4)^3 + \pi(3.6)^2 \times 6.5$	M3	M1 for either $\frac{2}{3}\pi(3.6)^3$ or $\frac{2}{3}\pi(5.4)^3$ M1 for $\pi(3.6)^2 \times 6.5$
	692.1 to 692.2...	A1	
8(a)(ii)	33.6 or 33.60 to 33.62	4	M3 for $\left(\frac{0.6}{3.6}\right)^3 \times 692 \times 10.49$ oe or M2 for $\left(\frac{0.6}{3.6}\right)^3 \times 692$ oe or M1 for $\left(\frac{0.6}{3.6}\right)^3$ or $\left(\frac{3.6}{0.6}\right)^3$ oe If 0 scored, SC1 for <i>their</i> volume $\times 10.49$
8(b)(i)	12π final answer	2	M1 for $\frac{216}{360} \times 2\pi \times 10$ oe After 0 scored SC1 for final answer 8π or $12\pi + 20$
8(b)(ii)	302 or 301.5 to 301.6...	4	M1 for $2\pi r = \text{their (b)(i)}$ oe or for $\frac{216}{360} \times \pi \times 10^2 = \pi \times r \times 10$ oe and M1 for $[h =] \sqrt{10^2 - \text{their } 6^2}$ oe and M1 for $[V =] \frac{1}{3}\pi(\text{their } 6)^2 \times (\text{their } 8)$
9(a)(i)	-20	1	
9(a)(ii)	$\frac{x+3}{2}$ oe final answer	2	M1 for $x = 2y - 3$ or better or $y + 3 = 2x$ or better or $\frac{y}{2} = x - \frac{3}{2}$ or better
9(a)(iii)	125	2	M1 for $g(64)$ or $2(4^{2x-1}) - 3$
9(b)	2.5 oe	2	M1 for $2(2x) - 3 = 7$ or better
9(c)	$2x^2 + 4x - 11$ final answer	3	B2 for $2x^2$ and either $+4x$ or -11 in final 3 term answer or for correct answer seen then spoiled or M1 for $2x^2 - 3 + 2(2x - 3) - 3 [+ 1]$

Question	Answer	Marks	Partial Marks
9(d)	1.5 oe	2	M1 for $4^{2x-1} = 4^2$ or better
9(e)	$a = 3$ $b = 4$ $c = -59$ $d = -20$	3	B2 for 3 correct values or for correct unsimplified expanded expression or for simplified four-term expression of correct form with 3 terms correct or B1 for 2 correct values or for correct expansion of one pair of brackets with at least 3 out of 4 terms correct.
10(a)(i)	(15, 6)	2	B1 for each
10(a)(ii)	$\begin{pmatrix} 3 \\ 24 \end{pmatrix}$	1	
10(a)(iii)	13.6 or 13.60...	2	M1 for $(-11)^2 + 8^2$ oe
10(b)(i)	$\mathbf{a} + \frac{3}{5}(\mathbf{b} - \mathbf{a})$ or $\mathbf{b} + \frac{2}{5}(\mathbf{a} - \mathbf{b})$ leading to $\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$ with no errors	M3	M2 for $[\overrightarrow{MR}] = \frac{3}{5}(\mathbf{b} - \mathbf{a})$ oe or $[\overrightarrow{NR}] = \frac{2}{5}(\mathbf{a} - \mathbf{b})$ oe or M1 for $\overrightarrow{MN} = \mathbf{b} - \mathbf{a}$ or $\overrightarrow{NM} = \mathbf{a} - \mathbf{b}$ or a correct route for $\overrightarrow{OR}$
10(b)(ii)(a)	$k = 5, c = 10$	4	B2 for $c = 10$ or M1 for $c(\frac{2}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}) = \mathbf{b} + 4\mathbf{a} + k\mathbf{b}$ oe or for $\frac{2}{5}c = 4$ and M1 for $\frac{3}{5} \times \text{their } c = k + 1$
10(b)(ii)(b)	$3\mathbf{a} + 6\mathbf{b}$ final answer	1	FT $3\mathbf{a} + (\text{their } k + 1)\mathbf{b}$
11(a)	$3x^2 - 8x - 3$	2	B1 for two terms correct or correct answer seen

Question	Answer	Marks	Partial Marks
11(b)	$3x^2 - 8x - 3 = 0$	M1	FT their part (a)
	Correct method to solve their 3-term quadratic $(3x + 1)(x - 3) [=0]$ $\frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(-3)}}{2(3)}$	M2	M1 for $(3x + a)(x + b) [=0]$ where $ab = -3$ or $3b + a = -8$ or for $\sqrt{(-8)^2 - 4(3)(-3)}$ or for $\frac{p \pm \sqrt{q}}{r}$ where $p = -(-8)$ and $r = 2(3)$ seen or for a correct method for solving a 2-term quadratic
	$(3, -18)$ $\left(-\frac{1}{3}, \frac{14}{27}\right)$	B2	B1 for one correct point or for two correct x -values, or M1 for substitution of <i>their</i> x -values into $y = x^3 - 4x^2 - 3x$ shown

Question	Answer	Marks	Partial Marks
11(c)	$(3, -18)$ minimum with reason $\left(-\frac{1}{3}, \frac{14}{27}\right)$ maximum with reason	3	Reasons could be e.g. 1. A reasonable sketch of a positive cubic 2. Correct use of 2nd derivative = $6x - 8 = 10$, $10 > 0$, so $(3, -18)$ is a minimum oe. 2nd derivative = $6x - 8 = -10$, $-10 < 0$ so $\left(-\frac{1}{3}, \frac{14}{27}\right)$ is a maximum oe. 3. Evaluates correctly values of y on both sides of both correct stationary points 4. Finds gradient on each side of both correct stationary points. B2 for 1 correct with a reason for that stationary point or for both x-values correct with correct conclusions and reasonable sketch of a positive cubic, or for correct substitution of both of <i>their</i> x-values into <i>their</i> second derivative shown, or substitution shown for one x-value either side of both of <i>their</i> stationary points to find the gradients. Or M1 for showing [2nd derivative =] $6x - 8$ or substitution shown for one x-value either side of one of <i>their</i> stationary points to find the gradients. or for reasonable sketch of positive cubic.



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MATHEMATICS**0580/42**

Paper 4 (Extended)

October/November 2023**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

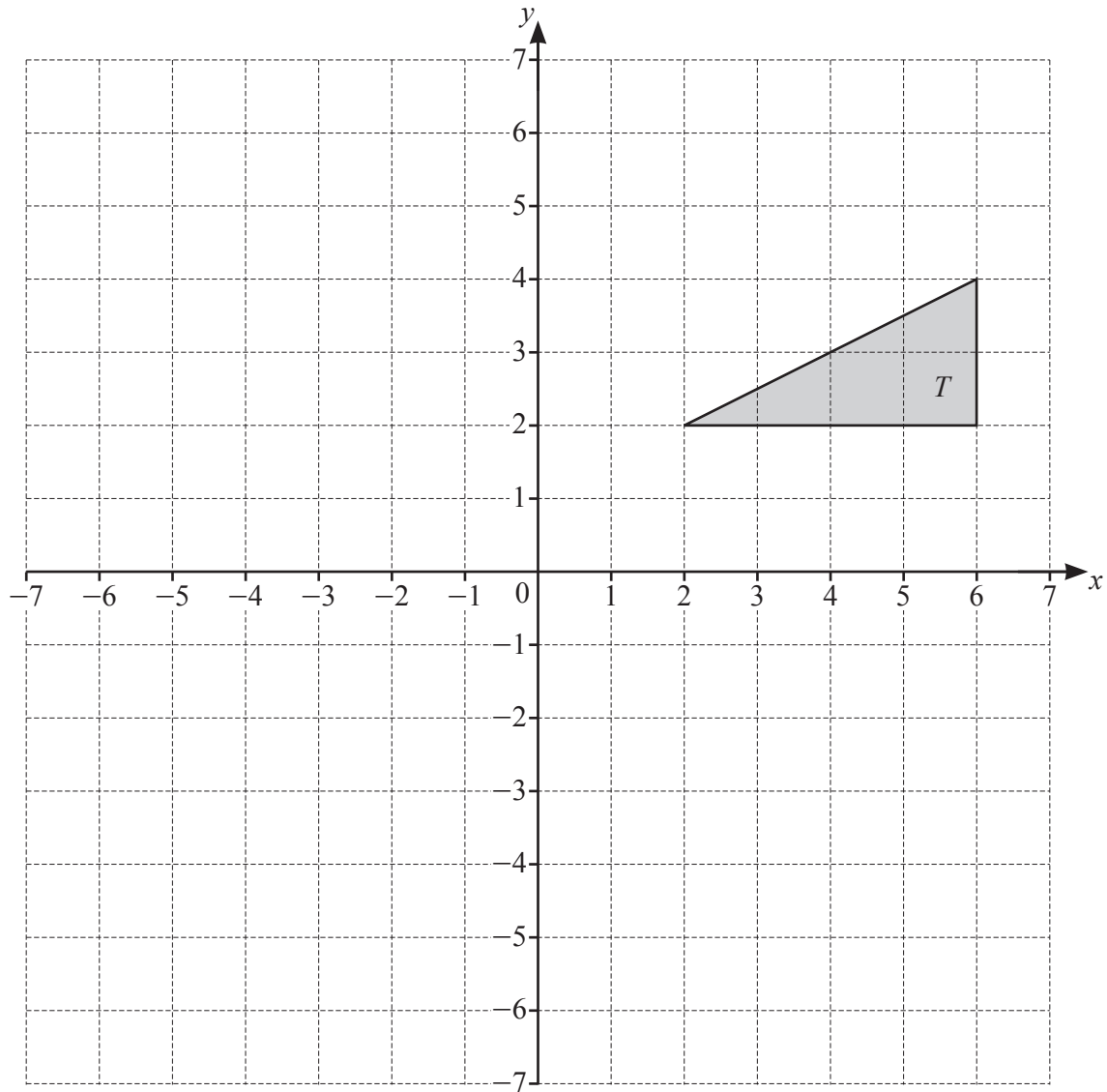
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1



- (a) (i) Translate triangle T by the vector $\begin{pmatrix} -7 \\ 1 \end{pmatrix}$. Label the image K . [2]

(ii) Describe fully the **single** transformation that maps triangle K onto triangle T .

.....

..... [1]

- (b) Reflect triangle T in the line $y = 4$. [2]

- (c) Rotate triangle T through 90° clockwise about $(0, 0)$. [2]

- (d) (i) Enlarge triangle T by scale factor $-\frac{1}{2}$, centre $(0, 0)$. Label the image P . [2]

(ii) Describe fully the **single** transformation that maps triangle P onto triangle T .

.....

..... [2]

- 2 (a) Daisy records her 50 homework marks.
The table shows the results.

Homework mark	15	16	17	18	19	20
Frequency	1	3	19	11	10	6

- (i) Write down the range.

..... [1]

- (ii) Write down the mode.

..... [1]

- (iii) Find the median.

..... [1]

- (iv) Calculate the mean.

..... [3]

- (b) 21 33 20 25 21 34 22 21 20 30 18

The list shows Ed's scores in 11 tests.

- (i) Complete the stem-and-leaf diagram to show this information.

1	
2	
3	

Key: 2|5 represents 25

[2]

- (ii) Find the median.

..... [1]

- (iii) Find the interquartile range.

..... [2]

- 3 (a) The value of Priya's car decreases by 10% every year.
The value today is \$7695.

(i) Calculate the value of the car after one year.

\$ [2]

(ii) Calculate the value of the car one year ago.

\$ [2]

- (b) Ali invests \$600 at a rate of 2% per year simple interest.

Calculate the value of Ali's investment at the end of 5 years.

\$ [3]

- (c) Sara invests \$500 at a rate of $r\%$ per year compound interest.
At the end of 12 years, the value of Sara's investment is \$601.35, correct to the nearest cent.

Find the value of r .

$r =$ [3]

(d) The mass of a radioactive substance decreases exponentially at a rate of 3% each day.

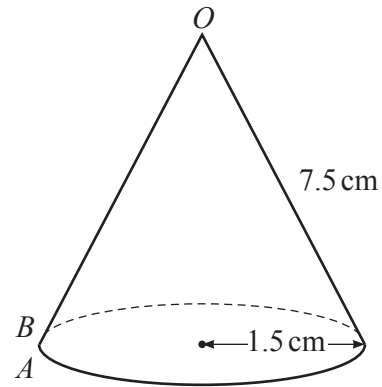
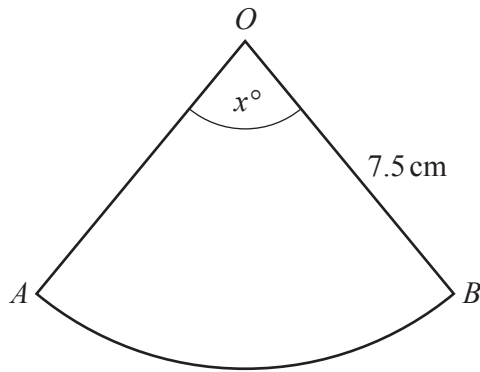
(i) Find the overall percentage decrease at the end of 10 days.

..... % [2]

(ii) Find the number of whole days it takes until the mass of this substance is one half of its original amount.

..... [3]

4 (a)



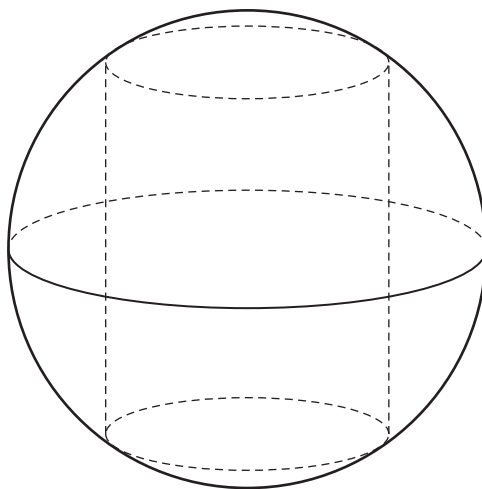
NOT TO
SCALE

The diagram shows a sector of a circle that is made into a cone by joining OA to OB .
The sector angle is x° and the radius of the sector is 7.5 cm.
The base radius of the cone is 1.5 cm.

Calculate the value of x .

$x = \dots\dots\dots$ [3]

(b)



NOT TO
SCALE

The diagram shows a cylinder with radius 8 cm inside a sphere with radius 17 cm.
Both ends of the cylinder touch the curved surface of the sphere.

(i) Show that the height of the cylinder is 30 cm.

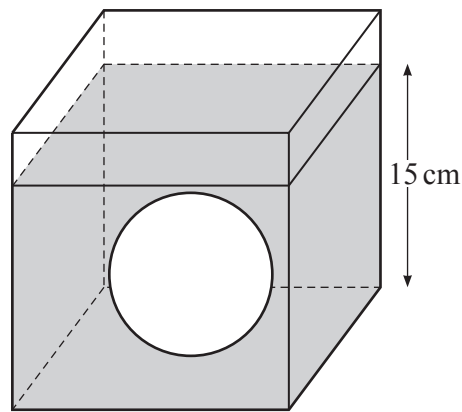
[2]

- (ii) Calculate the volume of the cylinder as a percentage of the volume of the sphere.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... % [4]

(c)



NOT TO
SCALE

The diagram shows a solid sphere with radius 6 cm inside a cube with side length 20 cm.
The cube contains water to a depth of 15 cm.
The sphere is removed.

Calculate the new depth of water in the cube.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm [3]

- 5 (a) In a shop the cost of a fiction book is \$ x and the cost of a reference book is \$ $(x + 2)$.
The cost of 11 fiction books is the same as the cost of 10 reference books.

Find the value of x .

$$x = \dots\dots\dots [2]$$

- (b) In another shop, the cost of a fiction book is \$ y and the cost of a reference book is \$ $(y + 2)$.
Maria spends \$95 on fiction books and \$147 on reference books.
She buys a total of 12 books.

- (i) Show that $6y^2 - 109y - 95 = 0$.

[4]

- (ii) Factorise $6y^2 - 109y - 95$.

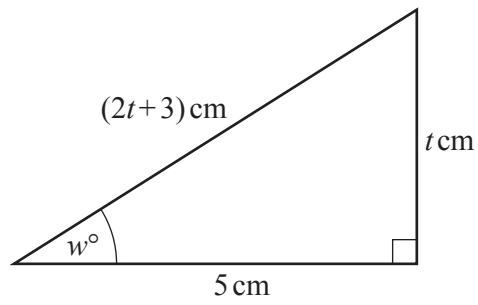
$$\dots\dots\dots [2]$$

- (iii) Find the value of y .

$$y = \dots\dots\dots [1]$$

9

6



NOT TO
SCALE

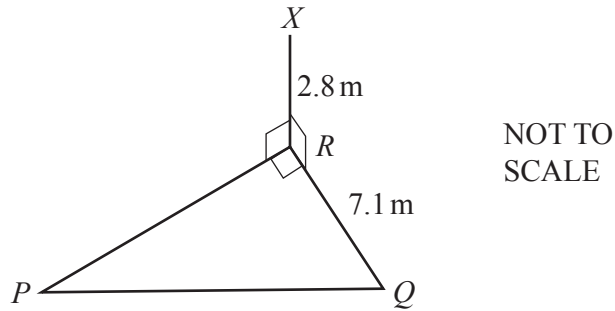
The diagram shows a right-angled triangle.

Find the value of w .

$w = \dots\dots\dots [7]$

10

7 (a)



The diagram shows a right-angled triangle PQR on horizontal ground. X is vertically above R and the angle of elevation of X from P is 21° . $XR = 2.8$ m and $RQ = 7.1$ m.

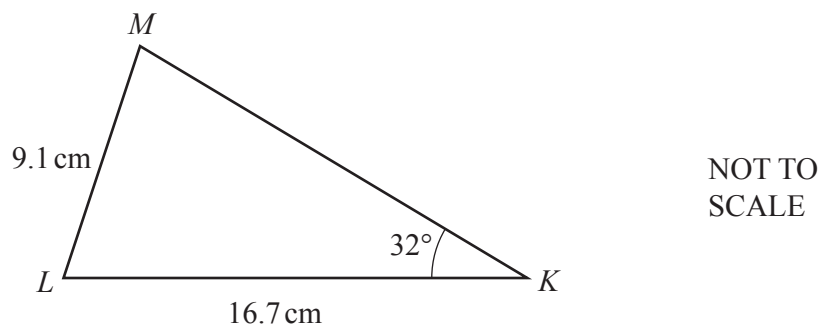
(i) Calculate the angle of elevation of X from Q .

..... [2]

(ii) Calculate PQ .

..... m [3]

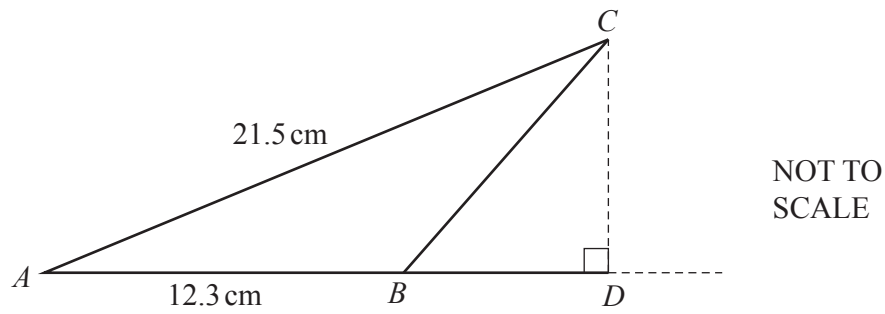
(b)



Calculate the acute angle KML .

Angle $KML =$ [3]

(c)



The area of triangle ABC is 62.89 cm^2 .

(i) Show that angle $BAC = 28.4^\circ$, correct to 1 decimal place.

[2]

(ii) Calculate BC .

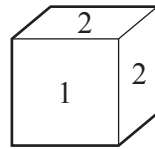
..... cm [3]

(iii) AB is extended to a point D such that angle $BDC = 90^\circ$.

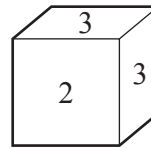
Calculate BD .

..... cm [3]

8



Dice A



Dice B

The diagram shows two fair dice.

Dice A is numbered 1, 2, 2, 2, 3, 6.

Dice B is numbered 2, 3, 3, 4, 4, 4.

(a) (i) Dice A is rolled once.

Write down the probability that it lands on the number 6.

..... [1]

(ii) Dice A is rolled 150 times.

Find the number of times it is expected to land on the number 6.

..... [1]

(b) Dice A and Dice B are each rolled once.

(i) Find the probability that the two numbers they land on have a total of 6.

..... [3]

(ii) Find the probability that when the two numbers they land on have a total of 6, both numbers are 3.

..... [2]

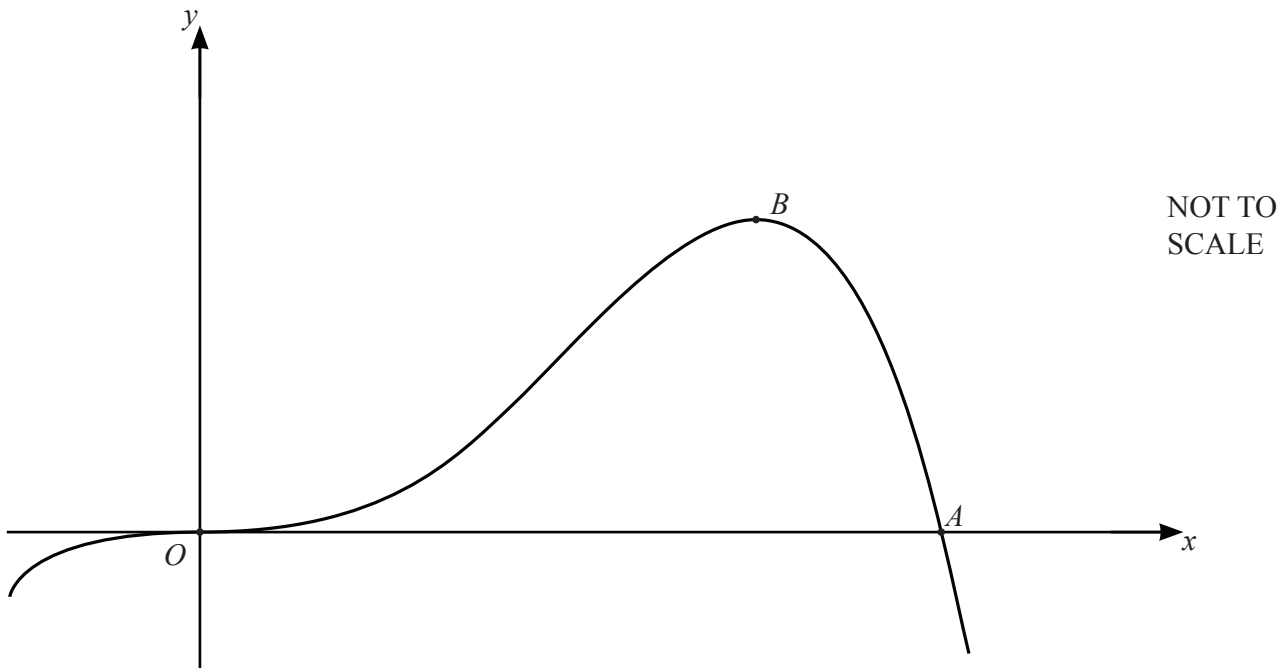
- (c) Dice B is rolled n times.

The probability that on the n th roll it first lands on a number 3 is $\frac{32}{729}$.

Find the value of n .

$n = \dots\dots\dots$ [2]

9



The diagram shows a sketch of the graph of $y = 4x^3 - x^4$.
The graph crosses the x -axis at the origin O and at the point A .
The point B is a maximum point.

(a) Differentiate $4x^3 - x^4$.

..... [2]

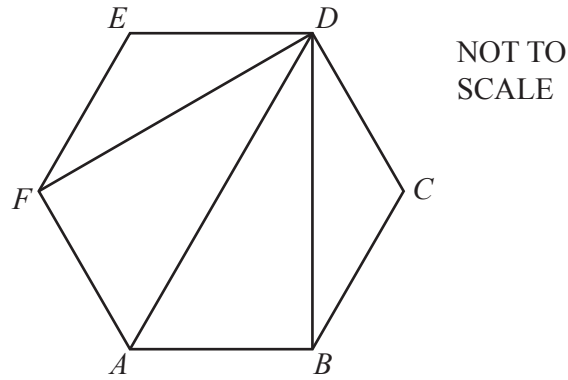
(b) Find the coordinates of B .

(....., ...) [3]

(c) Find the gradient of the graph at the point A .

..... [3]

10 (a)



$ABCDEF$ is a regular hexagon.
 DF , DA and DB are diagonals.

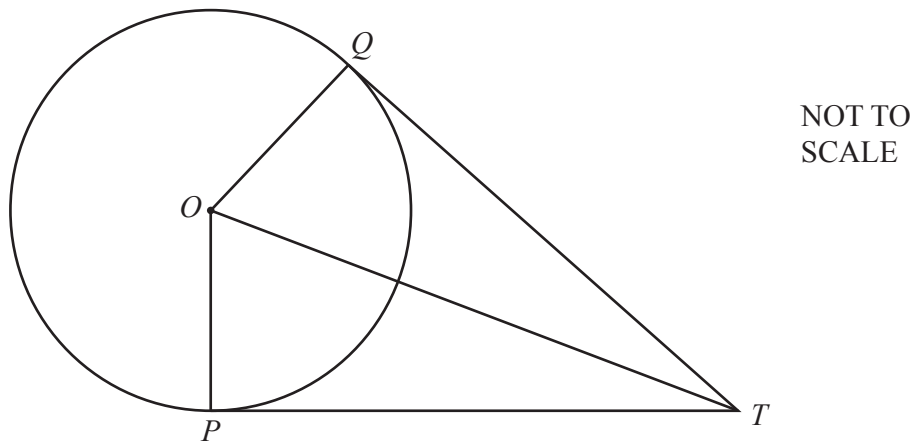
Complete the following statements using three different triangles.

Triangle DEF is congruent to triangle

Triangle is congruent to triangle

[2]

(b)



P and Q are points on the circle with centre O .
 TP and TQ are tangents to the circle from the point T .

Complete the following statements and reasons.

In triangles OPT and OQT

$OP = \dots\dots\dots$ because each is a radius of the circle

OT is a common side

Angle $OPT = \text{angle } \dots\dots\dots = 90^\circ$ because

Triangles OPT and OQT are congruent using the criterion

This proves that the tangents TP and TQ are

[5]

11 $f(x) = 1 - 3x$ $g(x) = (x - 1)^2$ $h(x) = \frac{3}{x}, x \neq 0$

(a) Find $g(3)$.

..... [1]

(b) Find $f(x-2)$, giving your answer in its simplest form.

..... [2]

(c) Find $f^{-1}(x)$.

$f^{-1}(x) =$ [2]

(d) $gf(x) - g(x)f(x) = 3x^3 + ax^2 + bx + c$

Find the value of each of a , b and c .

$a =$

$b =$

$c =$ [5]

(e) Find $h(x) - f(x)$, giving your answer as a single fraction in its simplest form.

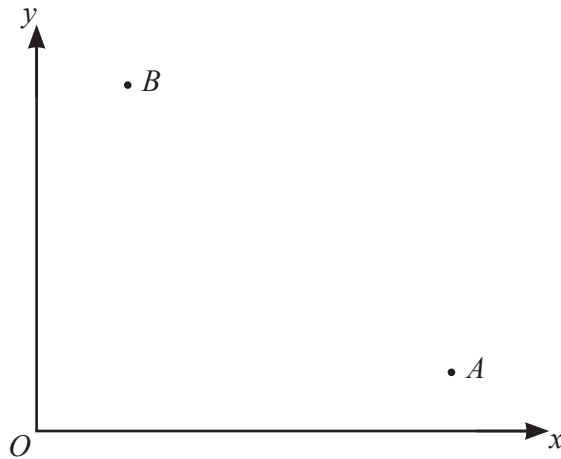
..... [3]

(f) $h(x^n) = 3x^7$

Find the value of n .

$n =$ [1]

12



NOT TO
SCALE

O is the origin $(0, 0)$, A is the point $(8, 1)$ and B is the point $(2, 5)$.

(a) Write as column vectors.

(i) $\vec{OB}$

$$\vec{OB} = \begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(ii) $\vec{AB}$

$$\vec{AB} = \begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(b) Find the equation of the line AB .

Give your answer in the form $y = mx + c$.

$$y = \dots\dots\dots [3]$$

- (c) Find the equation of the perpendicular bisector of AB .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [4]

- (d) The line AB meets the y -axis at P .
The perpendicular bisector of AB meets the y -axis at Q .
Find the length of PQ .

$\dots\dots\dots$ [2]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2023

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks						
1(a)(i)	Image at (−5, 3), (−1, 3), (−1, 5)	2	B1 for translation $\begin{pmatrix} -7 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 1 \end{pmatrix}$						
1(a)(ii)	Translation $\begin{pmatrix} 7 \\ -1 \end{pmatrix}$ cao	1							
1(b)	Image at (6, 4), (6, 6), (2, 6)	2	B1 for reflection in line $x = 4$ or for reflection in line $y = k$						
1(c)	Image at (2, −2), (2, −6), (4, −6)	2	B1 for correct size and orientation or for rotation 90° anticlockwise about (0, 0)						
1(d)(i)	Image at (−1, −1), (−3, −1), (−3, −2)	2	B1 for correct size and orientation or for enlargement SF $\frac{1}{2}$, centre (0, 0)						
1(d)(ii)	Enlargement and [centre] (0, 0) [factor] −2	2	B1 for Enlargement and [centre] (0, 0) B1 for [factor] −2						
2(a)(i)	5	1							
2(a)(ii)	17	1							
2(a)(iii)	18	1							
2(a)(iv)	17.88	3	M2 for (1×15 + 3×16 + 19×17 + 11×18 + 10×19 + 6×20) ÷ 50 oe or M1 for 1×15 + 3×16 + 19×17 + 11×18 + 10×19 + 6×20 oe						
2(b)(i)	<table><tr><td>1</td><td>8</td></tr><tr><td>2</td><td>0 0 1 1 1 2 5</td></tr><tr><td>3</td><td>0 3 4</td></tr></table>	1	8	2	0 0 1 1 1 2 5	3	0 3 4	2	B1 for two rows correct or for fully correct unordered stem-and-leaf diagram
1	8								
2	0 0 1 1 1 2 5								
3	0 3 4								
2(b)(ii)	21	1							
2(b)(iii)	10 nfww	2	B1 for [upper qtile] = 30 or [lower qtile] = 20 soi						
3(a)(i)	6925.5[0] cao	2	M1 for $7695 \times \frac{100-10}{100}$ oe or B1 for answer 769.5						
3(a)(ii)	8550	2	M1 for $X \times \frac{100-10}{100} = 7695$ oe						

Question	Answer	Marks	Partial Marks
3(b)	660	3	B2 for 60 or M2 for $600 + \frac{600 \times 2 \times 5}{100}$ oe or M1 for $\frac{600 \times 2 \times 5}{100}$ oe
3(c)	1.55 or 1.549 to 1.550	3	M2 for $\sqrt[12]{\frac{601.35}{500}}$ or M1 for $500 \times (\dots)^{12} = 601.35$
3(d)(i)	26.3 or 26.25 to 26.26	2	M1 for $[k] \left(\frac{100-3}{100} \right)^{10}$ oe
3(d)(ii)	23	3	M2 for a correct trial evaluated with $n = 22$ or $n = 23$ or M1 for $[k] (0.97)^n < 0.5[k]$ oe soi or for $[k](0.97)^n = 0.5[k]$ oe soi, implied by one correct trial $n > 10$ or for $[k](0.97)^{23}$ oe seen If 0 scored SC1 for answer 22
4(a)	72 or 72.0 cao nfw	3	M2 for $\frac{x}{360} \times 2 \times \pi \times 7.5 = 2 \times \pi \times 1.5$ oe or M1 for $\frac{x}{360} \times 2 \times \pi \times 7.5$ or for $2 \times \pi \times 1.5$ oe OR M2 for $\frac{x}{360} \times \pi \times 7.5^2 = \pi \times 1.5 \times 7.5$ oe or M1 for $\frac{x}{360} \times \pi \times 7.5^2$ or for $\pi \times 1.5 \times 7.5$ oe
4(b)(i)	$2 \times \sqrt{17^2 - 8^2}$ or $\sqrt{34^2 - 16^2}$ oe	M2	M1 for $17^2 = 8^2 + d^2$ or $34^2 = 16^2 + k^2$
4(b)(ii)	29.3 or 29.30 to 29.31	4	M3 for $([\pi] \times 8^2 \times 30) \div \frac{4}{3} \times [\pi] \times 17^3 [\times 100]$ oe OR M1 for $\pi \times 8^2 \times 30$ oe M1 for $\frac{4}{3} \times \pi \times 17^3$ oe

Question	Answer	Marks	Partial Marks
4(c)	12.7 or 12.73 to 12.74	3	B2 for 2.26 or 2.261 to 2.262.... soi or M2 for $\left(20^2 \times 15 - \frac{4}{3} \times \pi \times 6^3\right) \div 20^2$ oe or for $15 - \left(\frac{4}{3} \times \pi \times 6^3 \div 20^2\right)$ oe or M1 for $20^2 \times 15 - \frac{4}{3} \times \pi \times 6^3$ oe or $20^2 \times D = \frac{4}{3} \times \pi \times 6^3$ oe If 0 scored, SC1 for answer 11[.0] or 10.97 to 10.98
5(a)	20	2	M1 for $11x = 10(x + 2)$ oe

Question	Answer	Marks	Partial Marks
5(b)(i)	$\frac{95}{y} + \frac{147}{y+2} = 12$	M2	M1 for $\frac{95}{y}$ or $\frac{147}{y+2}$
	$95(y+2) + 147y = 12y(y+2)$ oe	M1	Allow correct or for clearing <i>their</i> equation with algebraic fractions in y and $y+2$ Allow $95y + 190 + 147y = 12y^2 + 24y$ oe
	leading to $6y^2 - 109y - 95 = 0$	A1	With all brackets shown expanded and no errors or omissions
5(b)(ii)	$(6y+5)(y-19)$	2	B1 for $(6y+a)(y+b)$ with $ab = -95$ or $a+6b = -109$ or $(3y+a)(2y+b)$ with $ab = -95$ or $2a+3b = -109$ or for partial factorisation $y(6y+5) - 19(6y+5)$ or $6y(y-19) + 5(y-19)$
5(b)(iii)	19	1	Correct or FT <i>their</i> positive answer from factors dep on B1 earned
6	11.9 or 11.91 to 11.92	7	B5 for $t = 1.055$ or $1.0550...$ M1 for $\tan w = \frac{\text{their } t}{5}$ oe OR M1 for $(2t+3)^2 = t^2 + 5^2$ oe seen isw M2 for $3t^2 + 12t - 16 [= 0]$ oe seen isw or B1 for $4t^2 + 6t + 6t + 9$ M1FT for $\frac{-12 \pm \sqrt{12^2 - 4(3)(-16)}}{2(3)}$ oe M1 for $\tan w = \frac{\text{their } t}{5}$ oe
7(a)(i)	21.5 or 21.52...	2	M1 for $\tan(\dots) = \frac{2.8}{7.1}$ oe
7(a)(ii)	10.2 or 10.17 to 10.18	3	M2 for $\left(\frac{2.8}{\tan 21}\right)^2 + 7.1^2$ oe or M1 for $\frac{2.8}{PR} = \tan 21$ oe

Question	Answer	Marks	Partial Marks
7(b)	76.5 or 76.52 to 76.53	3	M2 for $[\sin =] \frac{16.7 \sin 32}{9.1}$ oe or M1 for $\frac{9.1}{\sin 32} = \frac{16.7}{\sin M}$ oe
7(c)(i)	$\frac{1}{2} \times 12.3 \times 21.5 \sin(\dots) = 62.89$ or better	M1	
	28.40 to 28.41...	A1	
7(c)(ii)	12.2 or 12.17 to 12.18	3	M2 for $\sqrt{12.3^2 + 21.5^2 - 2 \times 12.3 \times 21.5 \times \cos 28.4}$ OR M1 for $12.3^2 + 21.5^2 - 2 \times 12.3 \times 21.5 \times \cos 28.4$ A1 for 148 or 148.2 to 148.3
7(c)(iii)	6.6[0] to 6.62	3	M2 for $21.5 \cos 28.4 - 12.3$ or M1 for $21.5 \cos 28.4$
8(a)(i)	$\frac{1}{6}$ oe	1	
8(a)(ii)	25	1	FT their (a)(i) dep on $0 < \mathbf{(a)} < 1$
8(b)(i)	$\frac{11}{36}$ oe	3	M2 for $\frac{1}{6} \times \frac{2}{6} + \frac{3}{6} \times \frac{3}{6}$ oe or correct possibility diagram with 11 outcomes identified or M1 for $\frac{1}{6} \times \frac{2}{6}$ or $\frac{3}{6} \times \frac{3}{6}$ oe or lists the 11 required outcomes or for possibility diagram but required outcomes not indicated
8(b)(ii)	$\frac{2}{11}$ oe	2	M1 for $\frac{2}{k}$ or $\frac{p}{\text{their } 11}$ seen oe leading to answer
8(c)	6	2	M1 for $\left(\frac{4}{6}\right)^k \times \frac{2}{6} = \frac{32}{729}$ written oe soi by one trial with $k > 1$ or $2^{n-1} = 32$ or better or $3^n = 729$ or better
9(a)	$12x^2 - 4x^3$ oe final answer	2	B1 for $12x^2$ or $-4x^3$ in final answer or for correct answer seen

Question	Answer	Marks	Partial Marks
9(b)	(3, 27)	3	B2 for $x = 3$ OR M1 for <i>their</i> $12x^2 - 4x^3 = 0$ or better or states $\frac{dy}{dx} = 0$ M1dep for substituting <i>their</i> x into $y = 4x^3 - x^4$ shown
9(c)	-64	3	M1 for $4x^3 - x^4 = 0$ B1 for $x = 4$
10(a)	[DEF], BCD ADF, ADB	2	B1 for each pair
10(b)	OQ OQT Tangent perpendicular to radius RHS equal	5	B1 for each
11(a)	4	1	
11(b)	$7 - 3x$ final answer	2	M1 for $1 - 3(x - 2)$
11(c)	$\frac{1-x}{3}$ oe final answer	2	M1 for $x = 1 - 3y$ or $y - 1 = -3x$ or $1 - y = 3x$ or $\frac{y}{3} = \frac{1}{3} - x$
11(d)	$a = 2, b = 5, c = -1$	5	B4 for two correct values <u>only</u> after correct substitution seen i.e. $(1 - 3x - 1)^2 - (x - 1)^2(1 - 3x)$ or for correct unsimplified expansion or a correct simplified expansion. OR M1 for $(1 - 3x - 1)^2 - (x - 1)^2(1 - 3x)$ B2 for correct expansion of $[-](x - 1)^2(1 - 3x)$ $[-](x^2 - x - x + 1 - 3x^3 + 3x^2 + 3x^2 - 3x)$ or better or B1 for expansion of one pair of brackets $[(x - 1)^2 =]x^2 - x - x + 1$ or better or $[(x - 1)(1 - 3x) =] - 3x^2 + x + 3x - 1$

Question	Answer	Marks	Partial Marks
11(e)	$\frac{3-x+3x^2}{x}$ final answer	3	B1 for $3-x(1-3x)$ or better B1 for common denominator x isw
11(f)	-7	1	
12(a)(i)	$\begin{pmatrix} 2 \\ 5 \end{pmatrix}$	1	
12(a)(ii)	$\begin{pmatrix} -6 \\ 4 \end{pmatrix}$	1	
12(b)	$[y=]-\frac{2}{3}x+\frac{19}{3}$ oe	3	M1 for gradient = $\frac{1-5}{8-2}$ oe M1 for substituting (8, 1) or (2, 5) into $y = \text{their } mx + c$
12(c)	$[y=]\frac{3}{2}x-\frac{9}{2}$ oe	4	B1 for (5, 3) oe M1 for gradient = $-\frac{1}{\text{their gradient of } AB}$ M1 substituting <i>their</i> midpoint into $y = \text{their } mx + c$
12(d)	$\frac{65}{6}$ oe	2	M1 for <i>their</i> $\frac{19}{3} - \text{their } -\frac{9}{2}$ oe



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MATHEMATICS**0580/43**

Paper 4 (Extended)

October/November 2023**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 The table shows the amount received when exchanging \$100 in some countries.

Country	Amount received for \$100
Wales	77.05 pounds
India	7437.05 rupees
China	671.20 yuan
Spain	85.35 euros

- (a) Brad changes \$250 to Indian rupees.

Calculate the amount he receives correct to the nearest rupee.

..... rupees [2]

- (b) Wang changes 5400 Chinese yuan into dollars.

Calculate how much he receives in dollars, correct to the nearest cent.

\$ [2]

- (c) Gretal lives in Spain and goes on holiday to Wales.
She spends 3500 euros in total on travel and hotels in the ratio

$$\text{travel} : \text{hotels} = 4 : 3.$$

- (i) Work out how much Gretal spends, in euros, on travel.

..... euros [2]

- (ii) Work out how much she spends, in **pounds**, on hotels.

..... pounds [3]

- (iii) Greta flies home to Spain.

The plane flies a distance of 2200 km, correct to the nearest 100 km.

The average speed of the plane is 740 km/h, correct to the nearest 20 km/h.

Calculate the lower bound of the time taken, in hours and minutes, for this flight.

..... h min [3]

- 2 The table shows the number of each type of bird seen in a garden on Monday.

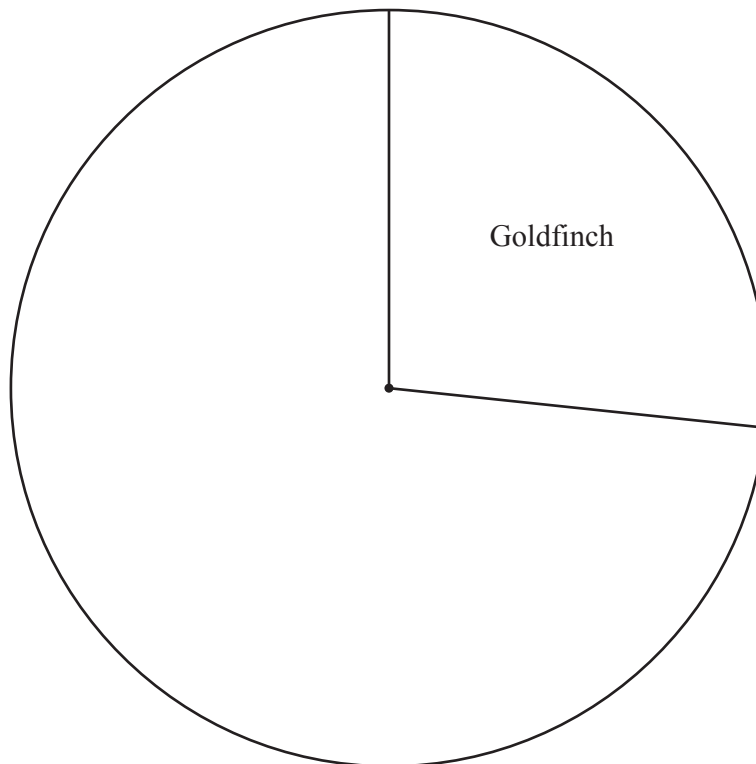
Type of bird	Frequency	Pie chart sector angle
Goldfinch	8	96°
Jay	6	
Starling	11	
Robin	5	

- (a) Find the percentage of the birds that are Starlings.

..... % [2]

- (b) (i) In the table, complete the column for the pie chart sector angle. [2]

- (ii) Complete the pie chart to show the information in the table.



[2]

- (c) On Tuesday, the number of Goldfinches seen in the garden increased by 262.5%.

Calculate the number of Goldfinches seen on Tuesday.

..... [2]

- (d) One of the most common birds in the world is the Red-Billed Quelea which lives in Sub-Saharan Africa.

There are approximately 1500 million of these birds in this area.

- (i) Write 1500 million in standard form.

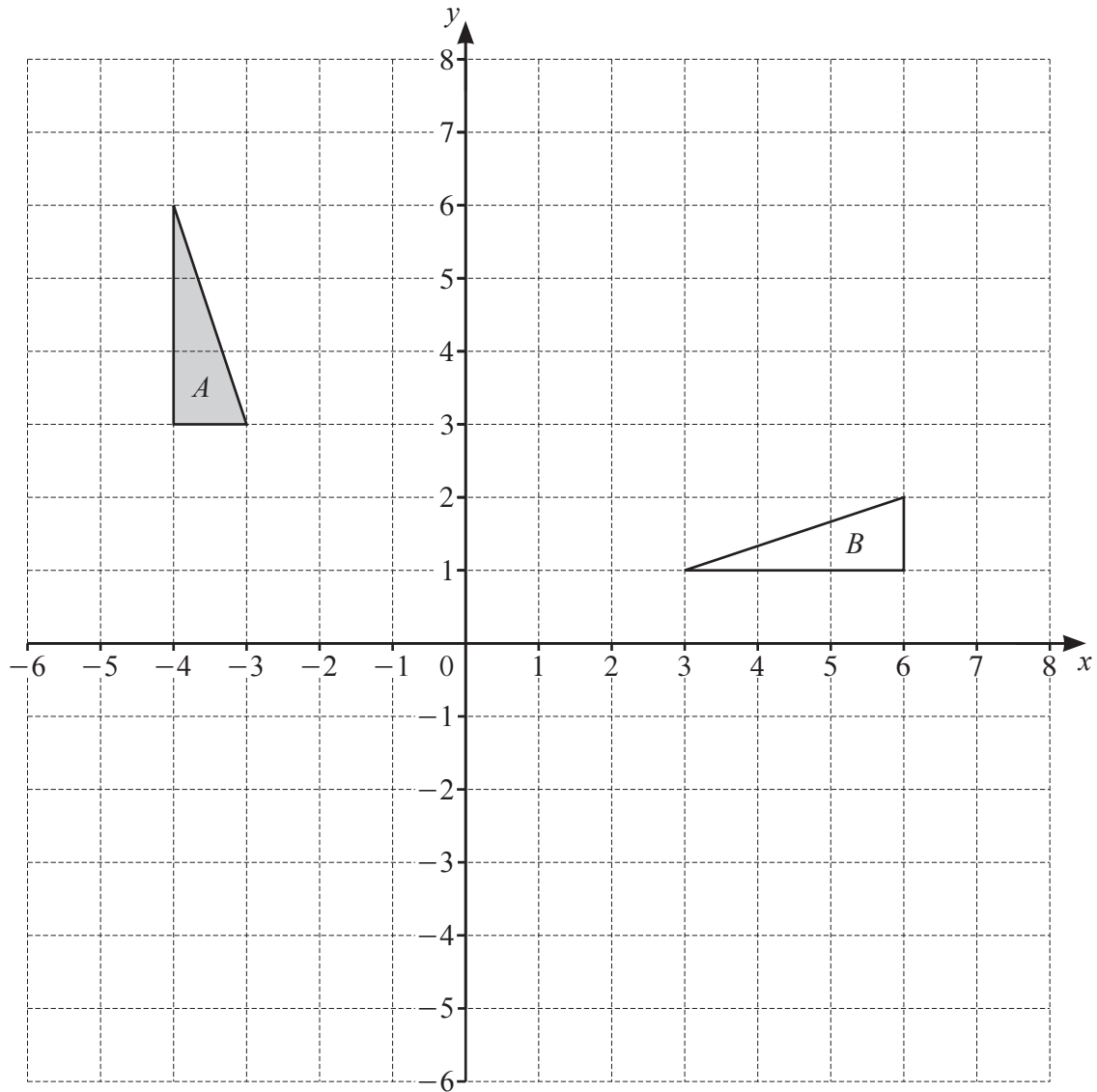
..... [1]

- (ii) The land area of Sub-Saharan Africa is approximately 21.2 million square kilometres.

Work out the average number of these birds per square kilometre.

..... birds/km² [2]

3



- (a) Describe fully the **single** transformation that maps triangle A onto triangle B .

.....
 [3]

- (b) Draw the image of triangle A after

(i) a reflection in the line $y = 1$ [2]

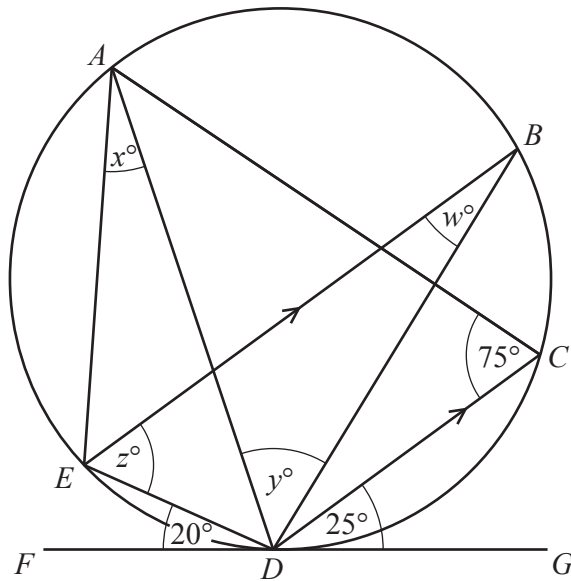
(ii) a translation by the vector $\begin{pmatrix} 5 \\ -7 \end{pmatrix}$ [2]

(iii) an enlargement, scale factor 2, centre $(-4, 5)$. [2]

- 4 (a) Find the size of one interior angle of a regular 10-sided polygon.

..... [2]

(b)



NOT TO
SCALE

The points A , B , C , D and E lie on a circle.
 FG is a tangent to the circle at D .
 EB is parallel to DC .

Find the value of each of w , x , y and z .

$w =$

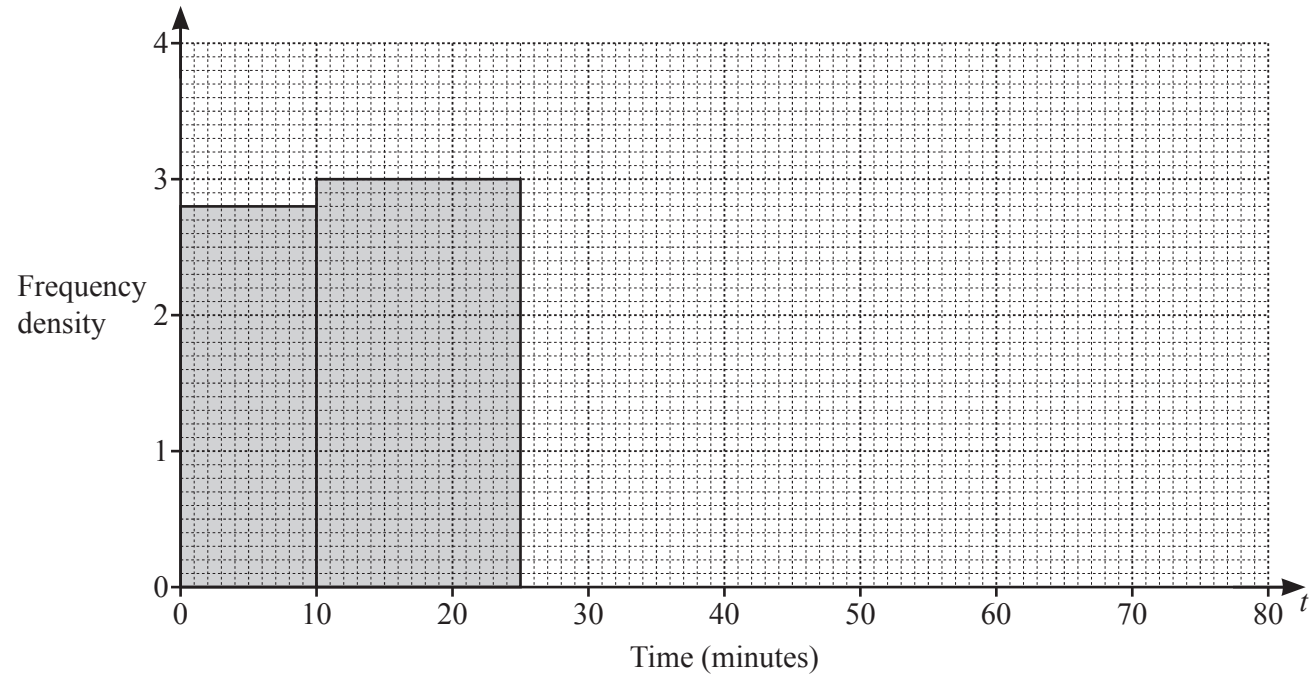
$x =$

$y =$

$z =$ [5]

- 5 Indira records the time taken for workers in her company to travel to work.
The table and the histogram each show part of this information.

Time (t minutes)	$0 < t \leq 10$	$10 < t \leq 25$	$25 < t \leq 40$	$40 < t \leq 60$	$60 < t \leq 80$
Frequency			57	38	12



- (a) Complete the table and the histogram.

[5]

- (b) Calculate an estimate of the mean time.

..... min [4]

(c) Rashid says:

‘The longest time that any of these workers take to travel to work is 80 minutes.’

Give a reason why Rashid may be wrong.

.....

..... [1]

(d) Indira picks three workers at random from those who take longer than 25 minutes to travel to work.

Calculate the probability that one worker takes 60 minutes or less and the other two each take more than 60 minutes.

..... [4]

10

6 $f(x) = 5x - 3$ $g(x) = 64^x$ $h(x) = \frac{2}{x+1}, \quad x \neq -1$

(a) Find the value of

(i) $f(2)$

..... [1]

(ii) $gf(0.5)$.

..... [2]

(b) Find $h^{-1}(x)$.

$h^{-1}(x) =$ [3]

(c) Find x when $g(x) = \frac{1}{2^5}$.

$x =$ [2]

(d) Write as a single fraction in its simplest form $\frac{1}{f(x)} - h(x)$.

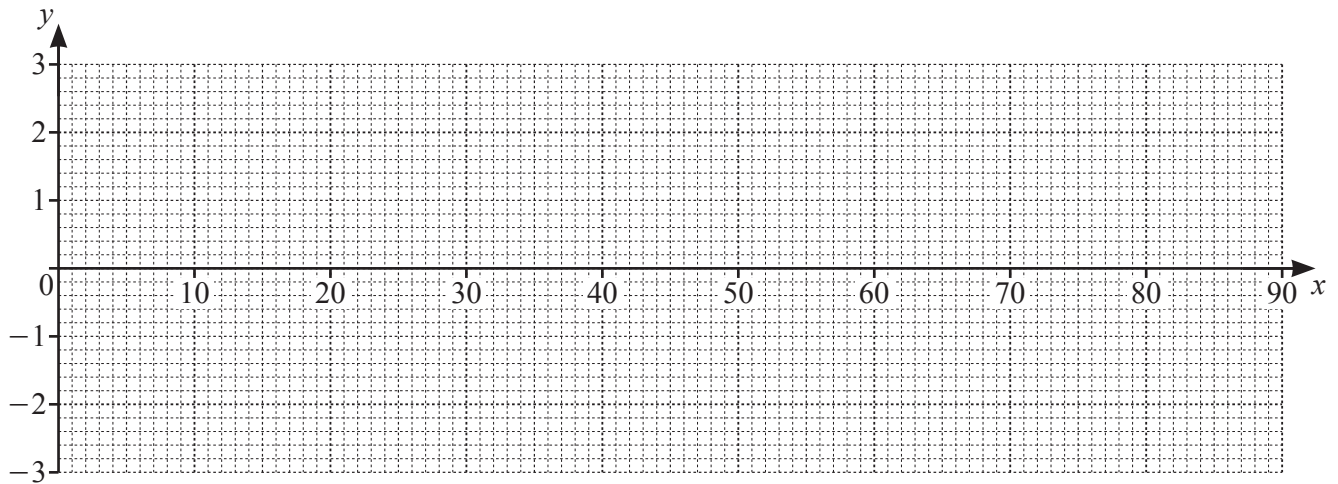
..... [4]

- 7 (a) Complete the table of values for $y = 3 \cos 2x^\circ$.
Values are given correct to 1 decimal place.

x	0	10	20	30	40	45	50	60	70	80	90
y	3.0	2.8	2.3	1.5	0.5		-0.5		-2.3		-3.0

[3]

- (b) Draw the graph of $y = 3 \cos 2x^\circ$ for $0 \leq x \leq 90$.



[4]

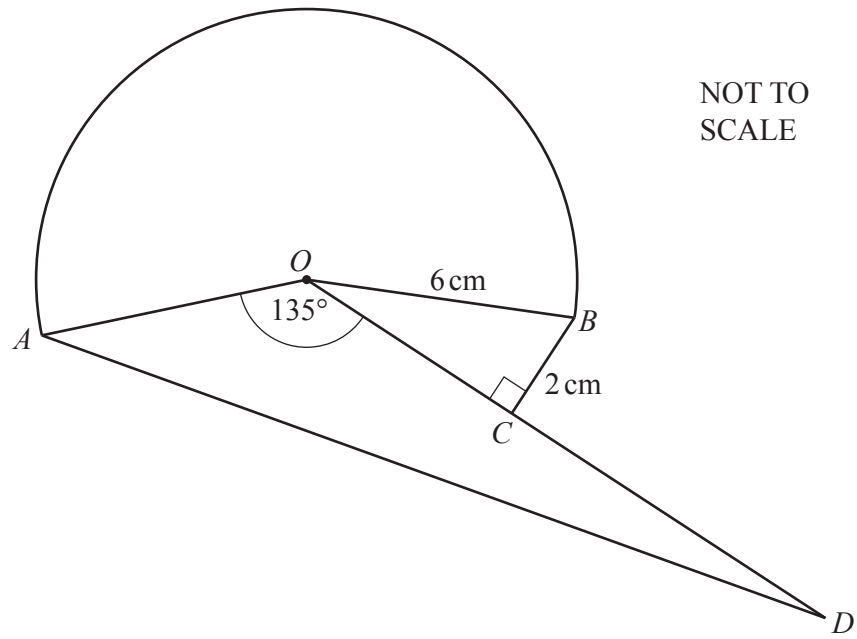
- (c) Use your graph to solve the equation $3 \cos 2x^\circ = -2$ for $0 \leq x \leq 90$.

$x = \dots\dots\dots$ [1]

- (d) By drawing a suitable straight line, solve the equation $120 \cos 2x^\circ = 80 - x$ for $0 \leq x \leq 90$.

$x = \dots\dots\dots$ [3]

8 (a)



The diagram shows a shape made from a major sector AOB and triangles OBC and AOD . $OB = 6\text{ cm}$, $BC = 2\text{ cm}$, obtuse angle $AOC = 135^\circ$ and angle $BCO = 90^\circ$.

(i) Show that angle $BOC = 19.5^\circ$, correct to 1 decimal place.

[2]

(ii) Calculate the area of the major sector AOB .

..... cm^2 [3]

- (iii) C is the midpoint of OD .

Calculate AD .

..... cm [5]

- (iv) Calculate the total area of the shape.

..... cm^2 [4]

- (b) A sector of a circle has radius 8 cm and area 160 cm^2 .
A mathematically similar sector has radius 20 cm.

Calculate the area of the larger sector.

..... cm^2 [3]

9 A is the point $(0, 2)$, B is the point $(3, 3)$ and C is the point $(4, 0)$.

- (a) Determine if triangle ABC is scalene, isosceles or equilateral.
You must show all your working.

[4]

- (b) (i) Find the equation of the line AC .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

- (ii) Find the equation of the perpendicular bisector of AC .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [4]

15

- (iii) $ABCD$ is a kite.
The point D has coordinates $(w, 4w + 1)$.

Find the coordinates of D .

(..... , ...) [3]

10 (a) Expand and simplify.

$$4(2x - 1) - 6(3 - x)$$

..... [2]

(b) Factorise completely.

(i) $6x^2y + 9xy$

..... [2]

(ii) $4x^2 - y^2 + 8x + 4y$

..... [3]

- (c) Antonio travels 100 km at an average speed of x km/h.
He then travels a further 150 km at an average speed of $(x + 10)$ km/h.
The time taken for the whole journey is 4 hours 20 minutes.

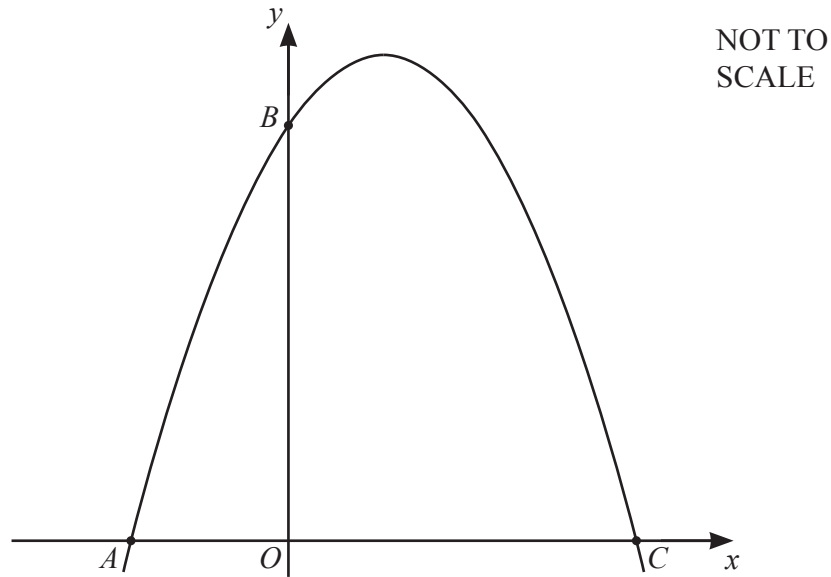
(i) Show that $13x^2 - 620x - 3000 = 0$.

[4]

- (ii) Solve $13x^2 - 620x - 3000 = 0$ to find the speed Antonio travels for the first 100 km of the journey.
You must show all your working and give your answer correct to 1 decimal place.

..... km/h [3]

11



The diagram shows a sketch of $y = 18 + 5x - 2x^2$.

(a) Find the coordinates of the points A , B and C .

A (..... , ...)

B (..... , ...)

C (..... , ...) [4]

(b) Differentiate $18 + 5x - 2x^2$.

..... [2]

(c) Find the coordinates of the point on $y = 18 + 5x - 2x^2$ where the gradient is 17.

(..... , ...) [3]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2023

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Mathematics-Specific Marking Principles

- 1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
- 2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
- 3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
- 4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
- 5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.
- 6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

awrt	answers which round to
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
nfw	not from wrong working
oe	or equivalent
rot	rounded or truncated
SC	Special Case
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	18593 cao	2	M1 for $7437.05 \times 250 \div 100$ oe
1(b)	804.53 cao	2	M1 for $5400 \div 671.20 [\times 100]$ oe
1(c)(i)	2000	2	M1 for $3500 \div (4 + 3) [\times k]$ oe
1(c)(ii)	1354.13 ...	3	M2 for $(3500 - \text{their (c)(i)}) \times \frac{77.05}{85.35}$ oe or M1 for $(3500 - \text{their (c)(i)}) \div \text{figs } 85.35$ oe or for $\frac{77.05}{85.35}$ oe or for $(3500 - \text{their (c)(i)}) \times \text{figs } 77.05$
1(c)(iii)	2 [h] 52 [min] nfww	3	M2 for $\frac{2100 \text{ to } 2200}{740 + 10}$ or $\frac{2200 - 50}{740 \text{ to } 760}$ or M1 for $2200 + 50$ or $2200 - 50$ or $740 + 10$ or $740 - 10$
2(a)	36.7 or 36.66 to 36.67 or $36\frac{2}{3}$	2	M1 for $\frac{11}{8 + 6 + 11 + 5} [\times 100]$ oe
2(b)(i)	72, 132 and 60	2	M1 for $360 \div (8 + 6 + 11 + 5)$ oe or $96 \div 8$
2(b)(ii)	Correct pie chart drawn	2	For 2 marks, strict FT <i>their</i> angles for correct pie chart only if angles add up to 360. B1FT for one correct sector
2(c)	29	2	M1 for $8 \times \left(1 + \frac{262.5}{100}\right)$ oe or B1 for 21
2(d)(i)	1.5×10^9	1	
2(d)(ii)	70.8 or 70.75...	2	M1 for $1500 [\text{million}] \div 21.2 [\text{million}]$
3(a)	Rotation 90° [anticlockwise] oe (2, 7)	3	B1 for each
3(b)(i)	Image at (−4, −1), (−3, −1), (−4, −4)	2	B1 for reflection in $y = k$ or $x = 1$
3(b)(ii)	Image at (2, −4), (1, −4), (1, −1)	2	B1 for translation by $\begin{pmatrix} 5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -7 \end{pmatrix}$
3(b)(iii)	Image at (−4, 7), (−4, 1), (−2, 1)	2	B1 for enlargement, factor 2 with other centre

Question	Answer	Marks	Partial Marks
4(a)	144	2	M1 for $180 - \frac{360}{10}$ or $\frac{180(10-2)}{10}$ oe
4(b)	$w = 20$ $x = 20$ $y = 60$ $z = 45$	5	B1 for w B1FT for $x = \text{their } w$ B2FT for $y = 80 - \text{their } w$ or B1 for angle $BDC = 20$ FT $\text{their } w$ or angle $ADE = 55$ or angle $CAD = 25$ B1FT for $z = 25 + \text{their } w$ or $105 - \text{their } y$
5(a)	28 and 45 on table	B2	B1 for each
	Histogram correctly completed	B3	B1 for each correct bar If 0 scored, SC1 for two of FD's 3.8, 1.9 or 0.6 oe soi
5(b)	30.7 or 30.66 to 30.67	4	M1 for midpoints soi M1 for use of $\sum fh$ with h in correct interval including both boundaries M1 (dep on 2 nd M1) for $\sum fh \div (\text{their } 28 + \text{their } 45 + 57 + 38 + 12)$
5(c)	Exact values are not known oe	1	
5(d)	$\frac{1254}{39\ 697}$ oe	4	M3 for $N \left(\frac{38+57}{57+38+12} \times \frac{12}{56+38+12} \times \frac{11}{56+38+11} \right)$ oe where $N = 1, 2$ or 3 or M2 for $\frac{38+57}{57+38+12}$ and $\frac{12}{56+38+12}$ or $\frac{12}{57+38+12}$ and $\frac{11}{57+38+11}$ oe seen or M1 for $\frac{38+57}{57+38+12}$ or $\frac{12}{57+38+12}$ oe seen If 0 scored SC1 for answer $\frac{41040}{1225043}$ or 0.0335...
6(a)(i)	7	1	
6(a)(ii)	$\frac{1}{8}$ oe	2	M1 for $g(-0.5)$ or for $64^{5(x)-3}$ or better

Question	Answer	Marks	Partial Marks
6(b)	$\frac{2-x}{x}$ or $\frac{2}{x}-1$ final answer	3	M1 for $y(x+1) = 2$ or $x = \frac{2}{y+1}$ or better M1 for $\frac{2-y}{y}$ or $xy = 2-x$ oe
6c	$-\frac{5}{6}$ -0.833 or better	2	M1 for $[64^x =] 2^{6x}$ or $(2^6)^x$ or $6x = -5$
6(d)	$\frac{7-9x}{(5x-3)(x+1)}$ or $\frac{7-9x}{5x^2+2x-3}$ or $-\frac{9x-7}{5x^2+2x-3}$ final answer	4	B1 for $\frac{1}{5x-3} - \frac{2}{x+1}$ M1 for $x+1-2(5x-3)$ seen isw M1 for $(5x-3)(x+1)$ seen isw
7(a)	0, -1.5 oe, -2.8	3	B1 for each
7(b)	Correct graph	4	B3 FT for 10 or 11 correct points FT <i>their</i> table or B2 FT for 8 or 9 correct points FT <i>their</i> table or B1 FT for 6 or 7 correct points FT <i>their</i> table
7(c)	65 to 67	1	FT intersection of <i>their</i> graph with $y = -2$
7(d)	$y = 2 - \frac{x}{40}$ oe ruled	M2	M1 for $[y =] 2 - \frac{x}{40}$ oe soi or for $3 \cos 2x = 2 - \frac{x}{40}$ oe soi
	32 to 36	B1	
8(a)(i)	$\sin[BOC] = \frac{2}{6}$ or better oe	M1	
	19.47...	A1	
8(a)(ii)	64.6 or 64.55 to 64.58	3	M2 for $\frac{360-135-19.5}{360} \times \pi \times 6^2$ oe or M1 for $\frac{k}{360} \times \pi \times 6^2$ oe

Question	Answer	Marks	Partial Marks
8(a)(iii)	16.1 or 16 10 to 16.13	5	M2 for $2 \times \sqrt{6^2 - 2^2}$ oe or $2 \times 6 \cos 19.5$ oe or M1 for $OC^2 + 2^2 = 6^2$ oe or $6 \cos 19.5$ or better AND M2 for $\sqrt{6^2 + \text{their } OD^2} - 2 \times 6 \times \text{their } OD \times \cos 135$ OR M1 for $6^2 + \text{their } OD^2 - 2 \times 6 \times \text{their } OD \times \cos 135$ A1 for 259 to 260
8(a)(iv)	94.2 or 94.3 or 94.15 to 94.27... nfw	4	M1 for $\frac{1}{2} \times 6 \times \text{their } OD \times \sin 135$ oe M1 for $\frac{1}{2} \times 6 \times 2 \times \sin(90 - 19.5)$ oe or for $\frac{1}{2} \times \text{their } OC \times 2$ M1dep for their (a)(ii) + <i>their</i> two triangle areas
8(b)	1000 cao	3	M2 for $160 \times \left(\frac{20}{8}\right)^2$ or $160 \div \left(\frac{8}{20}\right)^2$ oe or M1 for $\left(\frac{20}{8}\right)^2$ or $\left(\frac{8}{20}\right)^2$ oe OR M2 for $\frac{\text{sector angle}}{360} \times \pi 20^2$ or M1 for $\frac{160}{\pi 8^2} \times 360$ oe or better OR M2 for $\frac{\text{percentage}}{100} \times \pi 20^2$ oe or better or M1 for $\frac{160}{\pi 8^2} [\times 100]$ oe or better
9(a)	$[AB^2 =] (3 - 0)^2 + (3 - 2)^2$ oe or better	M1	or $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ oe
	$[AC^2 =] (0 - 2)^2 + (4 - 0)^2$ oe or better	M1	or $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$ oe
	$[BC^2 =] (0 - 3)^2 + (4 - 3)^2$ oe or better	M1	or $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$ oe

Question	Answer	Marks	Partial Marks
	Triangle is isosceles [with 10, 20 and 10 or better shown]	A1	or Triangle is isosceles and only vector AB and BC have the same magnitude [because they have the same components]
9(b)(i)	$[y =] -\frac{1}{2}x + 2$ oe	3	M1 for $\frac{0-2}{4-0}$ oe M1 for substituting (0, 2) or (4, 0) into $y = \text{their } mx + c$ oe or B1 for answer $y = kx + 2$
9(b)(ii)	$[y =] 2x - 3$	4	M1 for $\frac{-1}{\text{their grad (b)(i)}}$ B1 for (2, 1) M1 for substituting <i>their</i> (2, 1) into $y = \text{their } px + d$ oe
9(b)(iii)	$(-2, -7)$	3	B2 for $w = -2$ or M1 for $4w + 1 = 2w - 3$ FT <i>their (b)(ii)</i> or for $2 = \frac{4w+1-3}{w-3}$
10(a)	$14x - 22$ or $2(7x - 11)$ final answer	2	B1 for answer $kx - 22$ or $14x + c$ or for $8x - 4$ or $-18 + 6x$ or for correct answer seen in working
10(b)(i)	$3xy(2x + 3)$ final answer	2	M1 for answer $3(2x^2y + 3xy)$ or $3x(2xy + 3y)$ or $3y(2x^2 + 3x)$ or $xy(6x + 9)$ B1 for correct answer seen and spoilt
10(b)(ii)	$(2x + y)(2x - y + 4)$ final answer	3	M1 for $(2x + y)(2x - y)$ M1 for $4(2x + y)$ If 0 scored, SC1 for answer $4x(x + 2) + y(4 - y)$ oe
10(c)(i)	$\frac{100}{x} + \frac{150}{x+10} = 4\frac{1}{3}$ oe or $150 = \left(\frac{13}{3} - \frac{100}{x}\right)(x+10)$	M1	
	$\frac{100(x+10)+150x}{x(x+10)} [= \text{their } 4\frac{1}{3}]$ or better	M1	
	$300x + 3000 + 450x = 13x^2 + 130x$ oe or better	B1	Allow correct multiples
	$13x^2 - 620x - 3000 = 0$	A1	With no errors or omissions

Question	Answer	Marks	Partial Marks
10(c)(ii)	$\frac{[- -]620 \pm \sqrt{(-620)^2 - 4(13)(-3000)}}{2(13)}$ or $-\frac{(-620)}{2 \times 13} \pm \sqrt{\frac{620^2}{4 \times 13^2} - \frac{(-3000)}{13}}$ both oe or better	M2	M1 for $\sqrt{(-620)^2 - 4 \times 13 \times -3000}$ oe or for $\frac{- - 620 + \sqrt{p}}{2(13)}$ or $\frac{- - 620 - \sqrt{p}}{2(13)}$ oe
	52.1 final answer	B1	
11(a)	(-2, 0) (0, 18) (4.5, 0) oe	4	B1 for $B = (0, 18)$ B3 for $A = (-2, 0)$ and $C = (4.5, 0)$ oe or B2 for $x = -2$ and $x = 4.5$ oe or B1 for $(9 - 2x)(2 + x)$ oe or either A or C correct
11(b)	$5 - 4x$ final answer	2	B1 for one correct term when simplified
11(c)	$(-3, -15)$	3	B2FT for $x = -3$ OR M1 for <i>their</i> (b) = 17 M1 dep for correct substitution of <i>their</i> x into $18 + 5x - 2x^2$ shown



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MATHEMATICS**0580/21**

Paper 2 (Extended)

May/June 2023**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

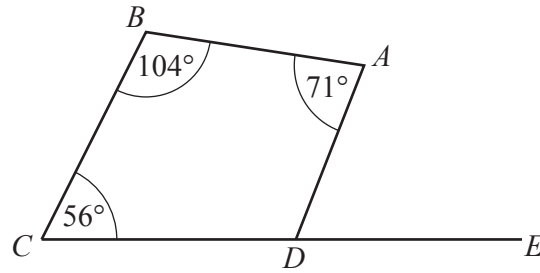
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

1



NOT TO
SCALE

CDE is a straight line.

Find angle ADE .

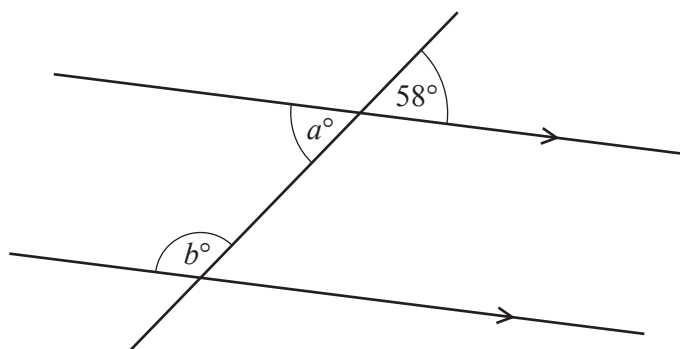
..... [2]

- 2 A train journey starts at 21 43.
It takes 8 hours and 32 minutes.

Find the time the journey finishes.

..... [1]

3



NOT TO
SCALE

The diagram shows a straight line intersecting two parallel lines.

Find the value of a and the value of b , giving a geometrical reason for each answer.

$a =$ because

$b =$ because [4]

- 4 By writing each number in the calculation correct to 1 significant figure, work out an estimate for the value of

$$\frac{6.7 \times 2.1}{18 - 5.9} \cdot$$

You must show all your working.

..... [2]

- 5 Eric has four colours of paint.
The table shows the probability that he uses each colour.

Colour	Red	Blue	Green	Yellow
Probability	0.3	0.35	0.13	x

Find the value of x .

$x =$ [2]

- 6 Calculate the volume of a sphere with diameter 4.8 cm.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm^3 [2]

- 7 The scale of a map is 1 : 125 000.
On a map, the length of an island is 9.4 cm.

Calculate the actual length of the island, giving your answer in kilometres.

..... km [2]
[Turn over]

- 8 (a) The n th term of a sequence is $10 - n^2$.

Write down the first three terms of this sequence.

....., ..., ... [2]

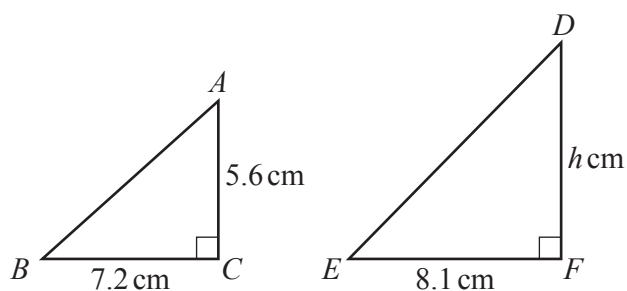
- (b) These are the first four terms of another sequence.

7 10 13 16

Find an expression for the n th term of this sequence.

..... [2]

9



NOT TO
SCALE

Triangle ABC is similar to triangle DEF .

Calculate the value of h .

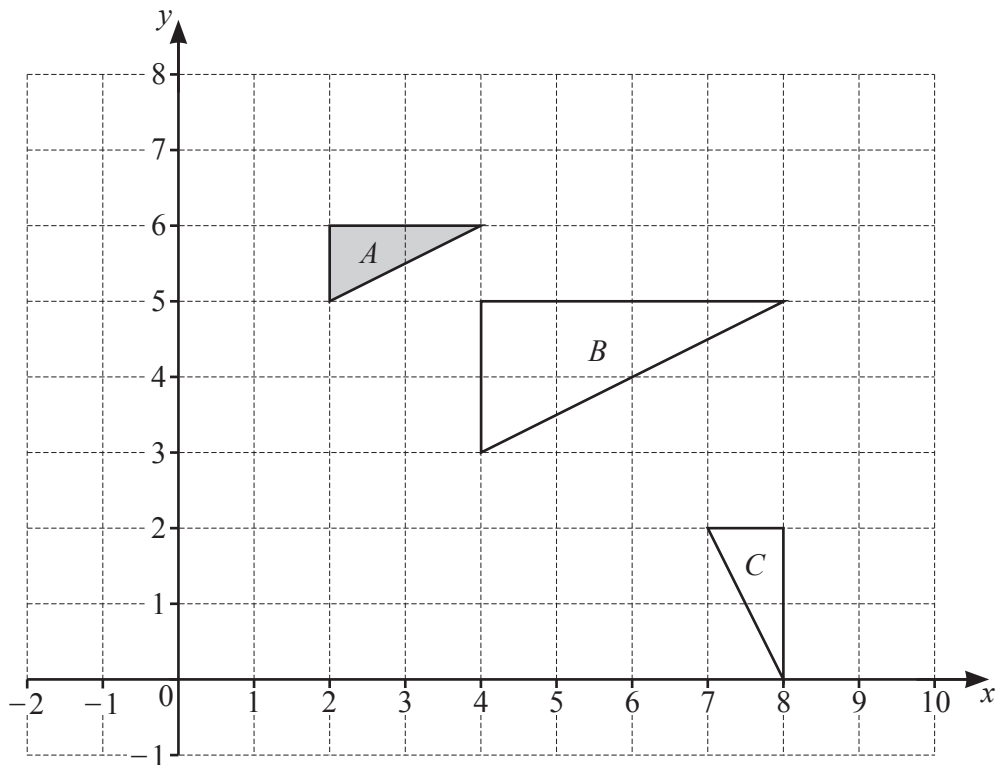
$h =$ [2]

- 10 Without using a calculator, work out $2\frac{1}{7} \div \frac{5}{9}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

11



Describe the **single** transformation that maps

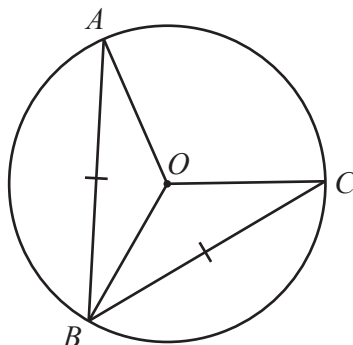
- (a) triangle *A* onto triangle *B*

.....
 [3]

- (b) triangle *A* onto triangle *C*.

.....
 [3]

12 (a)



NOT TO
SCALE

AO , OB and OC are all radii of the circle.

$AB = BC$.

Therefore triangle AOB is congruent to triangle COB .

Draw a ring around the correct criterion for this statement.

SAS

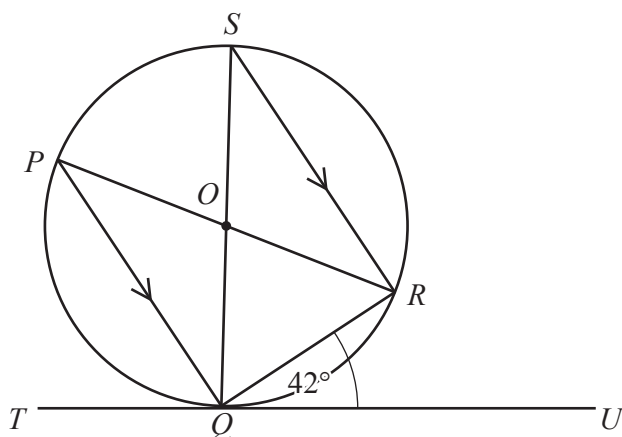
RHS

SSS

ASA

[1]

(b)



NOT TO
SCALE

P , Q , R and S are points on the circle and TQU is a tangent to the circle at Q .

PR and SQ intersect at the centre of the circle, O , and PQ is parallel to SR .

Angle $RQU = 42^\circ$.

Calculate

(i) angle QSR

Angle $QSR = \dots\dots\dots$ [1]

(ii) angle PQS

Angle $PQS = \dots\dots\dots$ [1]

(iii) angle POS .

Angle $POS = \dots\dots\dots$ [1]

- 13** Anya invests \$6000 in an account that pays compound interest at a rate of $r\%$ per year. At the end of 8 years, the account has earned \$621.70 in interest.

Calculate the value of r .

$$r = \dots\dots\dots [3]$$

- 14** y is directly proportional to the square of $(x + 3)$.
When $x = 2$, $y = 5$.

Find y when $x = 1$.

$$y = \dots\dots\dots [3]$$

- 15** A bag contains 5 green buttons, 2 blue buttons and 6 white buttons.
Maya takes two buttons at random from the bag, without replacement.

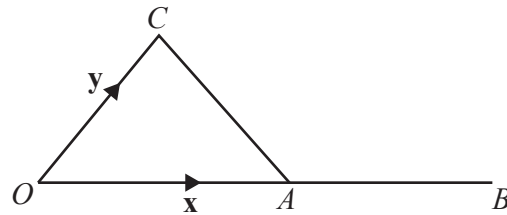
Calculate the probability that one button is green and the other button is not green.

$$\dots\dots\dots [3]$$

- 16 (a) Find the magnitude of the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$.

..... [2]

(b)



NOT TO
SCALE

The diagram shows a triangle OAC .
 A is the midpoint of the straight line OB .
 $\vec{OA} = \mathbf{x}$ and $\vec{OC} = \mathbf{y}$.

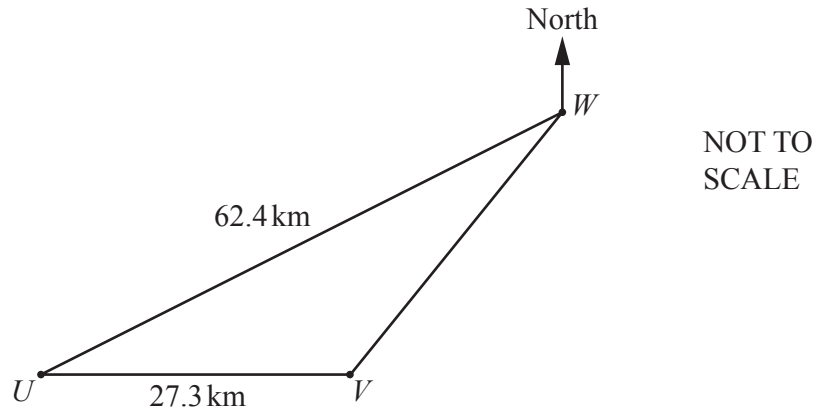
Find $\vec{CB}$ in terms of $\mathbf{x}$ and $\mathbf{y}$.

$\vec{CB} =$ [1]

- 17 Simplify $(81x^{12})^{\frac{3}{4}}$.

..... [2]

18

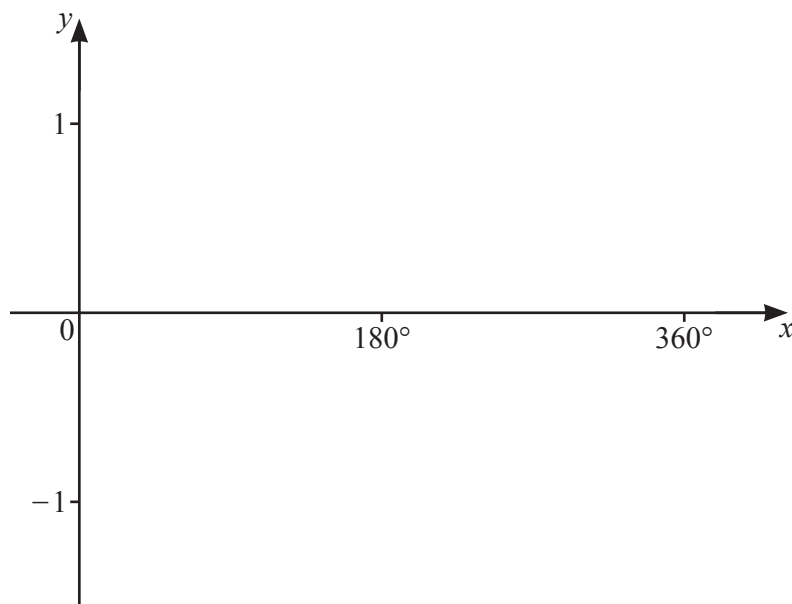


The diagram shows the position of three towns, U , V and W .
 U is due west of V and angle $UVW = 125^\circ$.

Calculate the bearing of U from W .

..... [4]

- 19 (a) On the diagram, sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (b) Solve the equation $5 \cos x + 3 = 0$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

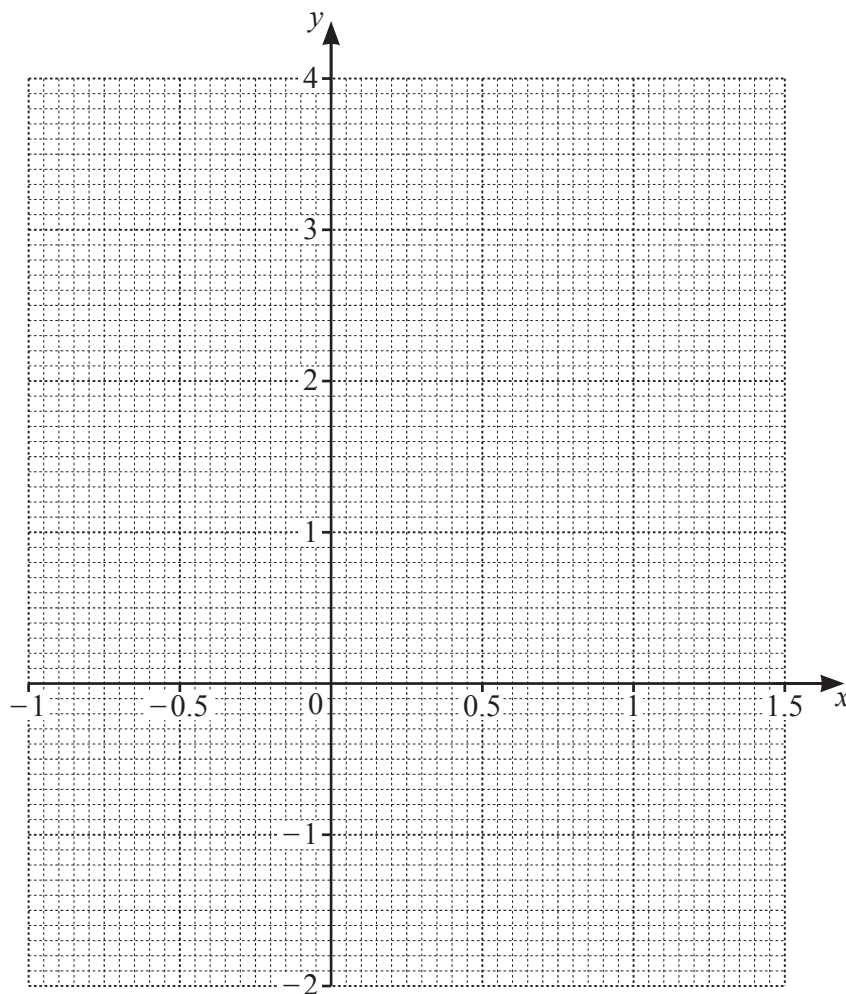
20 The table shows some values for $y = 3x^2 - 2x - 1$.

x	-1	-0.5	0	0.5	1	1.5
y	4		-1		0	2.75

(a) Complete the table.

[1]

(b) On the grid, draw the graph of $y = 3x^2 - 2x - 1$ for $-1 \leq x \leq 1.5$.



[3]

(c) By drawing a suitable straight line, solve the equation $3x^2 - 4x - 2 = 0$ for $-1 \leq x \leq 1.5$.

$x = \dots\dots\dots$ [3]

Question 21 is printed on the next page.

21 A curve has equation $y = x^3 - 12x$.

(a) Find the gradient of the curve at the point $(1, -11)$.

..... [3]

(b) Find the coordinates of the turning points of the curve.

(..... , ...) and (..... , ...) [3]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

May/June 2023

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

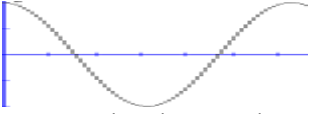
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	51	2	M1 for $360 - (56 + 104 + 71)$
2	06 15 or 6:15 am	1	
3	58, vertically opposite	2	B1 for each
	122, interior	2	B1 for each
4	$\frac{7 \times 2}{20 - 6}$	M1	
	1 nfw	A1	If 0 scored SC1 for 3 correct roundings or for all correct but with any trailing zeros
5	0.22 oe	2	M1 for $1 - (0.3 + 0.35 + 0.13)$ oe or B1 for 0.78 oe
6	57.9 or 57.90 to 57.91...	2	M1 for $\frac{4}{3} \times \pi \times \left(\frac{4.8}{2}\right)^3$
7	11.75	2	M1 for $\frac{9.4 \times 125000}{100 \times 1000}$ oe or B1 for figs 1175 or 1 cm : 1.25 km
8(a)	9 6 1	2	B1 for 2 correct
8(b)	$3n + 4$ oe final answer	2	B1 for $3n + j$ or $kn + 4$ $k \neq 0$, or $3n + 4$ seen then spoilt
9	6.3	2	M1 for $\frac{5.6}{h} = \frac{7.2}{8.1}$ oe or better
10	$\frac{15}{7} \times \frac{9}{5}$ oe or $\frac{135}{63} \div \frac{35}{63}$ oe with common denominator	M2	B1 for $\frac{15}{7}$ oe or M1 for $\frac{their 15}{7} \times \frac{9}{5}$ oe

Question	Answer	Marks	Partial Marks
	$3\frac{6}{7}$ cao	A1	
11(a)	Enlargement [sf] 2 (0, 7)	3	B1 for each
11(b)	Rotation (3, 1) 90° clockwise oe	3	B1 for each
12(a)	SSS	1	
12(b)(i)	42	1	
12(b)(ii)	42	1	FT their part (i)
12(b)(iii)	84	1	FT 2 × their part (ii)
13	1.24[0...]	3	M2 $\sqrt[8]{\frac{6000+621.70}{6000}}$ oe or M1 for $6000 + 621.70 = 6000(k)^8$ oe
14	3.2 oe	3	M1 for $y = k(x+3)^2$ oe or better M1 for substituting <i>their</i> k into $y = k(1+3)^2$
15	$\frac{20}{39}$ oe	3	M2 for $\frac{5}{13} \times \frac{8}{12} [\times 2]$ oe or M1 for $\frac{5}{13}$ or $\frac{8}{12}$ or $\frac{5}{12}$ or $\frac{8}{13}$ If 0 scored SC1 for answer $\frac{80}{169}$ oe
16(a)	6.4[0] or 6.403...	2	M1 for $(-4)^2 + 5^2$ oe
16(b)	$2x - y$	1	
17	$27x^9$ final answer	2	B1 for answer $27x^n$ or nx^9 , or for correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
18	236[.0...]	4	M2 for $\frac{27.3 \times \sin 125}{62.4}$ or M1 for $\frac{27.3}{\sin UWV} = \frac{62.4}{\sin 125}$ M1 for $180 + (125 - 90) + \text{their } 21$ oe or $180 + (90 - \text{their } 34) \text{ oe}$ If 0 scored SC1 for the correct bearing marked at <i>W</i>

Question	Answer	Marks	Partial Marks
19(a)	correct sketch  Correct sketch to go through (0, 1), (360, 1) and (180, -1)	2	B1 for correct cosine curve shape through (0, 1)
19(b)	126.9 or 126.86 to 126.87 233.1 or 233.13 to 233.14	3	B2 for 1 correct angle or M1 for $\cos x = -\frac{3}{5}$ oe If M1 or 0 scored SC1 for two angles with a sum of 360
20(a)	0.75 and -1.25	1	
20(b)	Correct curve	3	B2 FT for 6 or 5 correct plots or B1 FT for 4 or 3 correct plots
20(c)	ruled line $y = 2x + 1$	B2	B1 for correct equation [$y =$] $2x + 1$ soi or $y = 2x + k$ or $y = kx + 1$ drawn
	-0.35 to -0.45	B1	
21(a)	-9	3	B2 for $3x^2 - 12$ isw or B1 for $3x^2 - k$ or $kx^2 - 12$
21(b)	(-2, 16) (2, -16)	3	M1 for <i>their</i> $(3x^2 - 12) = 0$ or stating $\frac{dy}{dx} = 0$ A1 for $x = \pm 2$ or (-2, 16) or (2, -16)



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MATHEMATICS**0580/22**

Paper 2 (Extended)

May/June 2023**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

2

- 1 Find the temperature that is 8°C colder than -5°C .

..... $^{\circ}\text{C}$ [1]

- 2 There are two prime numbers in this list.

27 47 57 61 75 93

Work out the sum of these two prime numbers.

..... [2]

- 3 On ten days, Stefan records the number of minutes he has to wait for a train.

1 3 12 5 4 23 5 24 11 8

- (a) Complete the stem-and-leaf diagram to show this information.

0	1 3
1	
2	

Key: 0 | 1 represents 1 minute

[2]

- (b) Find the median.

..... min [1]

- 4 The distance from town *A* to town *B* on a map is 3.5 cm.
The scale on the map is 1 : 250 000.

Find the actual distance, in kilometres, from town *A* to town *B*.

..... km [2]

- 5 A spinner is spun.
The possible outcomes are A, B, C or D.
The probability of spinning A, C or D is shown in the table.

Letter on spinner	A	B	C	D
Probability	0.2		0.05	0.35

Complete the table.

[2]

- 6 $\mathcal{C} = \{x: 1 \leq x \leq 20\}$
 $E = \{\text{even numbers}\}$
 $M = \{\text{multiples of 5}\}$

(a) Find $n(M)$.

..... [1]

(b) Find the elements in the set $E \cap M$.

..... [1]

(c) $y \notin E$.

Write down a possible value of y .

..... [1]

- 7 Without using a calculator, work out $\frac{4}{7} \div 1\frac{5}{21}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

- 8 Solve.

(a) $\frac{30}{x} = 6$

$x =$ [1]

(b) $11x - 3 \geq 2(2x + 9)$

..... [3]

- 9 F is the point $(1, -4)$, $\overrightarrow{FG} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$ and $\overrightarrow{GH} = \begin{pmatrix} -12 \\ 35 \end{pmatrix}$.

Find

(a) $3\overrightarrow{FG}$

$$\begin{pmatrix} \\ \end{pmatrix} [1]$$

(b) $\overrightarrow{FG} + \overrightarrow{GH}$

$$\begin{pmatrix} \\ \end{pmatrix} [1]$$

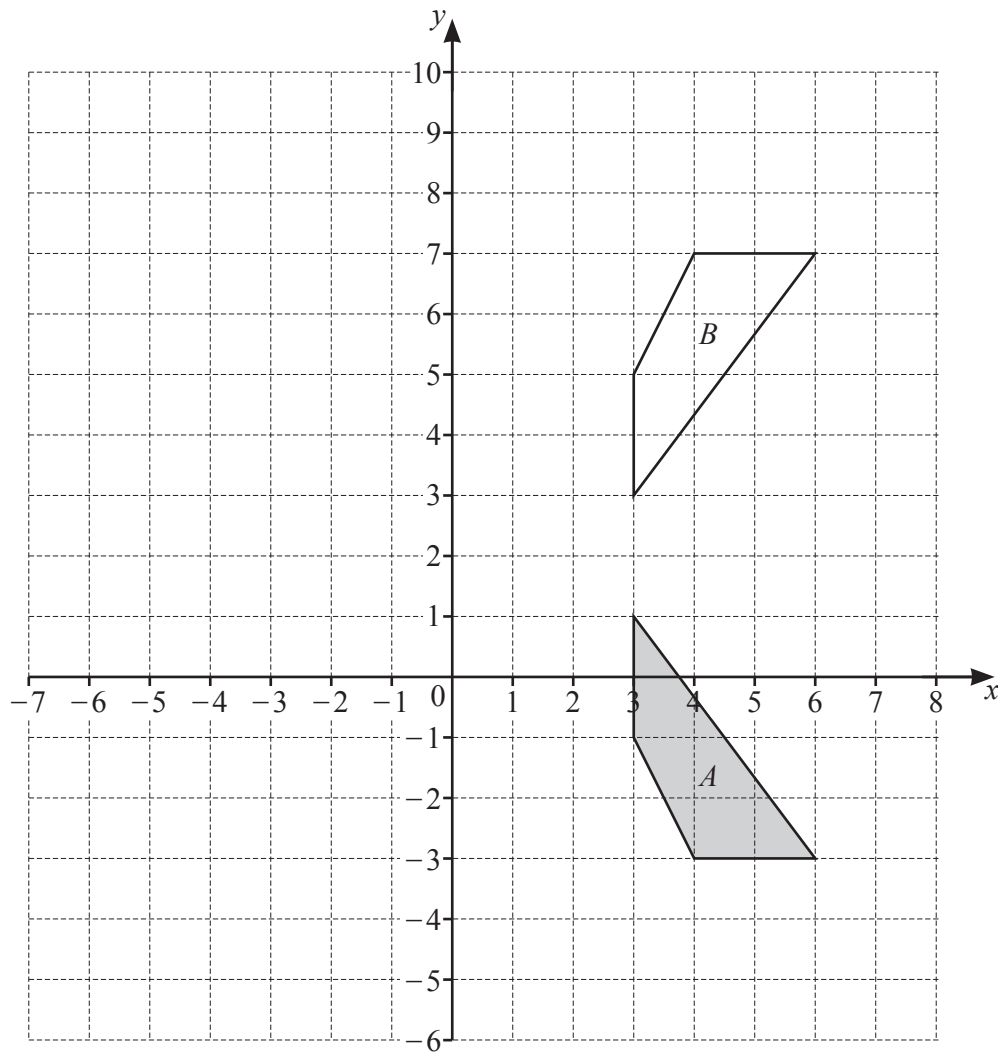
(c) the coordinates of the point G

$$(\dots\dots\dots, \dots\dots\dots) [1]$$

(d) the magnitude of vector $\overrightarrow{GH}$.

$$\dots\dots\dots [2]$$

10



- (a) Describe fully the **single** transformation that maps shape *A* onto shape *B*.

.....
 [2]

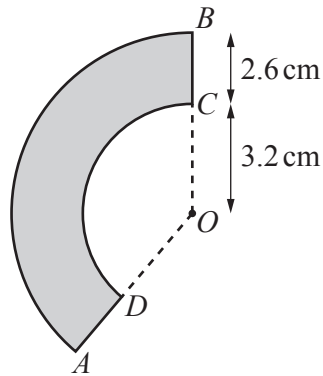
- (b) Rotate shape *A* 90° clockwise about the point $(-1, 2)$.

[2]

- (c) Enlarge shape *A* by scale factor -2 , centre $(2, 0)$.

[2]

11

NOT TO
SCALE

The diagram shows a shape, $ABCD$, formed by the sectors of two circles with the same centre O . Both sector angles are 140° , $OC = 3.2$ cm and $CB = 2.6$ cm. The area of the shape is $k\pi$ cm².

Find the value of k .

$k = \dots\dots\dots$ [3]

- 12 One solution of the equation $ax^2 + b = 181$ is $x = 8$.
 a and b are both positive integers **greater than 1**.

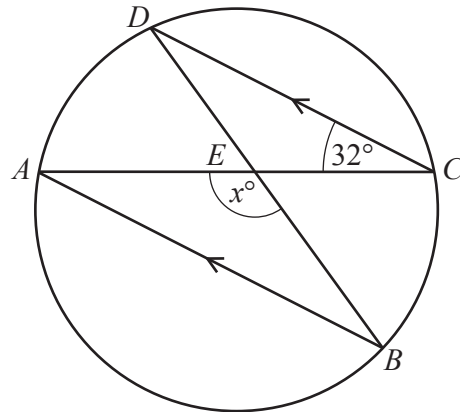
(a) Find the value of b .

$b = \dots\dots\dots$ [2]

(b) Write down the other solution of the equation $ax^2 + b = 181$.

$x = \dots\dots\dots$ [1]

13

NOT TO
SCALE

A, B, C and D are points on a circle.
 AB is parallel to DC and angle $ACD = 32^\circ$.
 Chords AC and DB intersect at E .

Find the value of x .

$x = \dots\dots\dots$ [2]

14 $f(x) = 5x + 2$

Find $f^{-1}(x)$.

$f^{-1}(x) = \dots\dots\dots$ [2]

15 C is the point $(5, -1)$ and D is the point $(13, 15)$.

(a) Find the midpoint of CD .

(....., ...) [2]

(b) Find the gradient of CD .

..... [2]

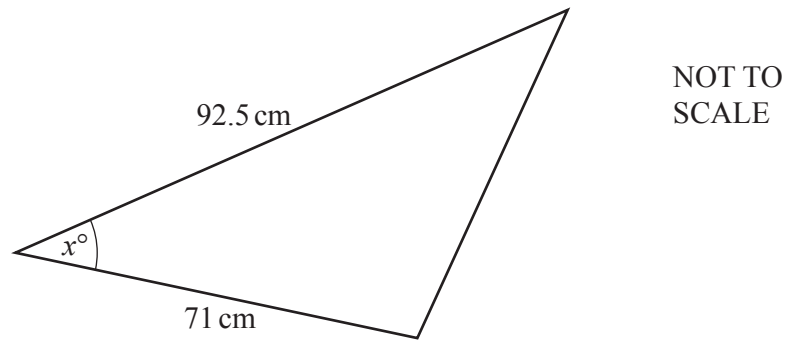
(c) Find the equation of the perpendicular bisector of CD .
Give your answer in the form $y = mx + c$.

$y =$ [3]

16 Write $0.6\dot{2}1$ as a fraction in its simplest form.
You must show all your working.

..... [3]

17



The diagram shows a triangle with an acute angle marked x° .
The area of the triangle is 2143 cm^2 .

Work out the value of x .

$x = \dots\dots\dots$ [2]

18 Make x the subject of the formula.

$$c = \frac{3x}{2x-5}$$

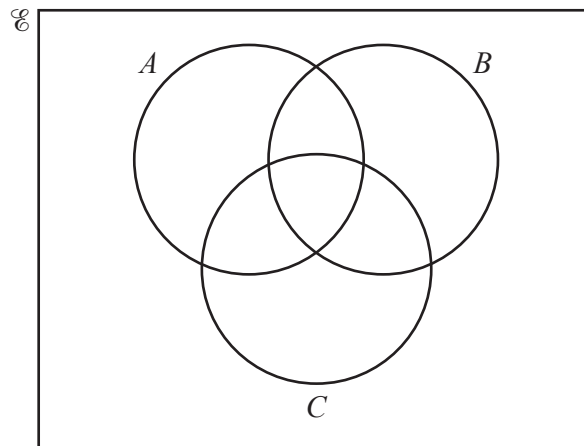
$x = \dots\dots\dots$ [4]

- 19 m is inversely proportional to the square of $(t+2)$.
 $m = 0.64$ when $t = 3$.

Find m when $t = 8$.

$m = \dots\dots\dots$ [3]

- 20 In the Venn diagram, shade the region $A \cap B' \cap C$.



[1]

- 21 Solve the equation $5 \sin x = -3$ for $0^\circ \leq x \leq 360^\circ$.

$\dots\dots\dots$ [3]

Questions 22 and 23 are printed on the next page.

- 22 Write as a single fraction in its simplest form.

$$\frac{5}{3x+2} + \frac{4}{2x-1}$$

..... [3]

- 23 Bag A and bag B each contain red sweets and yellow sweets.
 Anna picks a sweet at random from bag A .
 Ben picks a sweet at random from bag B .
 The probability that Anna picks a red sweet is $\frac{2}{5}$.
 The probability Anna and Ben both pick a yellow sweet is $\frac{1}{10}$.
 Find the probability that Anna and Ben both pick a red sweet.

..... [3]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

May/June 2023

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

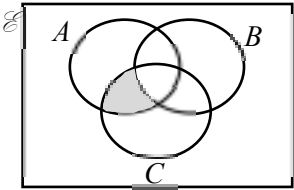
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks						
1	−13	1							
2	108	2	B1 for 47 or 61 identified						
3(a)	<table border="1"><tr><td>0</td><td>(1 3) 4 5 5 8</td></tr><tr><td>1</td><td>1 2</td></tr><tr><td>2</td><td>3 4</td></tr></table>	0	(1 3) 4 5 5 8	1	1 2	2	3 4	2	B1 for a correct diagram with one error or omission or for a fully correct unordered stem-and-leaf diagram
0	(1 3) 4 5 5 8								
1	1 2								
2	3 4								
3(b)	6.5	1							
4	8.75	2	M1 for $\frac{3.5 \times 250000}{100 \times 1000}$ oe or B1 for figs 875 or 1 cm : 2.5 km						
5	0.4 oe	2	M1 for $1 - (0.2 + 0.05 + 0.35)$ oe or B1 for 0.6 oe						
6(a)	4 cao	1							
6(b)	10, 20	1							
6(c)	An odd number or decimal in the range $1 \leq x \leq 20$	1							
7	$\frac{4}{7} \times \frac{21}{26}$ oe or $\frac{12}{21} \div \frac{26}{21}$ oe with common denominator	M2	B1 for $\frac{26}{21}$ or $\frac{21}{26}$ oe or M1 for $\frac{4}{7} \times \frac{21}{\text{their } 26}$ oe						
	$\frac{6}{13}$ cao	A1							
8(a)	5	1							

Question	Answer	Marks	Partial Marks
8(b)	$x \geq 3$ final answer	3	M1 for correct first step $11x - 3 \geq 4x + 18$ or $5.5x - 1.5 \geq 2x + 9$ or better M1 for correctly collecting <i>their</i> x terms on one side and <i>their</i> number terms on the other side e.g. $11x - 4x \geq 18 + 3$ or better
9(a)	$\begin{pmatrix} 24 \\ -9 \end{pmatrix}$	1	
9(b)	$\begin{pmatrix} -4 \\ 32 \end{pmatrix}$	1	
9(c)	(9, -7)	1	
9(d)	37	2	M1 for $(-12)^2 + 35^2$ oe
10(a)	Reflection $y = 2$	2	B1 for each
10(b)	Shape at (-2, -2), (-6, -5), (-6, -3), (-4, -2)	2	B1 for correct size and orientation but wrong position or for rotation of 90° anticlockwise about (-1, 2) or for three correct vertices
10(c)	Shape at (0, -2), (0, 2), (-2, 6), (-6, 6)	2	B1 for correct size and orientation but wrong position or for three correct vertices
11	9.1	3	M2 for $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2 - \frac{140}{360} \times [\pi] \times 3.2^2$ oe or M1 for $\frac{140}{360} \times [\pi] \times 3.2^2$ oe or $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2$ oe or $[\pi] \times (3.2 + 2.6)^2 - [\pi] \times 3.2^2$
12(a)	53	2	M1 for $a \times 8^2 + b = 181$ oe seen
12(b)	-8	1	

Question	Answer	Marks	Partial Marks
13	116	2	B1 for $ABD = 32$, $CAB = 32$, $BDC = 32$ or $CED = 116$ or M1 for $180 - 32 - 32$
14	$\frac{x-2}{5}$ oe final answer	2	M1 for a correct first step $x = 5y + 2$ or $y - 2 = 5x$ or $\frac{y}{5} = x + \frac{2}{5}$
15(a)	(9, 7)	2	B1 for each
15(b)	2	2	M1 for $\frac{15 - -1}{13 - 5}$ oe
15(c)	$[y =] -\frac{1}{2}x + \frac{23}{2}$ oe final answer	3	M1 for gradient = $-\frac{1}{\text{their } (b)}$ oe M1 for correct substitution of <i>their (a)</i> into $y = (\text{their } m)x + c$ oe
16	621.21... – 6.21... oe	M1	
	$\frac{41}{66}$ cao	A2	A1 for $\frac{615}{990}$ oe If M0 scored SC1 for $\frac{k}{990}$ or for answer $\frac{41}{66}$ with insufficient working
17	40.7 or 40.73 to 40.74	2	M1 for $\frac{1}{2} \times 92.5 \times 71 \sin x = 2143$ oe
18	$\frac{5c}{2c-3}$ oe final answer	4	M1 for correctly clearing the denominator and expanding bracket or correctly clearing the denominator and dividing by c M1 for correctly collecting terms in x on one side and terms not in x on the other M1 for correct factorising M1 for correct division dependent on x appearing only once in a factorised expression Maximum 3 marks for an incorrect answer

Question	Answer	Marks	Partial Marks
19	0.16 oe	3	M1 for $m = \frac{k}{(t+2)^2}$ oe M1 for substituting <i>their</i> k into $m = \frac{\text{their } k}{(8+2)^2}$ OR M2 for $0.64 \times (3+2)^2 = m(8+2)^2$ oe
20		1	
21	216.9 or 216.86 to 216.87 323.1 or 323.13...	3	B2 for one correct angle or M1 for $\sin x = -\frac{3}{5}$ or better If M1 or 0 scored SC1 for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
22	$\frac{22x+3}{(3x+2)(2x-1)}$ final answer	3	B1 for a common denominator $(3x+2)(2x-1)$ oe isw B1 for $5(2x-1) + 4(3x+2)$ oe isw
23	$\frac{1}{3}$ oe	3	M1 for $\left(1 - \frac{2}{5}\right) \times p = \frac{1}{10}$ oe M1 for $\frac{2}{5} \times (1 - \text{their } p)$ where $0 < \text{their } p < 1$



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MATHEMATICS**0580/23**

Paper 2 (Extended)

May/June 2023**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

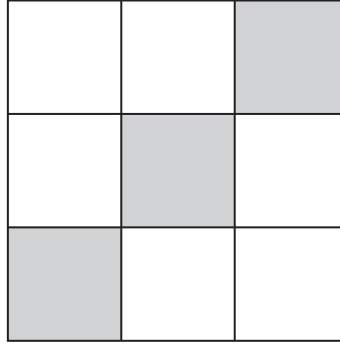
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

1



(a) Complete the statement.

The diagram has rotational symmetry of order [1]

(b) On the diagram, draw all the lines of symmetry.

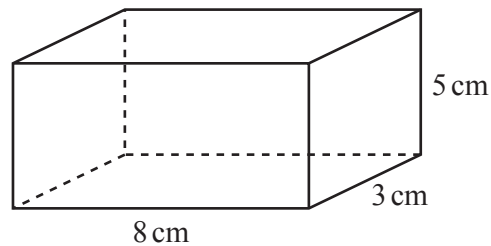
[2]

2 A film lasts for 2 hours 50 minutes.
The film ends at 23 05.

Find the time the film starts.

..... [1]

3



NOT TO
SCALE

Find the total surface area of the cuboid.

..... cm^2 [3]

4 $v = u - 9.8t$

Find the value of v when $u = 4$ and $t = -7$.

$v =$ [2]

5 Simplify $d^8 \div d^2$.

..... [1]

6 At the end of the day, a shopkeeper has 12 tins of cat food left.

This is $\frac{3}{13}$ of the number he had at the beginning of the day.

Calculate the number of tins he had at the beginning of the day.

..... [2]

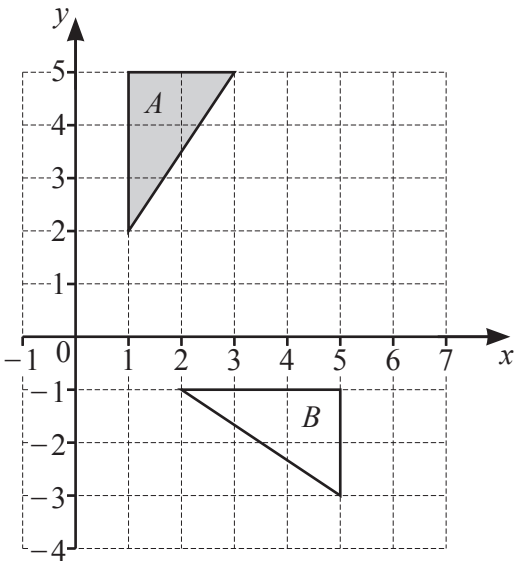
- 7 A spinner has five sides.
Each side is painted red, blue, green, yellow or orange.
The table shows some of the probabilities of the spinner landing on each colour.

Colour	Red	Blue	Green	Yellow	Orange
Probability	0.3	0.16	0.18	0.25	

- (a) Complete the table. [2]
- (b) Dan spins the spinner once.
- Find the probability that the spinner lands on red or blue.

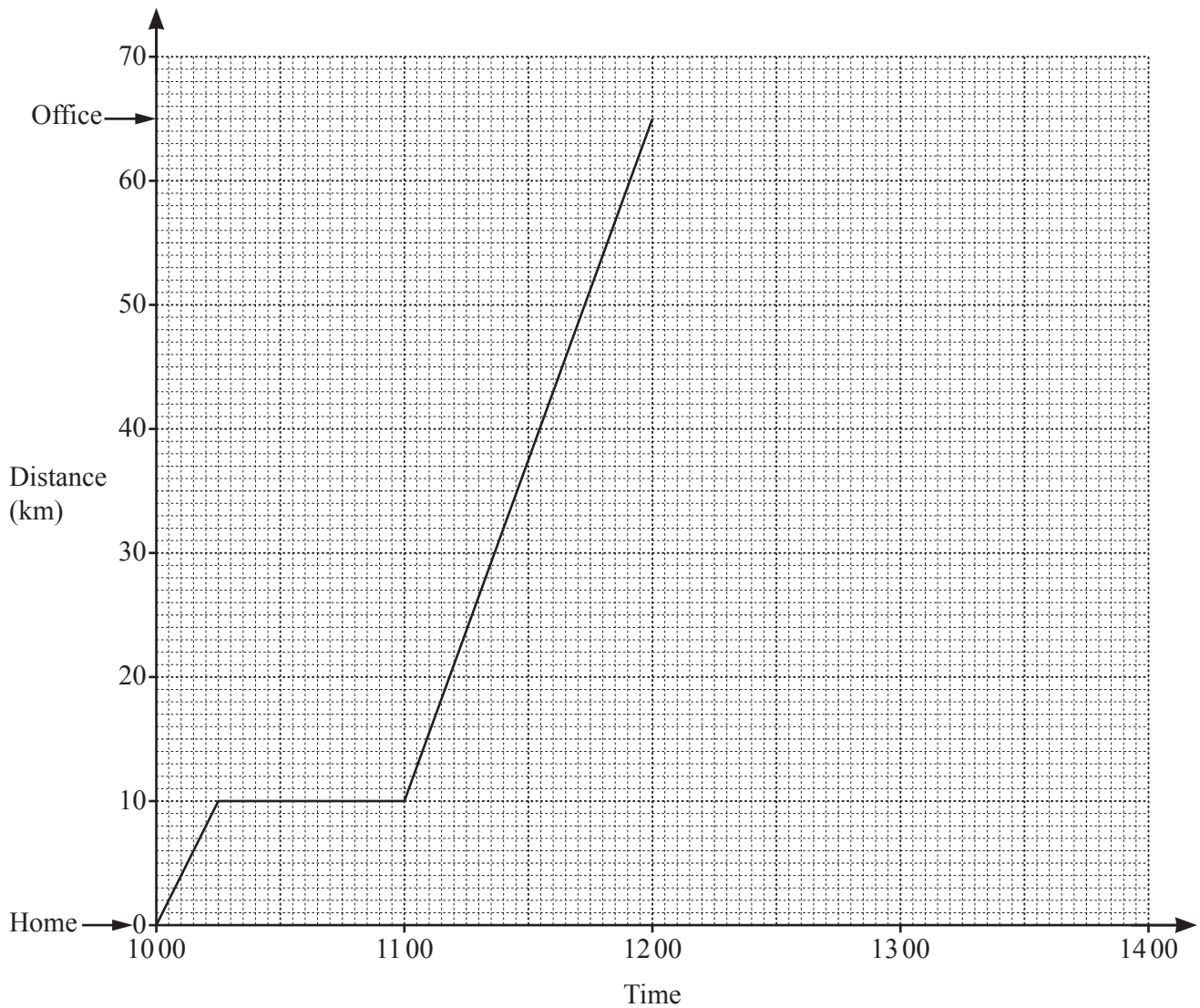
..... [2]

8



- Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.
-
- [3]

- 9 The distance–time graph shows information about Kai’s journey from home to the office.



- (a) Calculate the average speed, in km/h, for Kai’s journey from home to the office.

..... km/h [2]

- (b) When Kai arrives at the office, he finds his meeting is cancelled. He immediately returns home at a constant speed of 50 km/h.

Complete the distance–time graph to show his journey home.

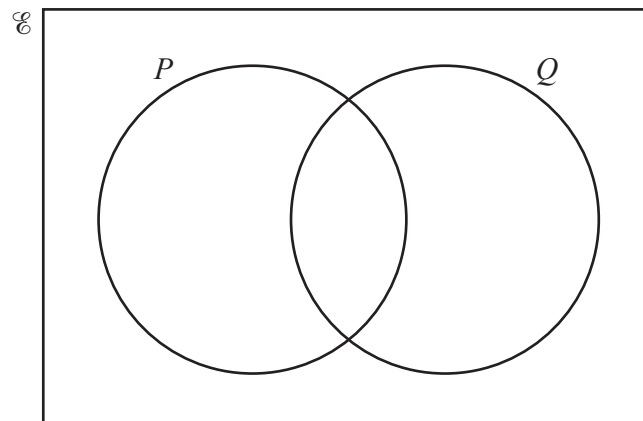
[1]

- 10 Without using a calculator, work out $5\frac{11}{12} + 2\frac{1}{4}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

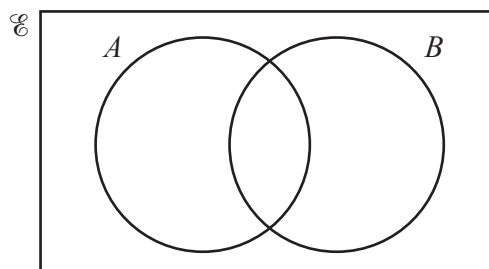
- 11 (a) $\mathcal{E} = \{a, b, e, g, l, m, o, r, t, y\}$
 $P = \{a, b, e, g, l, r\}$
 $Q = \{e, g, m, o, r, t, y\}$



Complete the Venn diagram.

[2]

- (b)



Shade the region $A' \cap B$.

[1]

- 12 The position vector of A is $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and $\overrightarrow{BA} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$.

Show that $|\overrightarrow{OB}| = 5.1$, correct to 1 decimal place.

[3]

- 13 Calculate $\sqrt{42} + 3^{0.4}$.

..... [1]

- 14 Write $0.5\overline{81}$ as a fraction.

You must show all your working and give your answer in its simplest form.

..... [3]

- 15 The number of trees in a forest is decreasing exponentially at a rate of 1.75% per year.
Eleven years ago there were 980 trees.

Calculate the number of trees in the forest now.

Give your answer correct to the nearest integer.

..... [2]

- 16** The volume of a cylinder is 1970 cm^3 .
The height of the cylinder is 12.8 cm .

Calculate the radius of the cylinder.

..... cm [3]

- 17** Rearrange the formula to make m the subject.

$$R = \frac{2(m-k)}{m}$$

$m =$ [4]

- 18** y is inversely proportional to the cube root of $(x + 5)$.
When $x = 3$, $y = 12$.

Find y when $x = 22$.

$y =$ [3]

- 19** Solve the equation $x^2 + 5x - 7 = 0$.

You must show all your working and give your answers correct to 2 decimal places.

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [4]$$

- 20** $f(x) = 6x - 7$ $g(x) = x^{-3}$

- (a)** Find $f(x+2)$.
Give your answer in its simplest form.

$$\dots\dots\dots [2]$$

- (b)** Find $f^{-1}(x)$.

$$f^{-1}(x) = \dots\dots\dots [2]$$

- (c)** Find x when $g(x) = f(22)$.

$$x = \dots\dots\dots [2]$$

21 Simplify.

$$\frac{2x^2 + 5x - 12}{4x^2 - 9}$$

..... [4]

22 These are the first four terms of a sequence.

2.75 6 11.25 20

The n th term of this sequence is $\frac{1}{4}n^3 + an^2 + bn$.

Calculate the value of a and the value of b .

$a =$

$b =$ [5]

- 23 A train travels between two stations.
The distance between the stations is 220 km, correct to the nearest kilometre.
The speed of the train is 125 km/h, correct to the nearest 5 km/h.

Calculate the upper bound for the time the journey takes.
Give your answer in hours and minutes.

..... h min [4]

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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 (Extended)

May/June 2023

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

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GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

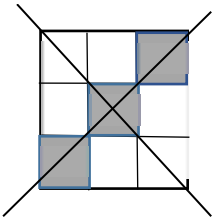
GENERIC MARKING PRINCIPLE 6:

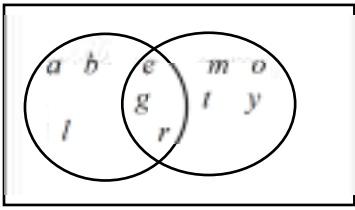
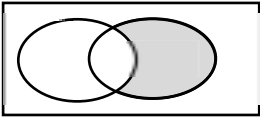
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	2	1	
1(b)		2	B1 for one correct line and no extras or two correct lines and one extra
2	20 15 or [0]8.15pm	1	
3	158	3	M2 for $[2](8 \times 5 + 8 \times 3 + 5 \times 3)$ or M1 for 8×5 or 8×3 or 5×3
4	72.6	2	M1 for $4 - 9.8 \times -7$ or better
5	d^6	1	
6	52	2	M1 for $12 = x \times \frac{3}{13}$ oe or better e.g. $12 \div \frac{3}{13}$ oe
7(a)	0.11 oe	2	M1 for $1 - (0.3 + 0.16 + 0.18 + 0.25)$ oe or B1 for 0.89 oe
7(b)	0.46 oe	2	M1 for $0.3 + 0.16$
8	Rotation (0,0) oe 90° clockwise oe	3	B1 for each
9(a)	32.5	2	M1 for $\frac{65}{\text{their time}}$ or $\frac{\text{their distance}}{2}$
9(b)	correct ruled line from (12 00, 65) to (13 18, 0)	1	
10	$\frac{k}{12} + \frac{27}{12}$ or $\frac{71}{12} + \frac{c}{12}$ oe [5] $\frac{11}{12}$ and [2] $\frac{3}{12}$ oe	M1	Accept with other correct common denominators e.g. 24, 36, 48 such as $\frac{71f}{12f}$ and $\frac{27f}{12f}$
	$8\frac{1}{6}$ cao	A2	A1 for fraction equivalent to $8\frac{1}{6}$ e.g. $\frac{49k}{6k}$ or $8\frac{1k}{6k}$ or $7\frac{7}{6}$

Question	Answer	Marks	Partial Marks
11(a)		2	B1 for 1 region correct
11(b)		1	
12	$\sqrt{1^2 + (-5)^2}$	M2	M1 for $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$ or $(5 - 4)^2 + (3 - 8)^2$ or $\sqrt{e^2 + f^2}$ from <i>their</i> $\overrightarrow{OB} = \begin{pmatrix} e \\ f \end{pmatrix}$ or <i>their</i> $B = (e, f)$ or only $\sqrt{1 + 25}$
	Correct working leading to 5.09[9..]	A1	Dep. on M2 or M1 for only $\sqrt{1 + 25}$
13	8.03 or 8.032 to 8.033	1	
14	581.81... – 5.81...oe	M1	
	$\frac{32}{55}$ cao	A2	A1 for $\frac{576}{990}$ oe If M0 scored SC1 for $\frac{k}{990}$ or for answer $\frac{32}{55}$ with insufficient working.
15	807	2	M1 for $980 \times \left(1 - \frac{1.75}{100}\right)^{11}$ oe or better
16	7.00 or 6.998 to 7.002	3	M2 for $[r^2] = \frac{1970}{12.8 \times \pi}$ oe or better or M1 for $1970 = \pi \times r^2 \times 12.8$ or better

Question	Answer	Marks	Partial Marks
17	$m = \frac{2k}{(2-R)}$ or $m = \frac{-2k}{(R-2)}$ final answer	4	M1 for clearing fractions M1 for expanding brackets (or $\div 2$) M1 for collecting terms in m on one side and terms not in m on the other M1 for dividing by a bracket maximum of 3 if final answer incorrect
18	8	3	M1 for $y = \frac{k}{\sqrt[3]{x+5}}$ oe M1 for substituting <i>their</i> k into $y = \frac{k}{\sqrt[3]{22+5}}$ oe OR M2 for $12\sqrt[3]{3+5} = y\sqrt[3]{22+5}$ oe
19	$\frac{-5 \pm \sqrt{5^2 - 4 \times 1 \times -7}}{2 \times 1}$	B2	B1 for $\sqrt{5^2 - 4 \times 1 \times -7}$ and if in form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$ B1 for $p = -5$ and $r = 2 \times 1$
	-6.14 and 1.14 cao	B2	B1 for 1 correct answer for -6.1 and 1.1 or -6.140... and 1.140... or 6.14 and -1.14 or correct answers seen in working
20(a)	$6x + 5$ cao final answer	2	M1 for $6(x+2) - 7$ oe
20(b)	$\frac{x+7}{6}$ or $\frac{x}{6} + \frac{7}{6}$ final answer	2	M1 for $x = 6y - 7$ or $y + 7 = 6x$ or $\frac{y}{6} = x - \frac{7}{6}$
20(c)	$\frac{1}{5}$ or 0.2	2	M1 for $x^{-3} = 6 \times 22 - 7$ or better
21	$\frac{x+4}{2x+3}$ final answer	4	B1 for $(2x-3)(2x+3)$ B2 for $(2x-3)(x+4)$ or B1 for $(2x+a)(x+b)$ where $ab = -12$ or $a + 2b = 5$ or $x(2x-3) + 4(2x-3)$ or $2x(x+4) - 3(x+4)$

Question	Answer	Marks	Partial Marks
22	$[a =] \frac{-1}{2}$ oe $[b =] 3$	5	B4 for $\frac{1}{4}n^3 - \frac{1}{2}n^2 + 3n$ seen OR M2 for any two of $\frac{1}{4} + a + b = 2.75$ $8 \times \frac{1}{4} + 4a + 2b = 6$ $27 \times \frac{1}{4} + 9a + 3b = 11.25$ $64 \times \frac{1}{4} + 16a + 4b = 20$ or M1 for one correct equation M1 for correct method to eliminate 1 variable B1 for 1 correct answer
23	1h 48 min nfw	4	B3 for 1.8 [hrs], $1\frac{4}{5}$ [hrs], $\frac{9}{5}$ [hrs] or 108 [mins] nfw or M2 for $\frac{220 \text{ to } 221}{125 - 2.5}$ or $\frac{220 + 0.5}{120 \text{ to } 125}$ or M1 for $220 + 0.5$ or $220 - 0.5$ or $125 + 2.5$ or $125 - 2.5$



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MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2023

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages.

- 1 (a) An orchard has 1250 trees.
The trees are in the ratio apple : pear : cherry = 12 : 9 : 4.

(i) Calculate the number of apple trees.

..... [2]

- (ii) Last year in the orchard, the mean mass of fruit produced was 64 kg per tree.

Calculate the total mass of fruit produced last year.

Give your answer in tonnes.

[1 tonne = 1000 kg]

..... tonnes [2]

- (iii) Last year, the mean mass of pears produced was 54 kg per tree.
This was a decrease of 10% on the mean mass of pears produced per tree from the year before.

Calculate the mean mass of pears produced by each pear tree the year before.

..... kg [2]

- (iv) The orchard loses $\frac{1}{5}$ of its total number of trees in a storm.

Calculate the number of trees that remain.

..... [2]

- (b) Paulo buys some pears from a market.
Pears cost \$0.54 each or 0.51 euros each.

- (i) Paulo pays **in dollars** for 12 pears.

Calculate the change he receives from \$10.

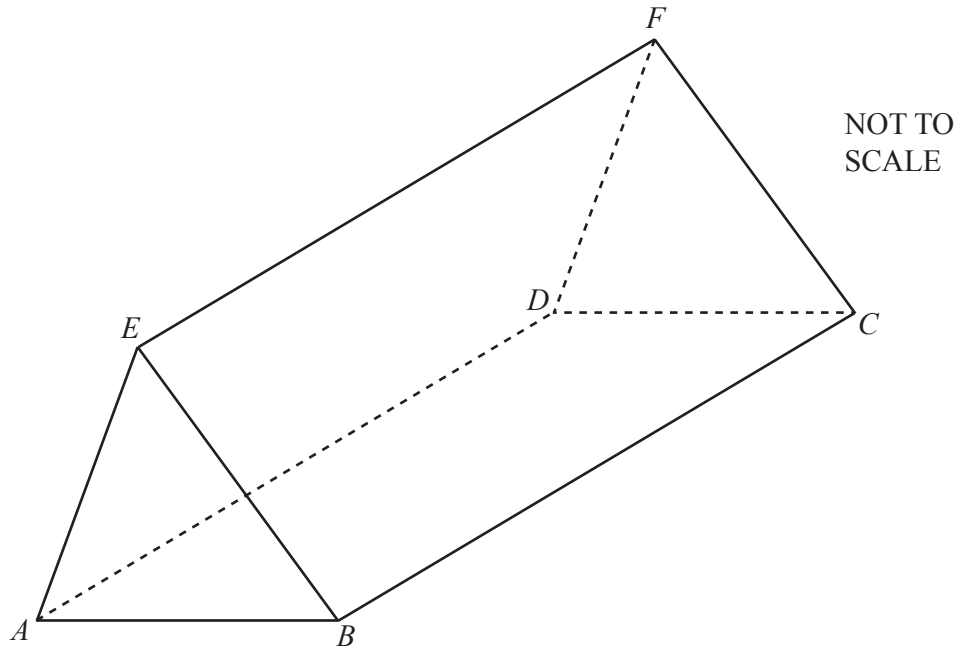
\$ [2]

- (ii) The exchange rate is $\$1 = 0.826$ euros.

Calculate how much more Paulo pays for **each** pear when he pays in euros.
Give your answer in dollars, correct to the nearest cent.

\$ [3]

2



The diagram shows a solid triangular prism $ABCDEF$ of length 15 cm.
 $AB = 6.4$ cm, $EB = 5.7$ cm and the volume of the prism is 145 cm^3 .

(a) Show that angle $EBA = 32^\circ$, correct to the nearest degree.

[3]

(b) Find the length of EA .

..... cm [3]

- (c) Calculate the shortest distance from E to AB .

..... cm [3]

- (d) Calculate the angle BF makes with the base, $ABCD$, of the prism.

..... [4]

- (e) The prism is made of plastic with density 938 kg/m^3 .

Calculate the mass of the prism in **grams**.

[Density = mass $\div$ volume]

..... g [3]

- 3 (a) The table shows information about the mass of each of 1000 eggs.

Mass (m grams)	$40 < m \leq 50$	$50 < m \leq 56$	$56 < m \leq 64$	$64 < m \leq 70$
Frequency	126	520	154	200

- (i) Calculate an estimate of the mean.

..... g [4]

- (ii) An egg is picked at random from the 1000 eggs.

Find the probability that this egg has a mass greater than 56 g.
Give your answer as a fraction in its simplest form.

..... [2]

- (b) One year, a farmer makes a profit of \$24 730 selling eggs.

Write this profit

- (i) correct to 2 significant figures

\$ [1]

- (ii) in standard form.

\$ [1]

(c) On a farm, there are 500 hens, correct to the nearest 10.

(i) In one year, the mean number of eggs laid per hen was 320 eggs, correct to the nearest 20.

Calculate the upper bound for the total number of eggs all the hens lay in that year.

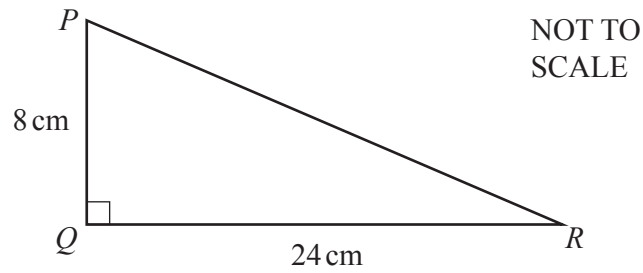
..... [3]

(ii) Another farm has 800 hens, correct to the nearest 20.

Calculate the lower bound for the difference between the number of hens on the two farms.

..... [2]

4 (a)



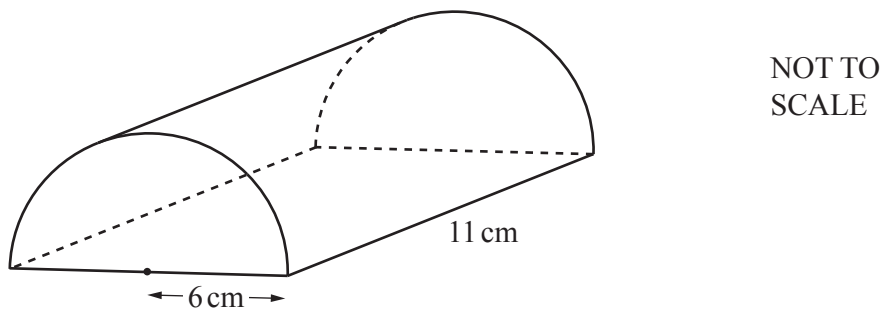
(i) Calculate the area of triangle PQR .

..... cm^2 [2]

(ii) Calculate angle PRQ .

Angle $PRQ =$ [2]

(b)

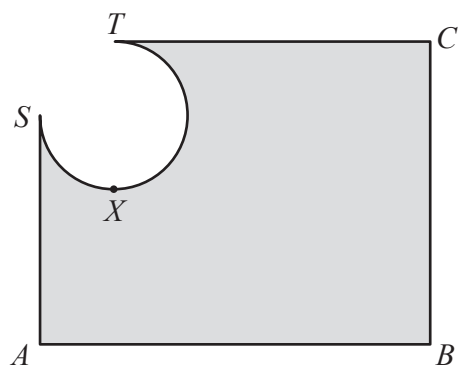
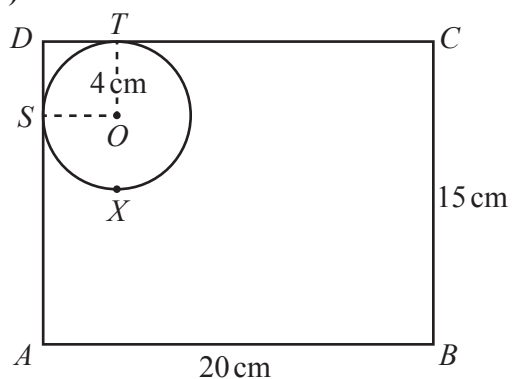


The diagram shows a half-cylinder of radius 6 cm and length 11 cm.

Calculate the volume of the half-cylinder.

..... cm^3 [2]

(c)



NOT TO
SCALE

- (i) $ABCD$ is a rectangle with $AB = 20\text{ cm}$ and $BC = 15\text{ cm}$.
 S , X and T are points on a circle centre O , such that DSA and DTC are tangents to the circle.
 The radius of the circle is 4 cm and TX is a diameter of the circle.
 The shape $DSXT$ is removed from the corner of the rectangle, leaving the shaded shape shown in the second diagram.

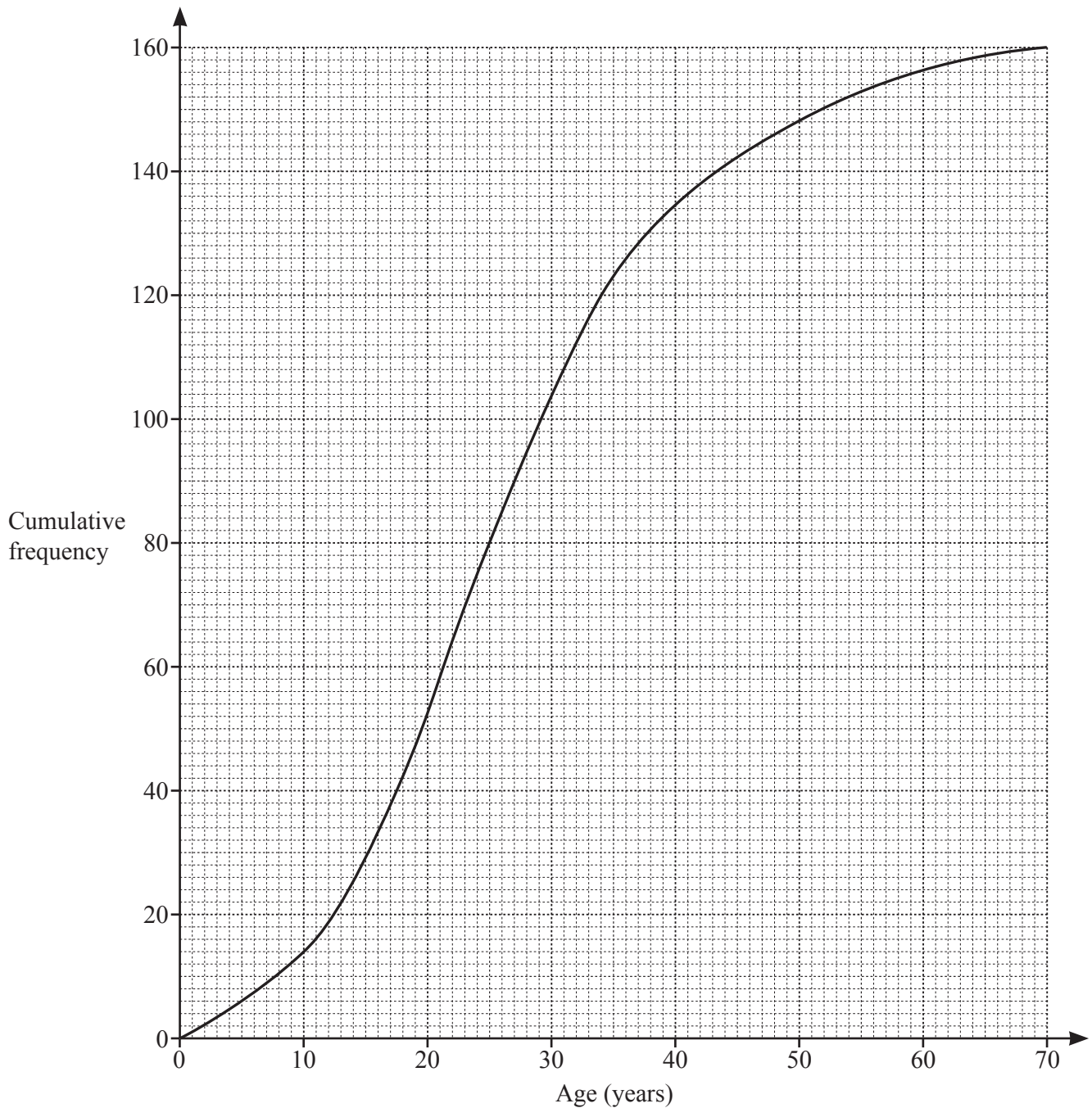
Calculate the area of the shaded shape.

..... cm^2 [5]

- (ii) Calculate the perimeter of the shaded shape.

..... cm [3]

- 5 (a) There are 160 people in a village.
The cumulative frequency diagram shows information about their ages.



- (i) Find an estimate for

(a) the median age

..... [1]

(b) the lower quartile

..... [1]

(c) the number of people who are 50 or more years of age

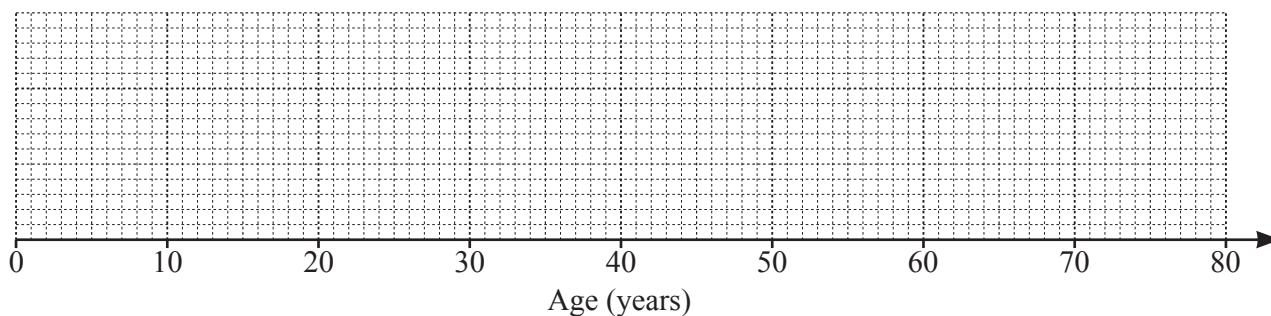
..... [2]

(d) the 65th percentile.

..... [2]

(ii) The youngest person in the village is 1 year old and the oldest is 70 years old.

(a) Draw a box-and-whisker plot to show the distribution of ages in the village.



[3]

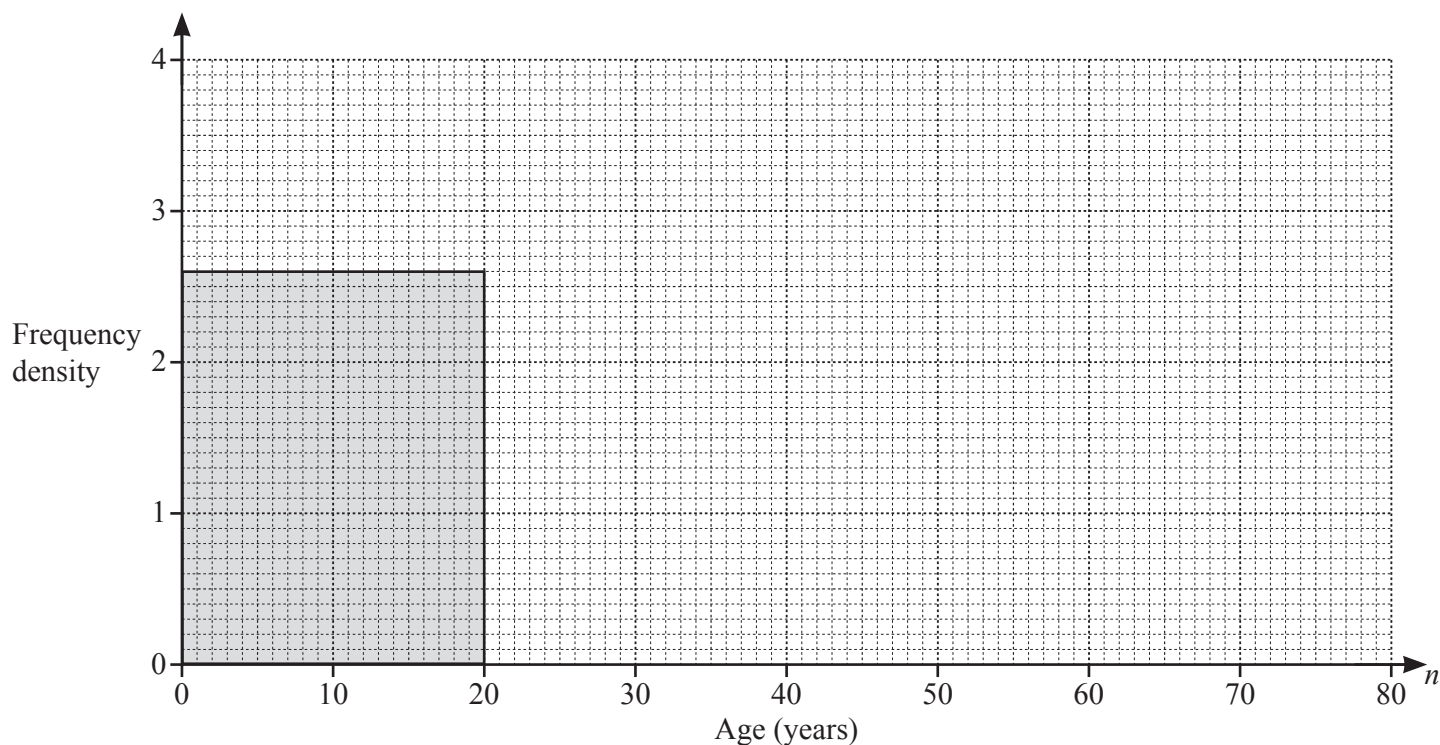
(b) Write down an estimate of the percentage of people in the village that are younger than the median age.

..... % [1]

(b) The frequency table shows information about the age of each person in another village.

Age (n years)	$0 < n \leq 20$	$20 < n \leq 30$	$30 < n \leq 50$	$50 < n \leq 80$
Frequency	52	37	24	60

On the grid, complete the histogram to show this information.
The first block has been drawn for you.

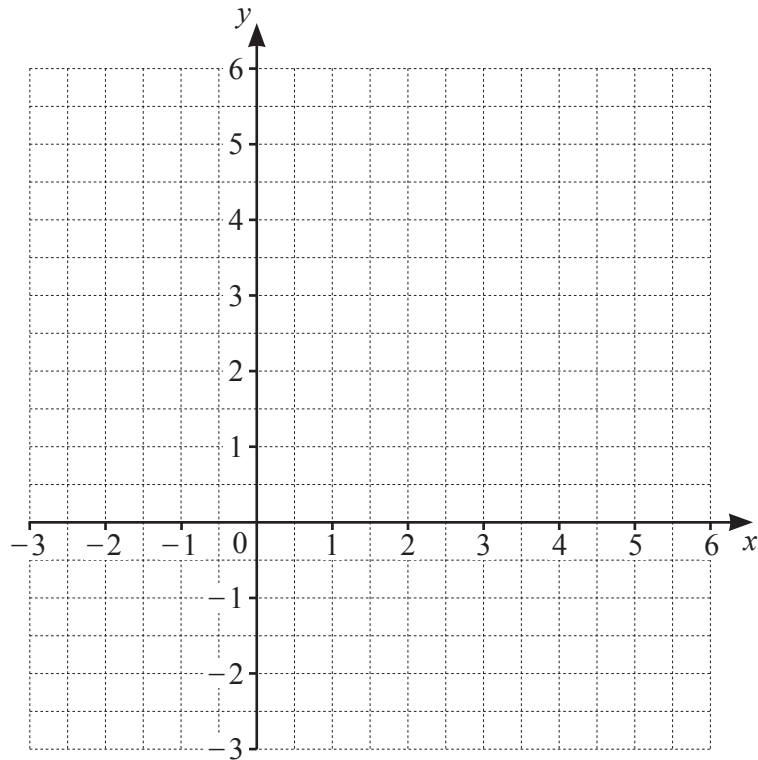


[3]

- 6 (a) In the square $ABCD$, A has coordinates $(-2, 1)$ and B has coordinates $(1, 5)$.
 C has coordinates (a, b) , where a and b are both positive integers.

Find the coordinates of C and the coordinates of D .

You may use the grid to help you.



C (..... , ...)

D (..... , ...) [4]

(b) P has coordinates $(-1, 3)$ and Q has coordinates $(6, 4)$.

(i) Find the coordinates of the midpoint of PQ .

(..... , ...) [2]

(ii) Find the length PQ .

..... [3]

(iii) Find the gradient of PQ .

..... [2]

(iv) Find the equation of the line parallel to PQ that crosses the x -axis at $x = 2$.

..... [3]

7 (a) Factorise fully.

(i) $27y^2 - 3$

..... [3]

(ii) $2m - pk + 2k - pm$

..... [2]

(b) Solve $\frac{x-1}{x+1} - \frac{6}{x-1} = 1$.

$x =$ [5]

(c) Solve $4x^2 - 3x - 2 = 0$.

You must show all your working and give your answers correct to 2 decimal places.

$x =$ or $x =$ [4]

(d) Make k the subject of the formula.

$$\frac{k}{m} = 4 + kp$$

$$k = \dots\dots\dots [4]$$

- 8 A tailor makes x dresses and y shirts in one week.
In one week

- he makes at least 4 dresses
- he makes no more than 7 shirts
- he makes less than 14 dresses and shirts altogether
- the number of shirts he makes is more than $\frac{2}{3}$ of the number of dresses.

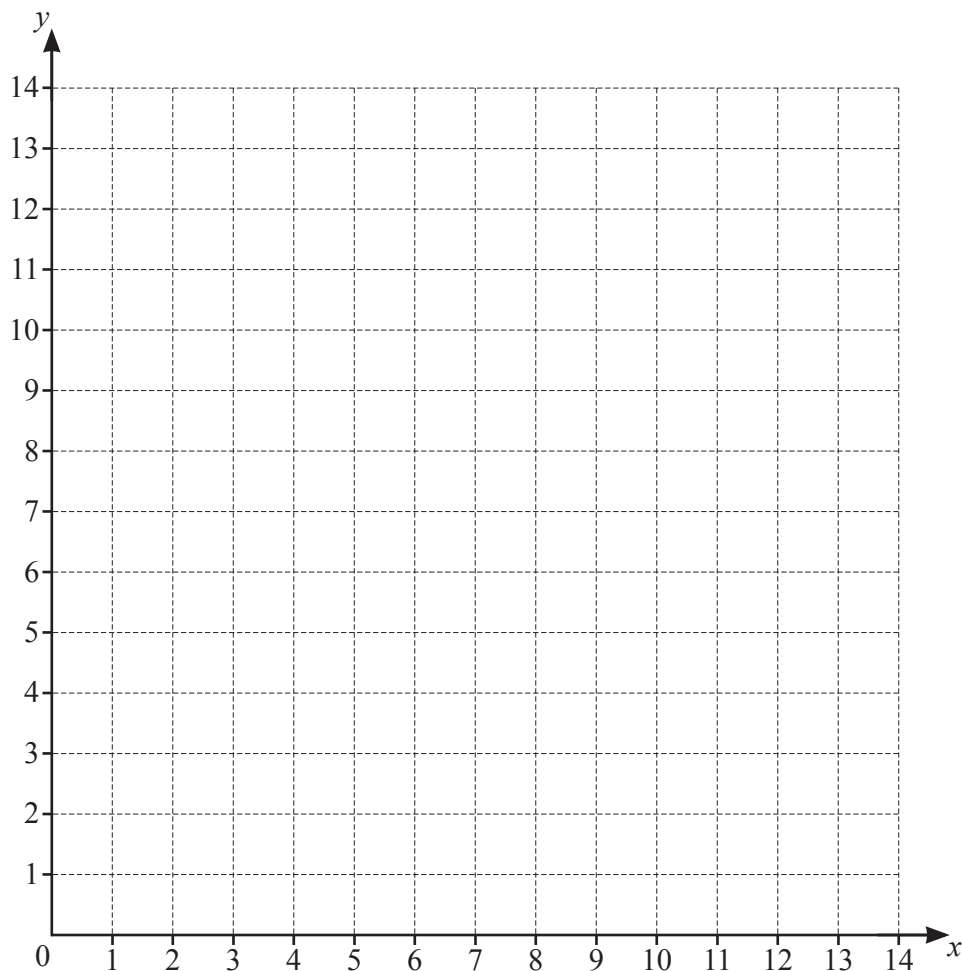
One of the inequalities that shows this information is $x \geq 4$.

- (a) Write down the other three inequalities in x and/or y .

.....

[3]

- (b)



On the grid, draw 4 straight lines and shade the unwanted regions to show these inequalities.
Label the region R that satisfies the 4 inequalities.

[6]

- (c) Use your diagram to find the smallest number of dresses and the smallest number of shirts the tailor makes in one week.

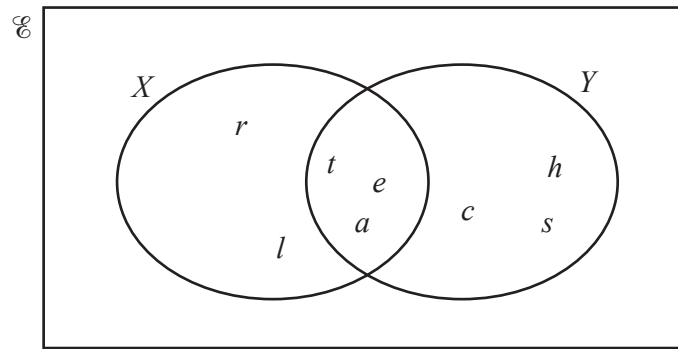
..... dresses and shirts [1]

- (d) The profit the tailor makes on one dress is \$10 and the profit on one shirt is \$6.

Use your diagram to find the largest profit the tailor can make in one week.

\$ [2]

- 9 (a) The Venn diagram shows set X and set Y .



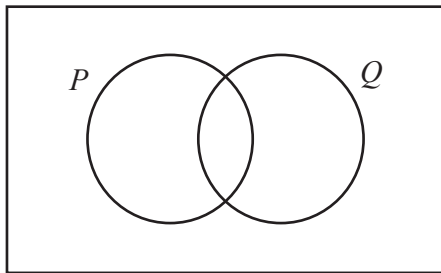
- (i) List the elements of X .

..... [1]

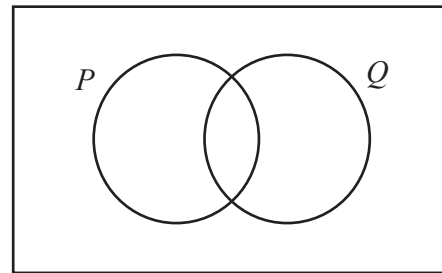
- (ii) Find $n(Y')$.

..... [1]

- (b) In each Venn diagram, shade the required region.



$P \cup Q$



$P \cap Q$

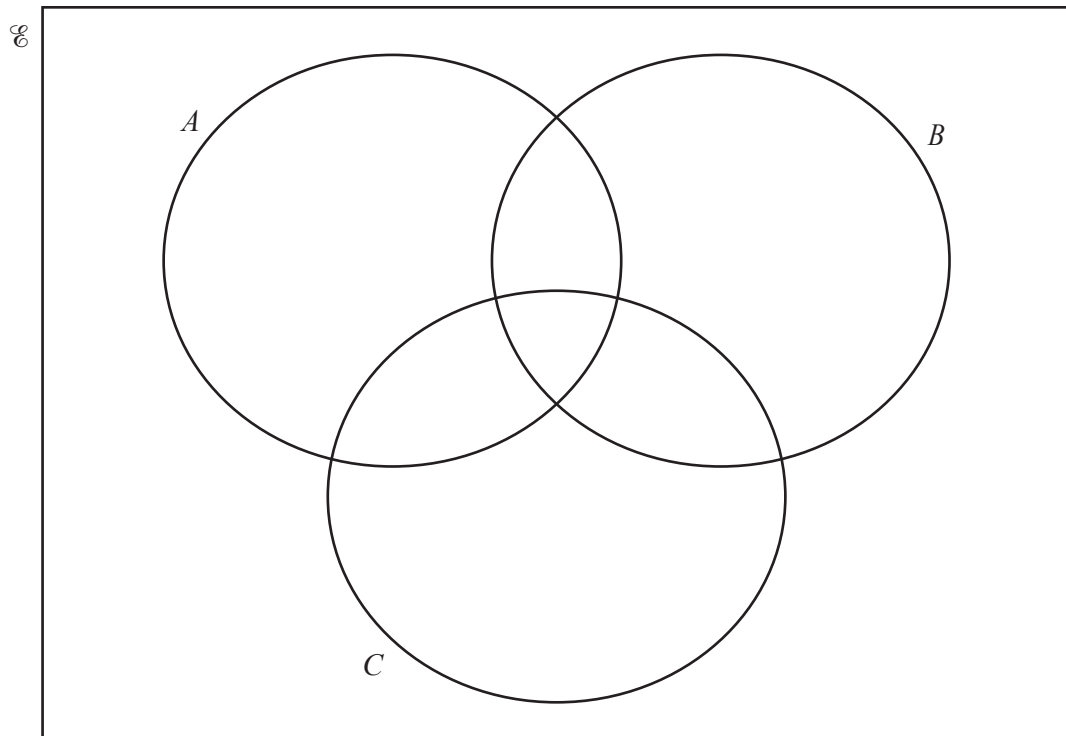
[2]

(c) $\mathcal{C} = \{\text{positive integers} < 13\}$

$$A = \{x : x < 9\}$$

$$B = \{x : x \text{ is even}\}$$

$$C = \{x : x \text{ is a multiple of } 3\}$$



(i) Complete the Venn diagram.

[3]

(ii) Find $n(A' \cup (B \cap C))$.

..... [1]

Question 10 is printed on the next page.

10

$f(x) = x - 4$

$g(x) = 2x + 5$

$h(x) = 3^x$

(a) Find

(i) $f(-3)$

..... [1]

(ii) $g^{-1}(x)$

$g^{-1}(x) = \dots\dots\dots [2]$

(iii) $f(x) \times g(x) \times f(x).$

..... [4]

(b) Find x when $h(x) = g(f(2)).$

$x = \dots\dots\dots [2]$

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2023

MARK SCHEME

Maximum Mark: 130

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Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

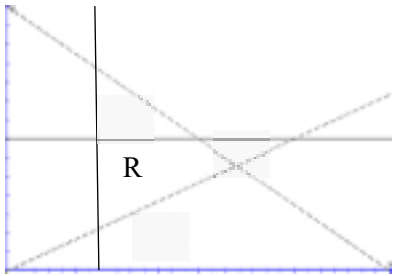
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

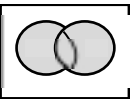
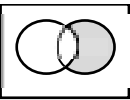
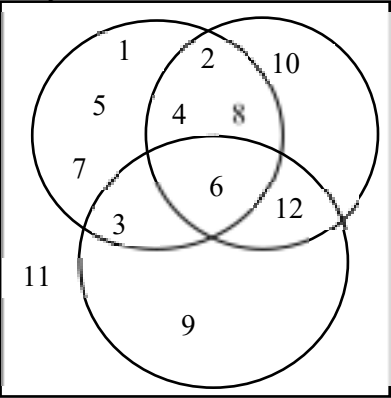
Question	Answer	Marks	Partial Marks
1(a)(i)	600	2	M1 for $\frac{1250}{12+9+4} \times k$ where $k = 1, 4, 9, 12$ oe
1(a)(ii)	80	2	M1 for $1250 \times 64 [\div 1000]$
1(a)(iii)	60	2	M1 for $x \times \left(1 - \frac{10}{100}\right) = 54$ oe
1(a)(iv)	1000	2	M1 for $1250 - (1250 \div 5)$ oe or B1 for 250
1(b)(i)	3.52	2	M1 for $[10 -] 12 \times 0.54$ or B1 for 6.48
1(b)(ii)	0.08	3	B2 for 0.077[4...] or M1 for $0.51 \div 0.826$ If 0 or 1 scored award instead SC2 for 0.93 final answer OR If 0 scored SC1 for 0.06 as answer
2(a)	$[\sin =] \frac{145}{\frac{1}{2} \times 6.4 \times 5.7 \times 15}$	M2	M1 for $145 = \frac{1}{2} \times 6.4 \times 5.7 \times \sin x \times 15$ oe or for $\frac{1}{2} \times 6.4 \times h \times 15 = 145$ and $\sin x = \frac{h}{5.7}$
	32.0[0]	A1	If M0 , SC1 for $145 = 0.5 \times 6.4 \times 5.7 \times \sin 32 \times 15$ oe
2(b)	3.4[0] or 3.402 to 3.403 nfww	3	M2 for $\sqrt{6.4^2 + 5.7^2 - 2 \times 6.4 \times 5.7 \times \cos(32)}$ OR M1 for $6.4^2 + 5.7^2 - 2 \times 6.4 \times 5.7 \times \cos(32)$ A1 for 11.6 or 11.57 to 11.58
2(c)	3.02 or 3.020 to 3.021	3	M2 for $\sin(32) = \frac{x}{5.7}$ $\sqrt{80^2 + 50^2 - 2 \times 80 \times 50 \times \cos 75}$ or M1 for recognition that the line from <i>E</i> is perpendicular to <i>AB</i> e.g. right angle seen or $\frac{1}{2} \times 6.4 \times h$

Question	Answer	Marks	Partial Marks
2(d)	10.8 or 10.9 or 10.84 to 10.85...	4	M3 for $[\sin =] \frac{\text{their}(c)}{\sqrt{15^2 + 5.7^2}}$ or $[\tan =] \frac{\text{their}(c)}{\sqrt{(5.7 \times \cos 32)^2 + 15^2}}$ or M2 for $15^2 + 5.7^2$ or $(5.7 \times \cos 32)^2 + 15^2$ oe or M1 for recognition of correct angle
2(e)	136 or 136.0...	3	M2 for $938 \times 145 \times \frac{1000}{1000000}$ oe or M1 for figs 136 or 13601
3(a)(i)	55.87	4	M1 for midpoints soi M1 for use of $\sum fm$ where m is in the correct interval including boundaries M1 (dep on 2nd M1) for $\sum fm \div 1000$
3(a)(ii)	$\frac{177}{500}$ cao	2	M1 for $\frac{154 + 200}{1000}$ oe
3(b)(i)	25000	1	
3(b)(ii)	2.473×10^4	1	
3(c)(i)	166 650 or 165816 nfw	3	M2 for $(500 + 5) \times '320 \text{ to } 340'$ or $'500 \text{ to } 510' \times (320 + 10)$ or M1 for $500 - 5$ or $500 + 5$ or $320 - 10$ or $320 + 10$ Alternative method M2 for $504 \times '320 \text{ to } 340'$ or $'500 \text{ to } 510' \times 329$ or M1 for 504 or 329
3(c)(ii)	285 or 286 nfw	2	M1 for $800 - 10$
4(a)(i)	96	2	M1 for $\frac{1}{2} \times 24 \times 8$
4(a)(ii)	18.4 or 18.43...	2	M1 for $\tan[x] = \frac{8}{24}$ oe

Question	Answer	Marks	Partial Marks
4(b)	622 or 622.0 to 622.1....	2	M1 for $[\frac{1}{2} \times] \pi \times 6^2 \times 11$ or $\frac{1}{2} \times \pi \times 6^2 [\times 11]$
4(c)(i)	246 or 246.2 to 246.3...	5	M4 for $15 \times 20 - 4 \times 4 - \frac{270}{360} \times \pi \times 4^2$ oe OR M2 for $\frac{270}{360} \times \pi \times 4^2$ oe or M1 for $k \times \pi \times 4^2$, where $k \leq 1$ M1 for 15×20 or 4×4 oe
4(c)(ii)	80.8 or 80.9 or 80.84 to 80.85...	3	M1 for $15 + 20 + 11 + 16$ oe M1 for $\frac{3}{4} \times 2 \times \pi \times 4$ oe
5(a)(i)(a)	25	1	
5(a)(i)(b)	17 to 18	1	
5(a)(i)(c)	12	2	B1 for 148 seen
5(a)(i)(d)	30	2	B1 for 104 seen
5(a)(ii)(a)	correct diagram or correct for <i>their</i> median and LQ	3	B1 for whiskers at 1 and at 70 B1 for with median and LQ at <i>their</i> (a)(i)(a) and (a)(i)(b) B1 for UQ at 34 Maximum 2 marks if diagram incorrect If 0 scored SC1 for <i>their</i> 5 correct ages plotted
5(a)(ii)(b)	50	1	
5(b)	correct histogram	3	B1 for each correct block width 10 height 3.7 width 20 height 1.2 width 30 height 2 If 0 scored SC1 for correct frequency densities 3.7, 1.2, 2 oe

Question	Answer	Marks	Partial Marks
6(a)	(5, 2) (2, - 2)	4	B3 for 3 correct values or answers for <i>C</i> and <i>D</i> reversed or correct coordinates given on diagram wrongly labelled or B2 for one correct coordinate pair correctly labelled or M2 for <i>A, B, C</i> and <i>D</i> correctly plotted or M1 for <i>A</i> and <i>B</i> correctly plotted If 0 or 1 scored instead award SC2 for answers (-3, 8) and (-6, 4) or answers (1.5, 1.5) and (-2.5, 4.5)
6(b)(i)	(2.5, 3.5) oe	2	B1 for each
6(b)(ii)	7.07 or 7.071...	3	M2 for $(6 - -1)^2 + (4 - 3)^2$ oe or M1 for $(6 - -1)$ or $(4 - 3)$ oe
6(b)(iii)	$\frac{1}{7}$	2	M1 for $\frac{4 - 3}{6 - -1}$ oe
6(b)(iv)	$y = \frac{1}{7}x - \frac{2}{7}$ or $7y = x - 2$ oe final answer	3	M1 for gradient = <i>their</i> (iii) M1dep for substituting (2, 0) in a linear equation with their <i>m</i> allow if (2, 0) satisfies $y = (\text{their}(\mathbf{b})(\mathbf{iii}) \text{ gradient})x + c$
7(a)(i)	$3(3y - 1)(3y + 1)$ final answer	3	B2 for $(9y - 3)(3y + 1)$ or $(3y - 1)(9y + 3)$ or or M1 for $3(9y^2 - 1)$ or [...] $(3y - 1)(3y + 1)$ if 0 scored SC1 for an otherwise correctly completely factorised expression but with fractions within the brackets
7(a)(ii)	$(2 - p)(m + k)$ final answer	2	M1 for $2(m + k) - p(m + k)$ or $m(2 - p) + k(2 - p)$
7(b)	$-\frac{1}{2}$ oe nfww	5	B4 $-8x = +4$ oe nfww or B3 for $\frac{x^2 - 8x - 5}{(x - 1)(x + 1)} = 1$ or better OR B2 $x^2 - 8x - 5$ or M1 for $(x - 1)(x - 1) - 6(x + 1)$ or better B1 $(x - 1)(x + 1)$ as full denominator or on the right hand side

Question	Answer	Marks	Partial Marks
7(c)	$\frac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(-2)}}{2 \times 4} \text{ oe}$ or $\frac{3}{8} \pm \sqrt{\left(\frac{3}{8}\right)^2 + \frac{2}{4}} \text{ oe}$	M2	M1 for $\sqrt{(-3)^2 - 4(4)(-2)}$ or for $\frac{-(-3) + \sqrt{q}}{2(4)}$ or $\frac{-(-3) - \sqrt{q}}{2(4)}$ or for $[4] \left(x - \frac{3}{8}\right)^2$
	-0.43 and 1.18 final ans cao	A2	B1 for each SC1 for -0.4, -0.42 or -0.425.... and 1.2 or 1.17 or 1.175.... or answers 0.43 and -1.18 or -0.43 and 1.18 seen in working
7(d)	$k = \frac{4m}{1 - pm}$ or $k = \frac{-4m}{pm - 1}$ final answer	4	M1 for clearing fractions M1 for collecting terms in k M1 for factorising M1 for dividing by bracket Maximum 3 marks if answer incorrect
8(a)	$y \leq 7$ oe $x + y < 14$ oe $y > \frac{2}{3}x$ oe	3	B1 for each
8(b)	$x = 4$ solid $y = 7$ solid $x + y = 14$ dashed $y = \frac{2}{3}x$ dashed	M4	B1 for each
	correct shading everywhere but region R 	A2	M1dep (dependent on M4 or B1B1B1B0 where the only error is wrong use of solid/dashed lines) for shading the correct side of 3 of the 4 lines.

Question	Answer	Marks	Partial Marks
8(c)	4 dresses and 3 shirts	1	
8(d)	106	2	M1 for $10x + 6y$ evaluated for (x, y) in <i>their</i> region R or B1 for (7, 6) After 0 scored, SC1 for answer 112 or 116
9(a)(i)	<i>r, l, t, e, a</i>	1	
9(a)(ii)	2	1	
9(b)		1	
		1	
9(c)(i)	Fully correct 	3	B2 for 7, 6, or 5 sections correct or B1 for 4, 3 or 2 sections correct
9(c)(ii)	5	1FT	strict FT from their diagram
10(a)(i)	-7	1	
10(a)(ii)	$\frac{x-5}{2}$ oe final answer	2	M1 for correct first step e.g. $x = 2y + 5$ or $2x = y - 5$ or $\frac{y}{2} = x + \frac{5}{2}$
10(a)(iii)	$2x^3 - 11x^2 - 8x + 80$ final answer	4	M1 for $(x-4)(2x+5)(x-4)$ oe B2 for $2x^3 - 8x^2 - 8x^2 + 5x^2 - 20x - 20x + 32x + 80$ or for simplified 4 term expression of the correct form with 3 terms correct in final answer or B1 for 3 terms correct out of 4 from $x^2 - 4x - 4x + 16$ or $2x^2 - 8x + 5x - 20$

Question	Answer	Marks	Partial Marks
10(b)	0	2	M1 for $g(-2)$ or $2(x-4)+5$ oe or $3^x = 1$ or $g(f(2)) = 1$



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MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2023

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

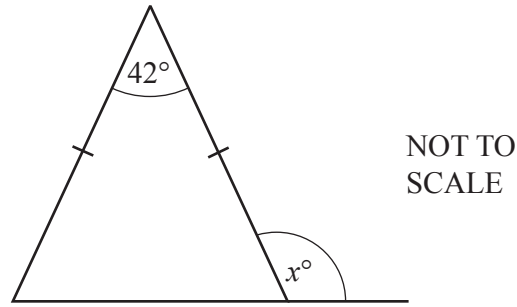
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1 (a)



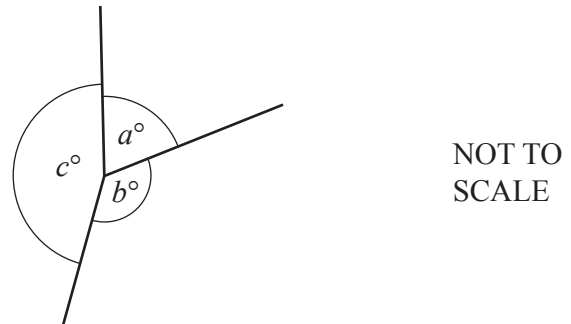
The diagram shows an isosceles triangle with the base extended.

Find the value of x .

$x = \dots\dots\dots$ [3]

- (b) The diagram shows three lines meeting at a point.
The ratio $a : b : c = 3 : 4 : 5$.

Find the value of c .



$c = \dots\dots\dots$ [3]

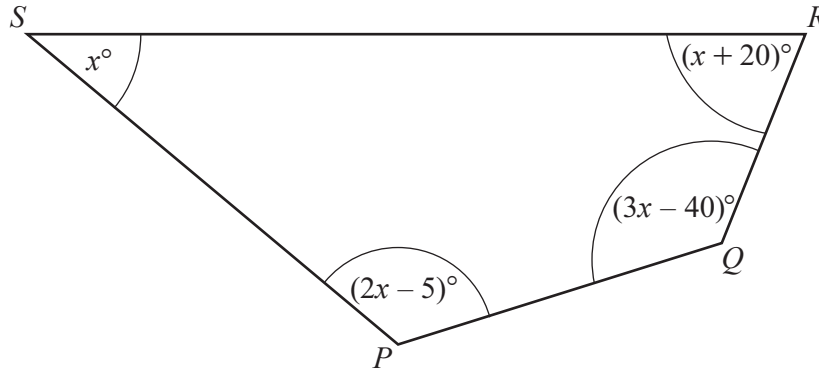
- (c) A regular pentagon has an exterior angle, d .
A regular hexagon has an interior angle, h .

Find the fraction $\frac{d}{h}$.

Give your answer in its simplest form.

$\dots\dots\dots$ [4]

(d)

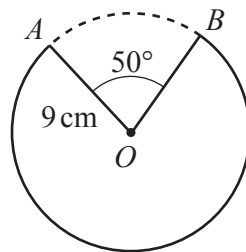


NOT TO
SCALE

Show that $PQRS$ is a cyclic quadrilateral.

[5]

(e)



NOT TO
SCALE

The diagram shows a circle of radius 9 cm , centre O .
The minor sector AOB , with sector angle 50° , is removed from the circle.

Calculate the length of the major arc AB .

..... cm [3]

- 2 (a) Anil changes \$830 into euros when the exchange rate is 1 euro = \$1.16 .
He spends 500 euros.
He then changes the remaining money back into dollars at the same exchange rate.

Work out how much, in dollars, Anil receives.

\$ [3]

- (b) In 2021, Anil earns \$37 000.

- (i) He spends \$12 400 on bills in 2021.

Calculate the percentage of his earnings he spends on bills.

..... % [2]

- (ii) His earnings of \$37 000 increase by 3.2% in 2022.

Calculate his earnings in 2022.

\$ [2]

(c) Anil invests \$3500 in an account that pays a rate of 2.4% per year compound interest.

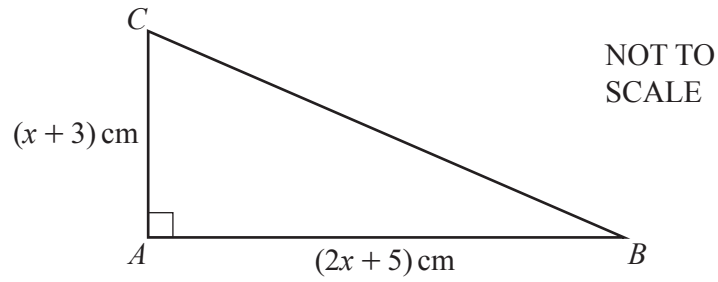
(i) Calculate the total interest earned at the end of 5 years.

\$ [3]

(ii) Find the number of complete years before Anil has at least \$5000 in this account.

..... years [3]

3



The diagram shows a right-angled triangle ABC .

- (a) (i) The area of the triangle is 60 cm^2 .

Show that $2x^2 + 11x - 105 = 0$.

[3]

- (ii) Solve by factorisation.

$$2x^2 + 11x - 105 = 0$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (iii) Calculate angle ACB .

$$\dots\dots\dots [3]$$

- (b) Triangle ABC is similar to triangle DEF .
Triangle DEF has an area of 93.75 cm^2 .

(i) Find the size of the smallest angle of triangle DEF .

..... [1]

(ii) Find the length of the shortest side of triangle DEF .

..... cm [3]

- 4 The table shows information about the heights of 80 children.

Height (h metres)	$1.2 < h \leq 1.4$	$1.4 < h \leq 1.5$	$1.5 < h \leq 1.65$	$1.65 < h \leq 1.8$	$1.8 < h \leq 1.9$
Frequency	2	13	24	32	9

- (a) (i) Write down the interval containing the median.

..... $< h \leq$ [1]

- (ii) Calculate an estimate of the mean height.

..... m [4]

- (b) (i) One of these children is chosen at random.
Calculate the probability that they have a height of 1.4 m or less.

..... [1]

- (ii) Two of these children are chosen at random.
Calculate the probability that both children are taller than 1.5 m but only one of them is taller than 1.8 m.

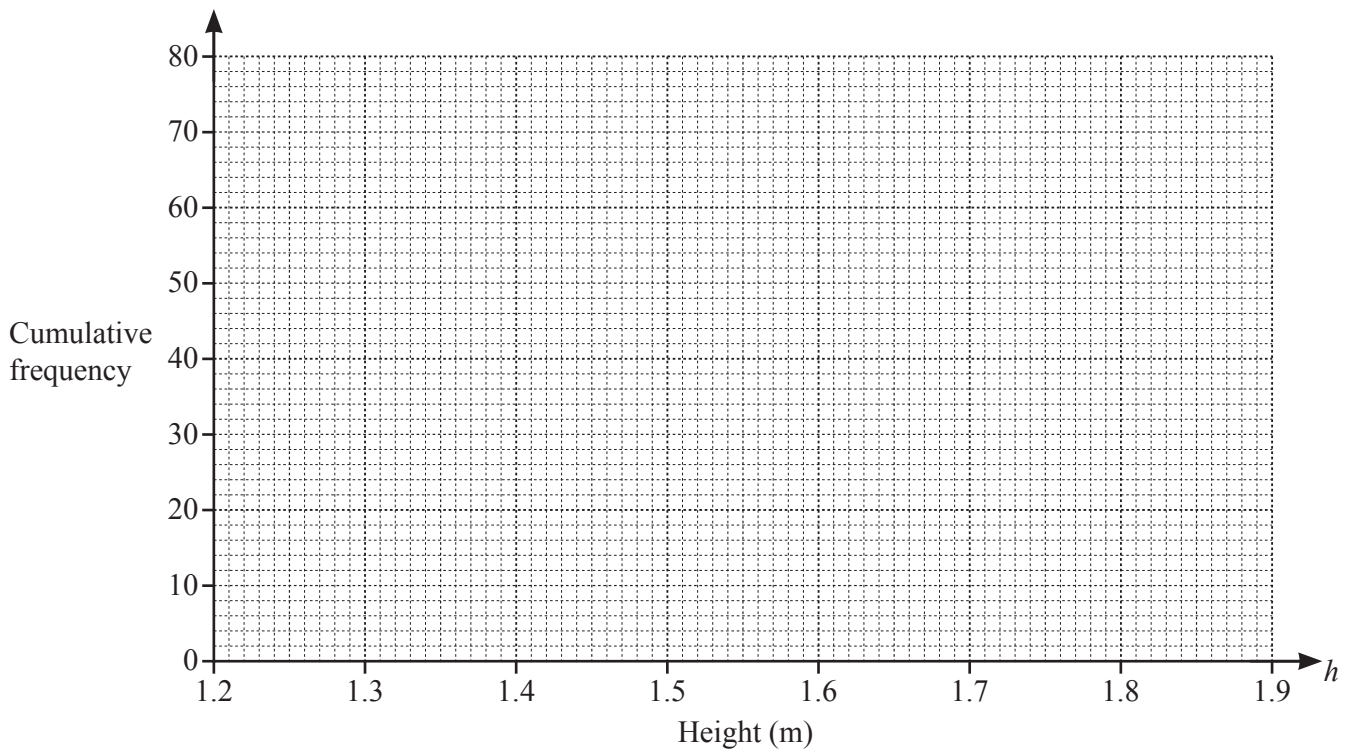
..... [3]

- (c) (i) Complete the cumulative frequency table for the heights.

Height (h metres)	$h \leq 1.4$	$h \leq 1.5$	$h \leq 1.65$	$h \leq 1.8$	$h \leq 1.9$
Cumulative frequency	2				

[2]

- (ii) On the grid, draw the cumulative frequency diagram.



[3]

- (d) Use your diagram to find an estimate of

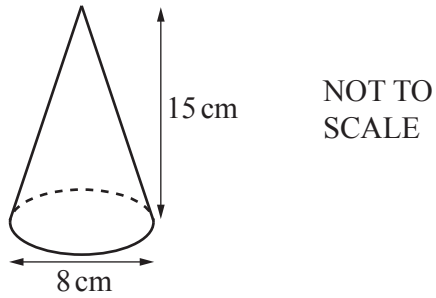
- (i) the interquartile range

..... m [2]

- (ii) the 60th percentile.

..... m [2]

5 (a)



A cone has base diameter 8 cm and perpendicular height 15 cm.

- (i) Calculate the volume of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [2]

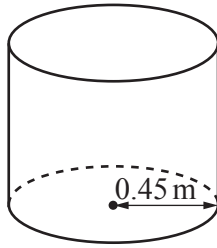
- (ii) A label completely covers the curved surface area of the cone.

Calculate the area of the label as a percentage of the **total** surface area of the cone.

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

..... % [5]

(b)

NOT TO
SCALE

An empty cylindrical container has radius 0.45 m.
300 litres of water is poured into the container at a rate of 375 ml per second.

- (i) Find the time taken, in minutes and seconds, for all the water to be poured into the container.

..... min s [3]

- (ii) Calculate the height of the water in the container.

..... m [3]

6 (a) A sequence has n th term $\frac{n}{2n+3}$.

(i) Find the first three terms of this sequence.

Give your answers as fractions.

....., ..., ... [2]

(ii) The k th term of this sequence is $\frac{12}{25}$.

Find the value of k .

$k =$ [2]

(b) Find the n th term of each sequence.

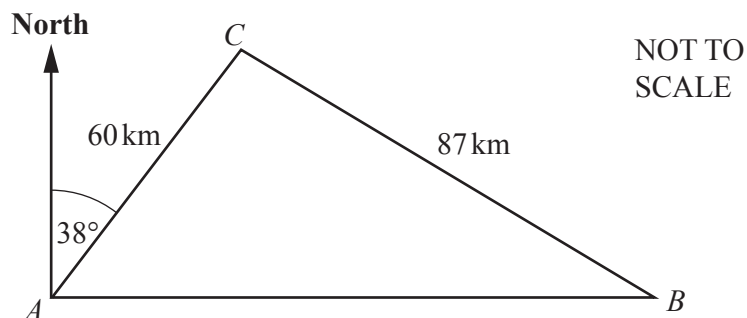
(i) 6, 13, 32, 69, 130, ...

..... [2]

(ii) 100, 50, 25, 12.5, 6.25, ...

..... [2]

7



The diagram shows the straight roads between town A , town B and town C .
 $AC = 60$ km, $CB = 87$ km and B is due east of A .
 The bearing of C from A is 038° .

- (a) Show that angle $ACB = 95.1^\circ$, correct to 1 decimal place.

[5]

- (b) Without stopping, a car travels from town A to town C then to town B , before returning directly to town A .
 The total time taken for the journey is 3 hours 20 minutes.

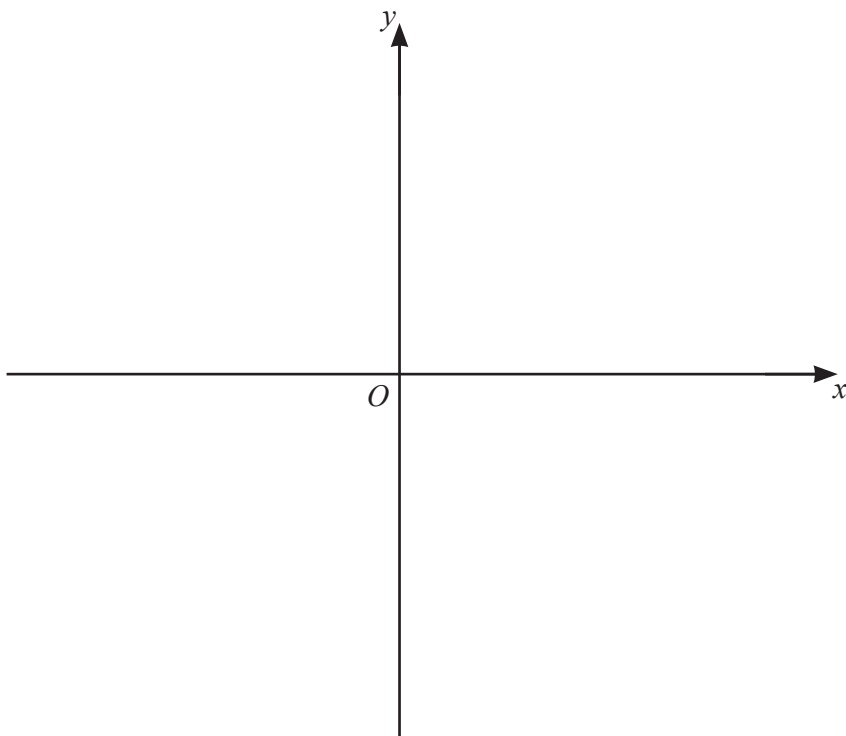
Calculate the average speed of the car for this journey.
 Give your answer in kilometres per hour.

..... km/h [6]

- 8 (a) (i) Show that the equation $y = (x-4)(x+1)(x-2)$ can be written as $y = x^3 - 5x^2 + 2x + 8$.

[2]

- (ii) On the diagram, sketch the graph of $y = x^3 - 5x^2 + 2x + 8$, indicating the values where the graph crosses the axes.



[4]

- (b) The graph of $y = x^3 - 5x^2 + 2x + 8$ has two tangents with a gradient of 10.

Find the equations of these two tangents.

You must show all your working and give your answers in the form $y = mx + c$.

$$y = \dots\dots\dots$$

$$y = \dots\dots\dots [7]$$

9 (a) Simplify.

(i) $(3x^2y^4)^3$

..... [2]

(ii) $\left(\frac{16}{x^{16}y^8}\right)^{-\frac{3}{2}}$

..... [3]

(b) (i) Factorise.

$$x^2 - 9$$

..... [1]

(ii) Simplify.

$$\frac{x^2 - 9}{2xy - 6y + 5x - 15}$$

..... [3]

- (c) Solve the simultaneous equations.

You must show all your working and give your answers correct to 2 decimal places.

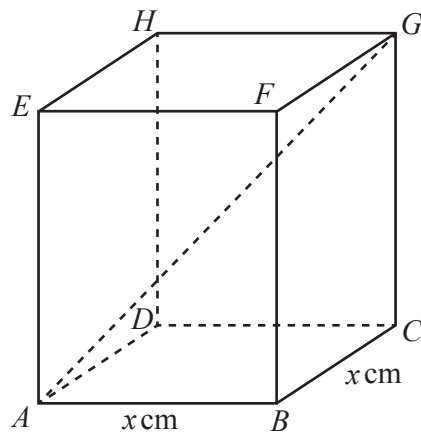
$$2x + y = 7$$

$$y = 5x^2 + 2x - 13$$

$$x = \dots\dots\dots, y = \dots\dots\dots$$

$$x = \dots\dots\dots, y = \dots\dots\dots [6]$$

10 (a)

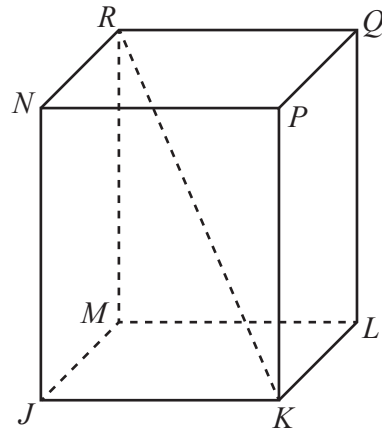
NOT TO
SCALE

$ABCDEFGH$ is a cuboid with a square base of side x cm.
 $CG = 20$ cm and $AG = 28$ cm.

Calculate the value of x .

$x = \dots\dots\dots$ [4]

(b)

NOT TO
SCALE

The diagram shows a different cuboid $JKLMNPQR$.

$MR = 30$ cm correct to the nearest centimetre.

$KR = 37$ cm correct to the nearest centimetre.

Calculate the lower bound of the angle between KR and the base $JKLM$ of the cuboid.

..... [4]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2023

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

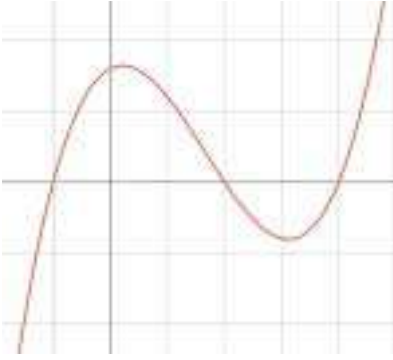
Question	Answer	Marks	Partial Marks
1(a)	111	3	M2 for $180 - \frac{180 - 42}{2}$ oe or $42 + \frac{180 - 42}{2}$ oe or M1 for $\frac{180 - 42}{2}$ oe
1(b)	150	3	M1 for $k \div (3 + 4 + 5) [\times p]$ where $p = 1, 3, 4$ or 5 or $\frac{5}{12}$ oe B1 for 360 used
1(c)	$\frac{3}{5}$ cao nfww	4	B3 for $\frac{72}{120}$ or B2 for $[d =] 72$ or $[h =] 120$ or M1 for $360 \div 5$ oe isw or $180 - (360 \div 6)$ isw or for $(6 - 2) \times 180 [\div 6]$
1(d)	$x + 2x - 5 + x + 20 + 3x - 40 = 360$	M1	Accept equivalent equation e.g. $7x - 25 = 360$
	$7x = 360 + 5 - 20 + 40$ or better	M1	FT <i>their</i> equation, accept e.g. $7x = 385$
	$x = 55$	B1	
	55 and 125 or 105 and 75	B1dep	Dep on M1M1B1 Accept $55 + 3 \times 55 - 40 = 180$ or $2 \times 55 - 5 + 55 + 20 = 180$ If B0 scored, SC1 for 55, 75, 105 and 125
	Opposite angles sum to 180 oe [so <i>PQRS</i> is a cyclic quadrilateral]	A1	Dep on M1M1B1B1
1(e)	48.7 or 48.69 to 48.70...	3	M2 for $\frac{360 - 50}{360} \times 2 \times \pi \times 9$ oe or M1 for $\frac{50}{360} \times 2 \times \pi \times 9$ oe
2(a)	249.98 to 250[.0...]	3	M2 for $830 - 500 \times 1.16$ or M1 for 500×1.16 OR M1 for $830 \div 1.16$ M1 for $(\text{their } 715.5... - 500) \times 1.16$

Question	Answer	Marks	Partial Marks
2(b)(i)	33.5 or 33.51...	2	M1 for $\frac{12400}{37000} [\times 100]$ oe If 0 scored, SC1 for answer 66.5 or 66.48 to 66.49
2(b)(ii)	38 184 cao	2	M1 for $37\,000 \times \left(1 + \frac{3.2}{100}\right)$ oe or B1 for 1184
2(c)(i)	441 or 440.6 or 440.64 to 440.65	3	B2 for answer 3941 or 3940.6 or 3940.64 to 3940.65 or M2 for $3500 \times \left(1 + \frac{2.4}{100}\right)^5 - 3500$ or M1 for $3500 \times \left(1 + \frac{2.4}{100}\right)^5$ oe isw
2(c)(ii)	16	3	B2 for 15[.0] nfw to 15.1 or M2 for $3500 \times \left(1 + \frac{2.4}{100}\right)^{15}$ oe seen or $3500 \times \left(1 + \frac{2.4}{100}\right)^{16}$ oe seen or M1 for $(3500 \text{ or } \textit{their } 3941) \times \left(1 + \frac{2.4}{100}\right)^n$ associated with 5000 oe
3(a)(i)	$\frac{(x+3)(2x+5)}{2} = 60$	M1	Accept $(x+3)(2x+5) = 2 \times 60$ or 120 Accept e.g. $(x+3)(x+2.5) = 60$ without division by 2 shown for M1 (but not A1)
	$2x^2 + 6x + 5x + 15$ seen	B1	Accept $2x^2 + 11x + 15$ seen
	$2x^2 + 11x - 105 = 0$	A1	Correct completion after M1B1 with the fraction seen removed with no errors or omissions seen
3(a)(ii)	$(2x+21)(x-5) [= 0]$	M2	M1 for partial factors $2x(x-5) + 21(x-5) [= 0]$ or $x(2x+21) - 5(2x+21) [= 0]$ OR $(2x+a)(x+b) [= 0]$ where $ab = -105$ or $2b+a = 11$
	-10.5 and 5	B1	

Question	Answer	Marks	Partial Marks
3(a)(iii)	61.9 or 61.92 to 61.93	3	M2 for $\tan = \frac{2 \times \text{their } 5 + 5}{\text{their } 5 + 3}$ oe or B1FT for $2 \times \text{their } 5 + 5$ and $\text{their } 5 + 3$
3(b)(i)	28.1 or 28.07 to 28.08	1	FT $\text{their } 90 - \text{their (a)(iii)}$ unless $\text{their (a)(iii)} < 45$, in which case FT their (a)(iii)
3(b)(ii)	10	3	M2 for $(\text{their } 5 + 3) \times \sqrt{\frac{93.75}{60}}$ oe or M1 for $\sqrt{\frac{93.75}{60}}$ or $\sqrt{\frac{60}{93.75}}$ oe seen or $\left(\frac{\text{their } 5 + 3}{x}\right)^2 = \frac{60}{93.75}$ oe
4(a)(i)	$1.65 < h \leq 1.8$	1	
4(a)(ii)	1.63875	4	M1 for midpoints soi M1 for use of $\sum fh$ with h in correct interval including both boundaries M1dep on 2nd M1 for $\sum fh \div 80$
4(b)(i)	$\frac{1}{40}$ oe	1	
4(b)(ii)	$\frac{63}{395}$ oe	3	M2 for $\frac{56}{80} \times \frac{9}{79} [\times 2]$ oe or B1 for $\frac{56}{80}$ or $\frac{9}{79}$ or $\frac{9}{80}$ or $\frac{56}{79}$ oe seen If 0 or B1 scored, instead award SC2 for answer $\frac{117}{632}$ oe or SC1 for answer $\frac{63}{400}$ oe
4(c)(i)	15, 39, 71, 80	2	B1 for 3 correct or M1 for 1 error in addition with other values then consistent

Question	Answer	Marks	Partial Marks
4(c)(ii)	Correct curve	3	B1 for correct horizontal placement for 5 plots B1FT for correct vertical placement for 5 plots B1FT dep on at least B1 for reasonable increasing curve or polygon through <i>their</i> 5 points If 0 scored SC1 FT for 4 out of 5 points correctly plotted
4(d)(i)	Strict FT <i>their</i> UQ – <i>their</i> LQ	2dep	B1dep for <i>their</i> UQ or <i>their</i> LQ seen Dep on increasing curve/polygon for 2 marks or B1
4(d)(ii)	Strict FT <i>their</i> reading at 48	2dep	B1 for 48 written
5(a)(i)	251 or 251.3 to 251.4	2	M1 for $\frac{1}{3} \times \pi \times 4^2 \times 15$ oe
5(a)(ii)	79.5 or 79.51...	5	M3 for $\pi \times 4 \times \sqrt{4^2 + 15^2}$ oe or M2 for $\sqrt{15^2 + 4^2}$ oe or M1 for $[l^2 =] 4^2 + 15^2$ oe or $\pi \times 4 \times \text{their } l$ M1 for $\frac{\text{their curved surface area}}{\text{their curved surface area} + \pi \times 4^2} [\times 100]$ oe
5(b)(i)	13 min 20 sec	3	B2 for 800 or $\frac{40}{3}$ oe seen or M1 for figs 3 ÷ figs 375 or figs 3 ÷ 22 500
5(b)(ii)	0.472 or 0.4715 to 0.4716...	3	M2 for $\pi \times 0.45^2 \times h = 0.3$ or $\pi \times 45^2 \times h = 300\,000$ oe or M1 for $\pi \times \text{figs } 45^2 \times h = \text{figs } 3$ oe
6(a)(i)	$\frac{1}{5}, \frac{2}{7}, \frac{3}{9}$ final answer	2	B1 for 2 correct terms isw or for 0.2 and (0.286 or 0.2857...) and 0.333...
6(a)(ii)	36	2	M1 for $k = \frac{12(2k+3)}{25}$ or better

Question	Answer	Marks	Partial Marks
6(b)(i)	$n^3 + 5$ oe final answer	2	B1 for any cubic or common third differences of 6 (at least 2) or for correct answer seen and spoilt
6(b)(ii)	$100 \times 2^{1-n}$ oe final answer	2	B1 for 2^{-n} [+k] oe or $\left(\frac{1}{2}\right)^{n[+k]}$ oe in answer or for correct answer seen and spoilt
7(a)	Angle $CAB = 52$	B1	
	$180 - 52 - \sin^{-1}\left(\frac{60 \sin their 52}{87}\right)$	M3	M2 for $[\sin[...]] = \frac{60 \sin their 52}{87}$ oe or M1 for $\frac{60}{\sin B} = \frac{87}{\sin their 52}$ oe
	95.08...	A1	
7(b)	77.1 or 77.08 to 77.11	6	B4 for dist travelled = 256.9 to 257[.0...] or B3 for $[AB =]$ 109.9 to 110[.0...] or M3 for $60 + 87 +$ $\sqrt{60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1}$ oe or M2 for $\sqrt{60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1}$ oe or $AB^2 = 12093. \dots$ to 12097. ... or $\frac{87 \sin 95.1}{\sin their 52}$ oe or M1 for $AB^2 = 60^2 + 87^2 - 2 \times 60 \times 87 \times \cos 95.1$ oe or $\frac{\sin 95.1}{AB} = \frac{\sin their 52}{87}$ oe M1 for <i>their</i> total distance $\div 3 \frac{20}{60}$ oe
8(a)(i)	Correct expansion of a pair of brackets $x^2 - 4x + [1]x - 4$ or $x^2 - 4x - 2x + 8$ or $x^2 + [1]x - 2x - 2$	M1	accept $x^2 - 3x - 4$ or $x^2 - 6x + 8$ or $x^2 - [1]x - 2$
	$x^3 - 4x^2 + x^2 - 4x - 2x^2 + 8x - 2x + 8$ leading to and stating $[y =] x^3 - 5x^2 + 2x + 8$	A1	Accept $x^3 - 3x^2 - 4x - 2x^2 + 6x + 8$ or $x^3 - 6x^2 + [1] x^2 + 8x - 6x + 8$ or $x^3 - [1] x^2 - 2x - 4x^2 + 4x + 8$ leading to and stating $[y =] x^3 - 5x^2 + 2x + 8$

Question	Answer	Marks	Partial Marks
8(a)(ii)	Correct labelled sketch positive cubic Crossing x-axis at -1, 2 and 4 only Crossing y – axis at 8 only 	4	B1 for positive cubic B2 for three intercepts only with x -axis labelled at -1, 2 and 4 or B1 for 1 or 2 correctly labelled x – intercepts B1 for a single intercept on y-axis labelled at 8 but not if line $y = 8$
8(b)	$3x^2 - 10x - 8 [= 0]$	M3	B2 for derivative $= 3x^2 - 10x + 2$ isw OR B1 for derivative with $3x^2$ or $-10x$ given in expression isw M1dep on B1 for <i>their</i> first derivative $= 10$
	$x = 4$ and $x = -\frac{2}{3}$	B1	
	$(4, 0)$ and $\left(-\frac{2}{3}, \frac{112}{27}\right)$ oe	B1	
	$[y =] 10x - 40$ and $[y =] 10x + \frac{292}{27}$	B2	B1 for each or for two different equations of the form $[y =] 10x + c$ (c must be numeric) or for $c = -40$ and $\frac{292}{27}$
9(a)(i)	$27x^6y^{12}$ final answer	2	B1 for two terms correct in answer e.g. $27x^6y^k$ or $27x^ky^{12}$ or kx^6y^{12} or for correct answer seen then spoilt

Question	Answer	Marks	Partial Marks
9(a)(ii)	$\frac{x^{24}y^{12}}{64}$ final answer	3	B2 for final answer with two correct elements or final answer $\frac{64}{x^{24}y^{12}}$ or $\frac{64^{-1}}{x^{-24}y^{-12}}$ or better or for correct answer seen or B1 for 64 or x^{24} or y^{12} seen in final answer or final answer $\frac{k}{x^{-24}y^{-12}}$ or M1 for first correct step seen eg $\left(\frac{x^{16}y^8}{16}\right)^{\left[\frac{3}{2}\right]}$ or $\left(\frac{4}{x^8y^4}\right)^{[-3]}$ or $\left(\frac{4096}{x^{48}y^{24}}\right)^{\left[\frac{-1}{2}\right]}$
9(b)(i)	$(x+3)(x-3)$ final answer	1	
9(b)(ii)	$\frac{x+3}{2y+5}$ final answer	3	M2 for $(x-3)(2y+5)$ or M1 for $2y(x-3) + 5(x-3)$ or $x(2y+5) - 3(2y+5)$
9(c)	$5x^2 + 4x - 20 [= 0]$ oe or $5y^2 - 78y + 221 [= 0]$ oe	M2	M1 for $7 - 2x = 5x^2 + 2x - 13$ oe seen or $y = 5\left(\frac{7-y}{2}\right)^2 + 2\left(\frac{7-y}{2}\right) - 13$ oe seen
	$\frac{-4 \pm \sqrt{(4)^2 - 4(5)(-20)}}{2(5)}$ oe or $-\frac{4}{10} \pm \sqrt{4 + \left(\frac{4}{10}\right)^2}$ oe	M2	FT <i>their</i> 3-term quadratic or M1 for $\sqrt{(4)^2 - 4(5)(-20)}$ or better or for $\frac{-4 + \sqrt{q}}{2 \times 5}$ or $\frac{-4 - \sqrt{q}}{2 \times 5}$ or for $\left(x + \frac{4}{10}\right)^2$ oe
	$x = 1.64$ $y = 3.72$ and $x = -2.44$ $y = 11.88$	B2	B1 for one correct pair or both x-values correct or both y-values correct

Question	Answer	Marks	Partial Marks
10(a)	13.9 or 13.85 to 13.86	4	M3 for $2x^2 = 28^2 - 20^2$ or better or $x = \left(\sqrt{28^2 - 20^2} \right) \sin 45$ oe or M2 for $x^2 + x^2 + 20^2 = 28^2$ oe or $\sin 45 = \frac{x}{\sqrt{28^2 - 20^2}}$ or M1 for any correct Pythag in 2D or <i>their</i> $AC \times \sin 45$ oe dep on trig/Pythagoras attempt for AC
10(b)	51.9 or 51.87 to 51.88	4	M3 for $\sin = \frac{29 \text{ to } 30}{37 + 0.5}$ or $\frac{30 - 0.5}{37 \text{ to } 38}$ oe or M2 for correct trig statement for correct angle with values in range 29 to 31 and 36 to 38 or M1 for $30 + 0.5$ or $30 - 0.5$ or $37 + 0.5$ or $37 - 0.5$ seen or for identifying correct angle RKM



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MATHEMATICS**0580/43**

Paper 4 (Extended)

May/June 2023**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages.

- 1 (a) Tomas sells a computer, a bike and a phone.
The amounts he receives are in the ratio computer : bike : phone = 14 : 17 : 9.
- (i) Calculate the amount he receives for the phone as a percentage of the total.

..... % [2]

- (ii) The total amount he receives is \$560.

Calculate how much he receives for the bike.

\$ [2]

- (iii) Tomas originally bought the bike for \$195.
He wanted to make a profit of at least 25% when he sold it.

Does Tomas make a profit of at least 25%?

You must show all your working to support your decision.

- (b) Ulla invests \$725 for 6 years in an account paying simple interest at a rate of 1.3% per year. [3]

Calculate the total interest earned at the end of 6 years.

\$ [2]

- (c) In a sale, all prices are reduced by 24%.
Victor pays \$36.86 for a pair of shoes in the sale.

Calculate the original price of the shoes.

\$ [2]

- 2 (a) Anna records the number of text messages she receives for 14 days.

17	15	31	38	31	22	13
18	21	27	28	21	31	29

- (i) Complete the stem-and-leaf diagram.

1	
2	
3	

Key:

[3]

- (ii) Find the median.

..... [1]

- (iii) Find the mode.

..... [1]

- (iv) Find the range.

..... [1]

- (b) In a shop, there are 4 red and 8 grey phones.
Anna and Pete each pick one of these phones at random.

Work out the probability that they both pick a grey phone.

..... [2]

- 3 (a) The scale drawing shows two sides, AB and BC , of a field.
The scale is 5 centimetres represents 200 metres.



Scale: 5 cm to 200 m

- (i) Measure angle ABC .

Angle $ABC = \dots\dots\dots$ [1]

- (ii) X is a point on BC .
 $BX = 332$ m.

Mark the point X on the diagram. [2]

- (iii) Find the scale in the form $1 : n$.

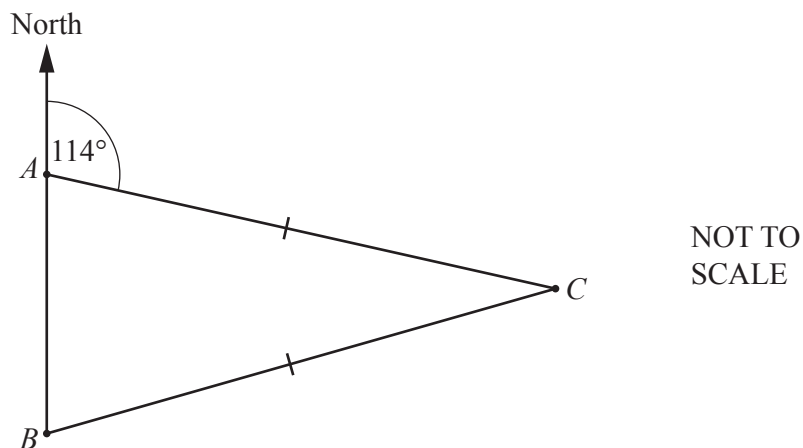
1: $\dots\dots\dots$ [2]

- (b) A bronze statue is 4.5 m high and has a mass of 195 200 kg.
The density of bronze is 8000 kg/m^3 .
The volume of a mathematically similar model of the statue is 0.385 m^3 .

Calculate the height of the model.
[Density = Mass $\div$ Volume]

$\dots\dots\dots$ m [5]

4 (a)

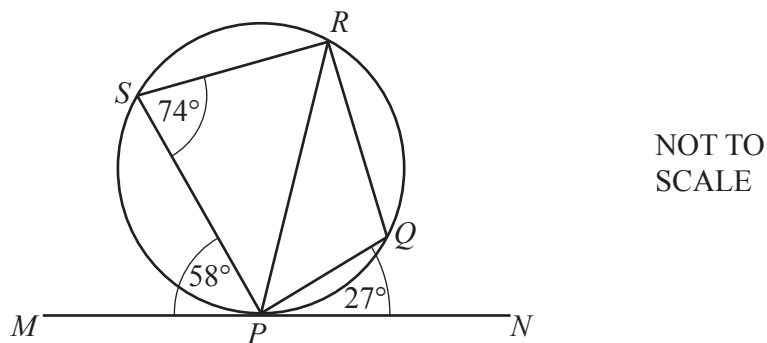


A , B and C are three towns and the bearing of C from A is 114° .
 B is due south of A and $AC = BC$.

Calculate the bearing of B from C .

..... [3]

(b)



P , Q , R and S lie on a circle.
 MPN is a tangent to the circle at P .
 Angle $MPS = 58^\circ$, angle $PSR = 74^\circ$ and angle $QPN = 27^\circ$.

(i) Find angle PRS .

Angle $PRS =$ [1]

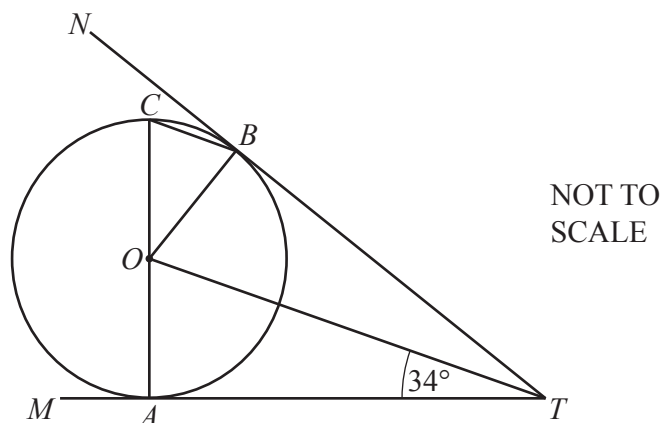
(ii) Find angle PQR .

Angle $PQR =$ [1]

(iii) Find angle RPQ .

Angle $RPQ =$ [2]

(c)



A , B and C lie on a circle, centre O , with diameter AC .
 TAM and TBN are tangents to the circle and angle $ATO = 34^\circ$.

Using values and geometrical reasons, complete these statements to show that CB is parallel to OT .

In triangles AOT and BOT , OT is common.

Angle $OAT = \text{angle } OBT = 90^\circ$ because

.....

$AT = BT$ because

.....

Triangle AOT is congruent to triangle BOT because of congruence criterion

Angle $AOT = \text{angle } BOT = 56^\circ$ because angles in a triangle add up to 180° .

Angle $BOC = \dots\dots\dots^\circ$ because

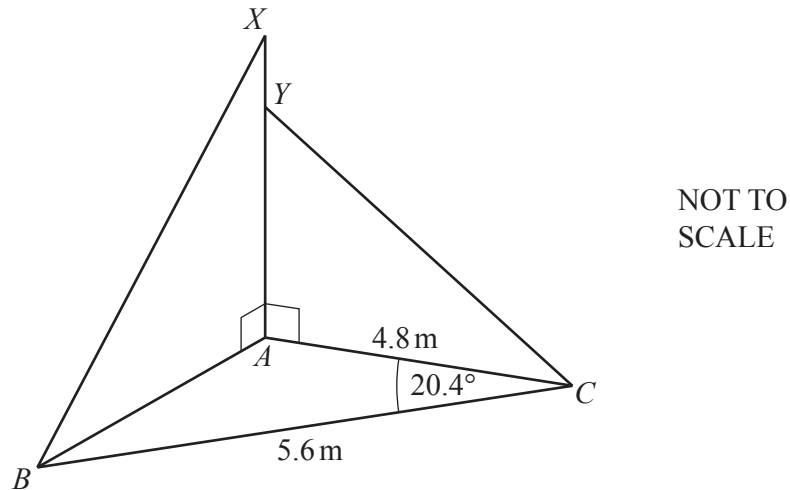
Angle $OBC = \dots\dots\dots^\circ$ because

.....

CB is parallel to OT because

[6]

5 (a)



ABC is a scalene triangle on horizontal ground.

AYX is a straight vertical post, held in place by two straight wires XB and YC .

$AC = 4.8$ m, $BC = 5.6$ m and angle $ACB = 20.4^\circ$.

(i) Calculate AB .

$AB = \dots\dots\dots$ m [3]

(ii) Angle $XBA = 64^\circ$.

Calculate AX .

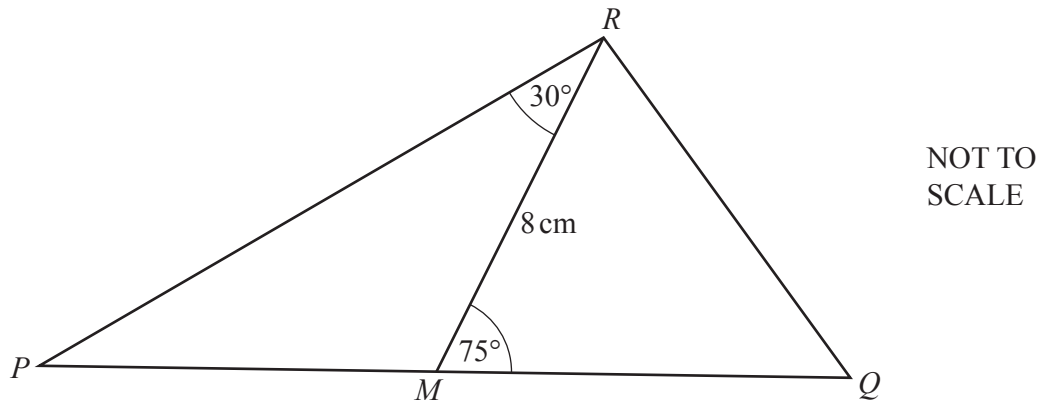
$AX = \dots\dots\dots$ m [2]

(iii) $AY = 2.9$ m.

Calculate the area of triangle YAC .

$\dots\dots\dots$ m² [2]

(b)



In triangle PQR , M is the midpoint of PQ .
 $RM = 8\text{ cm}$, angle $PRM = 30^\circ$ and angle $RMQ = 75^\circ$.

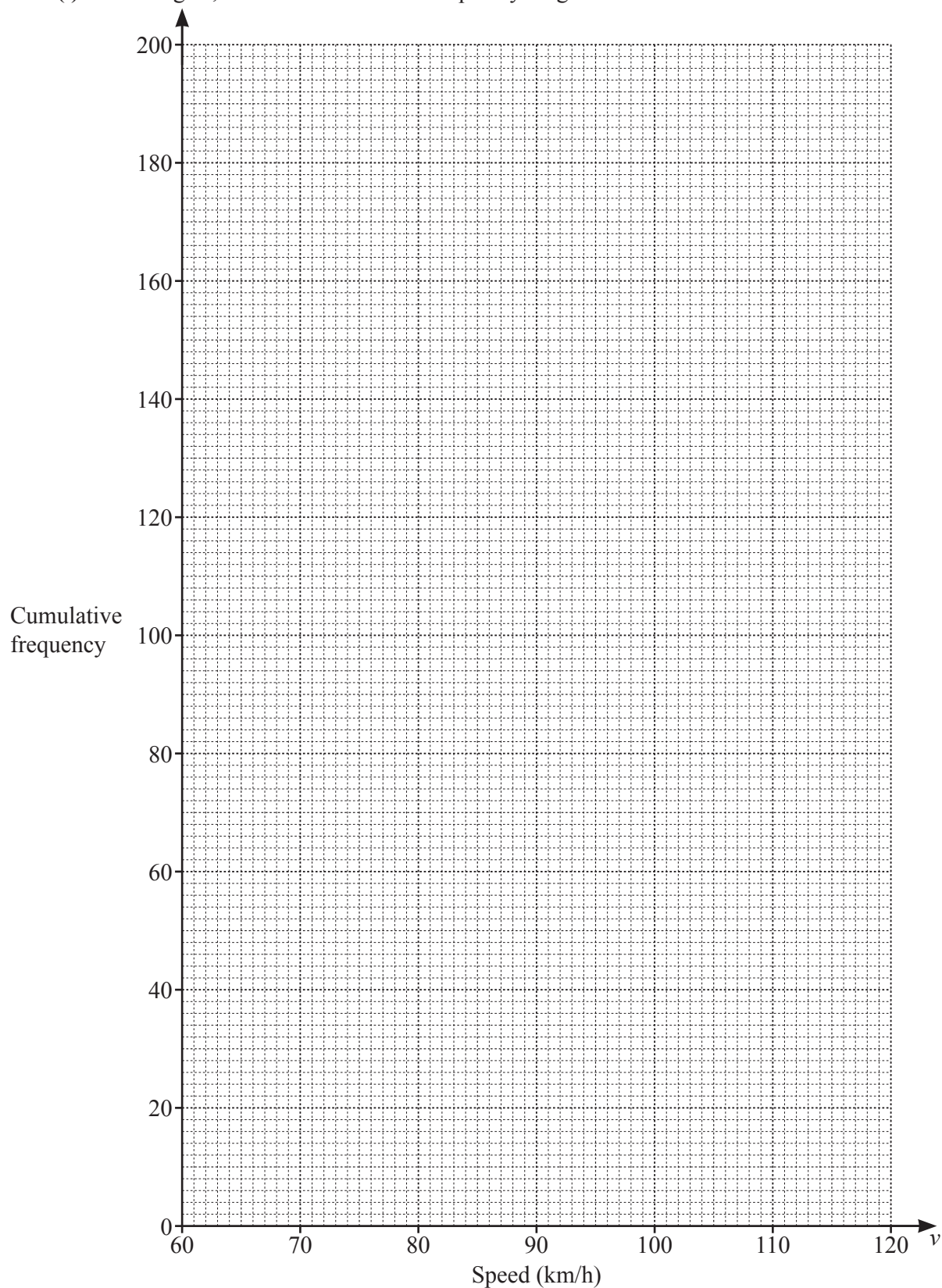
Calculate PQ .

$PQ = \dots\dots\dots\text{ cm}$ [5]

- 6 (a) The cumulative frequency table shows information about the speed of each of 200 cars as they pass a speed camera.

Speed (v km/h)	$v \leq 70$	$v \leq 80$	$v \leq 90$	$v \leq 95$	$v \leq 100$	$v \leq 120$
Cumulative frequency	12	46	115	155	177	200

- (i) On the grid, draw the cumulative frequency diagram.



(ii) Use your cumulative frequency diagram to find an estimate of

(a) the median

..... km/h [1]

(b) the interquartile range

..... km/h [2]

(c) the number of cars with a speed greater than 110 km/h.

..... [2]

(b) The frequency table shows information about the mass of each of 50 trucks.

Mass (m kg)	$2000 < m \leq 2600$	$2600 < m \leq 3500$	$3500 < m \leq 5000$	$5000 < m \leq 5700$
Frequency	12	15	16	7

(i) Calculate an estimate for the mean mass of the trucks.

..... kg [4]

(ii) In a histogram showing this information, the height of the first block is 6 cm.

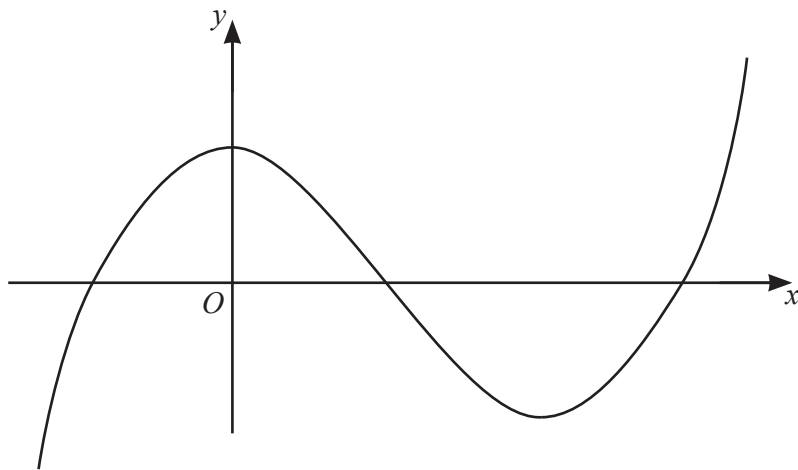
Calculate the heights of the remaining three blocks.

Height of block for $2600 < m \leq 3500$ cm

Height of block for $3500 < m \leq 5000$ cm

Height of block for $5000 < m \leq 5700$ cm [3]

- 7 (a) The diagram shows the graph of a function.

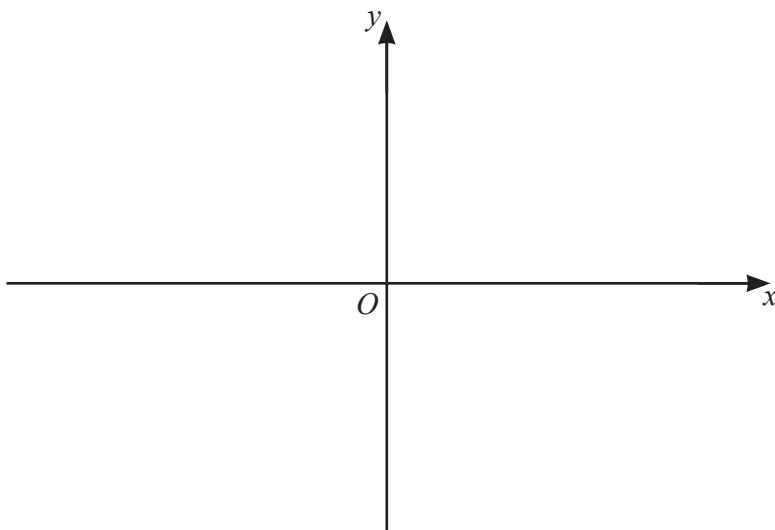


Put a ring around the word which correctly identifies the type of function.

reciprocal quadratic cubic exponential linear

[1]

- (b) (i)



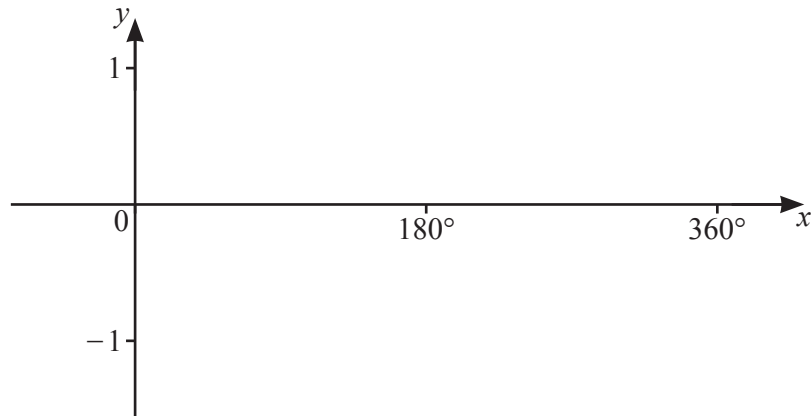
On the diagram, sketch the graph of $y = \frac{1}{2x}$, $x \neq 0$.

[2]

- (ii) Solve the equation $\frac{1}{2x} = 2x$.

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [2]

(c) (i)



On the diagram, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$. [2]

(ii) Solve the equation $3 \sin x + 1 = 0$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [3]

- 8 (a) A shop sells shirts for \$ x and jackets for \$ $(x + 27)$.
The shop sells 4 shirts and 3 jackets for a total of \$194.75 .

Write down and solve an equation to find the cost of one shirt.

\$ [3]

- (b) Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}x^2 + 4y &= 37 \\ 5x + y &= -8\end{aligned}$$

$x = \dots\dots\dots$, $y = \dots\dots\dots$

$x = \dots\dots\dots$, $y = \dots\dots\dots$ [5]

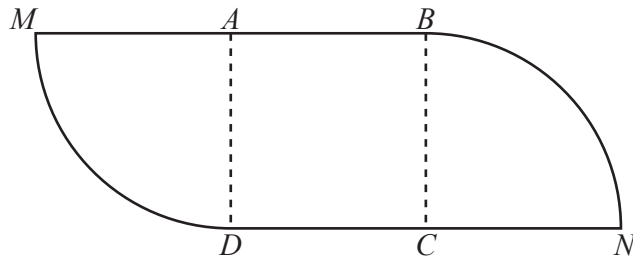
- (c) A solid cylinder has radius x and height $6x$.
A sphere of radius r has the same surface area as the total surface area of the cylinder.

Show that $r^2 = \frac{7}{2}x^2$.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

[4]

9 (a)



NOT TO
SCALE

The diagram shows a shape made from a square $ABCD$ and two equal sectors of a circle.
The square has side 11 cm.
 MAB and DCN are straight lines.

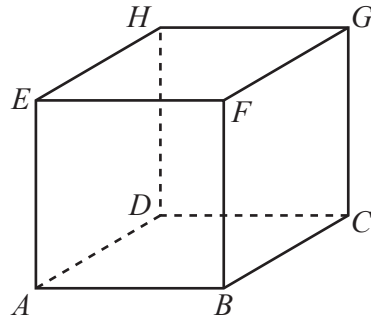
(i) Calculate the area of the shape.

..... cm^2 [3]

(ii) Calculate the perimeter of the shape.

..... cm [3]

(b)



NOT TO
SCALE

The diagram shows a cube $ABCDEFGH$ of edge 7 cm.

Calculate the angle between AG and the base of the cube.

..... [4]

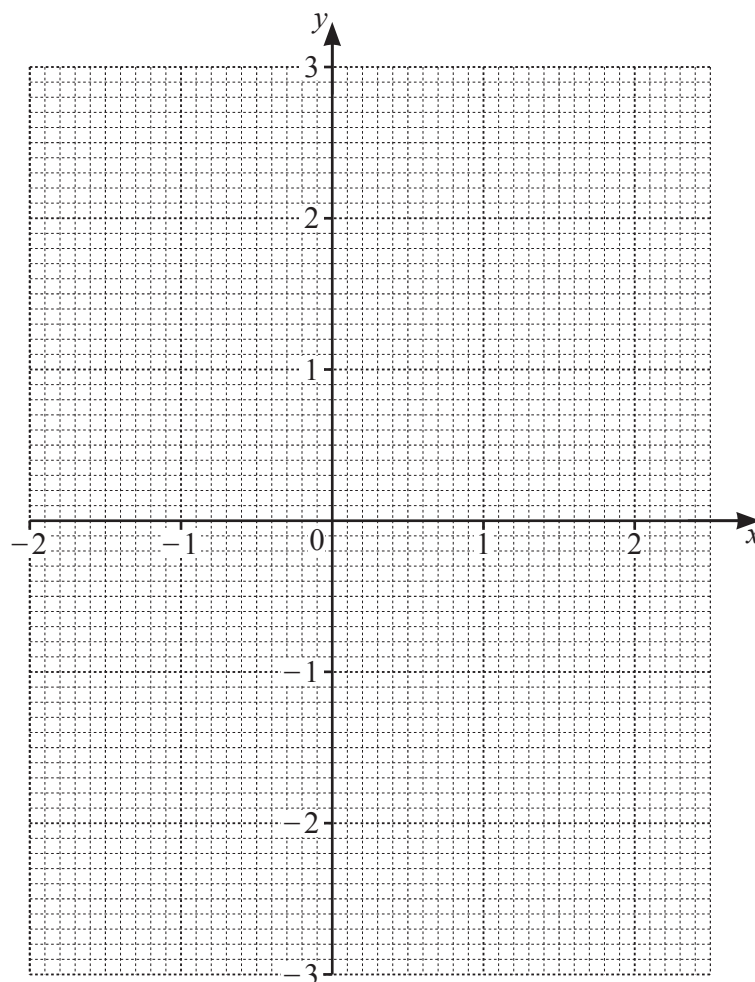
10 The table shows some values for $y = 2^x - 3$.

x	-2	-1	0	0.5	1	1.5	2	2.5
y	-2.75			-1.58		-0.17	1	2.66

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = 2^x - 3$ for $-2 \leq x \leq 2.5$.



[4]

(c) Use your graph to solve the equation $2^x - 3 = 2$.

$x = \dots\dots\dots$ [1]

(d) By drawing a suitable straight line, solve the equation $2^x - x - 1.5 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

11 M has coordinates $(4, 1)$ and N has coordinates $(-2, -7)$.

(a) Find the length of MN .

..... [3]

(b) Find the gradient of MN .

..... [2]

(c) Find the equation of the perpendicular bisector of MN .

..... [4]

Question 12 is printed on the next page.

12 The equation of a curve is $y = x^4 - 8x^2 + 5$.

(a) Find the derivative, $\left(\frac{dy}{dx}\right)$, of $y = x^4 - 8x^2 + 5$.

..... [2]

(b) Find the coordinates of the three turning points.
You must show all your working.

(..... , ...) and (..... , ...) and (..... , ...) [4]

(c) Determine which one of these turning points is a maximum.
Justify your answer.

[2]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2023

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

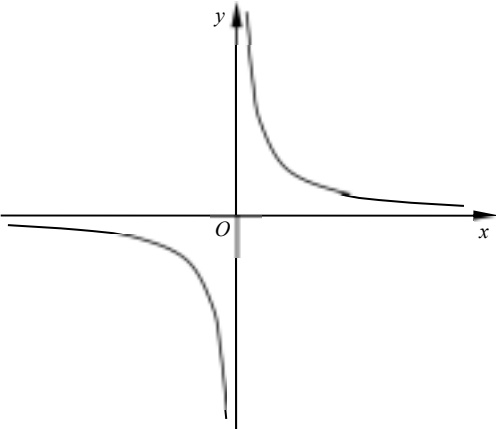
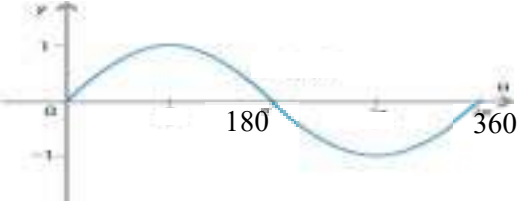
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	22.5	2	M1 for $\frac{9}{14+17+9} [\times 100]$
1(a)(ii)	238	2	FT <i>their</i> $14 + 17 + 9 = N$ seen in (a)(i) M1 for $\frac{560}{\text{their } (14+17+9)} \times k$, where $k = 1, 9, 14$ or 17
1(a)(iii)	<u>METHOD 1</u> 1.25×195 oe	M2	M1 for $\frac{25}{100} \times 195$
	243[.75] and No oe	A1	Strict FT yes if <i>their</i> (a)(ii) > 243.75 If M0 scored, then SC1 for 243.75 and a correct conclusion.
	<u>METHOD 2</u> $\frac{\text{their } 238}{195} - 1 = 0.22\ldots$ oe	(M2)	M1 for $\frac{\text{their } 238}{195} = 1.22\ldots$ oe
	22[%] (or better) and No oe	(A1)	Strict FT yes if <i>their</i> (a)(ii) gives answer > 25 If M0 scored, then SC1 for 22.05 and a correct conclusion.
	<u>METHOD 3</u> $195 \times 0.25 = 48.75$ oe and <i>their</i> $238 - 195 = 43$	(M2)	M1 for 0.25×195
	43 and 48.75 and NO	(A1)	Strict FT yes if <i>their</i> (a)(ii) gives profit > 48.75 If M0 scored, then SC1 for 43 and 48.75 and a correct conclusion.
	<u>METHOD 4</u> $\frac{\text{their } 238}{125} \times 100$	(M2)	M1 for $x \times \left(1 + \frac{25}{100}\right) = \text{their } 238$
	190.4 and NO	(A1)	Strict FT yes if <i>their</i> (a)(ii) gives answer > 195 If M0 scored then SC1 for 190.4 and a correct conclusion.
1(b)	56.55	2	M1 for $\frac{725 \times 1.3 [\times 6]}{100}$ oe

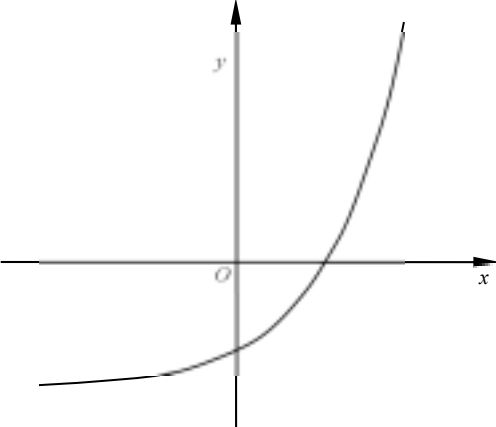
Question	Answer	Marks	Partial Marks						
1(c)	48.5[0]	2	M1 for $x \times \left(1 - \frac{24}{100}\right) = 36.86$ oe						
2(a)(i)	<table><tr><td>1</td><td>3 5 7 8</td></tr><tr><td>2</td><td>1 1 2 7 8 9</td></tr><tr><td>3</td><td>1 1 1 8</td></tr></table> 1 7 represents 17 [messages]	1	3 5 7 8	2	1 1 2 7 8 9	3	1 1 1 8	3	B2 for fully correct stem-and-leaf diagram OR B1 for two rows correct or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission B1 for correct key
1	3 5 7 8								
2	1 1 2 7 8 9								
3	1 1 1 8								
2(a)(ii)	24.5	1							
2(a)(iii)	31	1							
2(a)(iv)	25	1							
2(b)	$\frac{14}{33}$ oe	2	M1 for $\frac{8}{12} \times \frac{7}{11}$						
3(a)(i)	118	1							
3(a)(ii)	X is 8.3 cm from B	2	M1 for $(332 \div 200) \times 5$ oe						
3(a)(iii)	1 : 4000	2	M1 for $200 \div 5$ or 200×100 , both soi						
3(b)	1.13 or 1.128 to 1.129	5	M4 for $4.5 \times \sqrt[3]{\frac{0.385 \times 8000}{195200}}$ oe or $\sqrt[3]{\frac{4.5^3 \times 0.385 \times 8000}{195200}}$ oe or M3 for $\sqrt[3]{\frac{0.385}{\text{their}24.4}}$ or $\sqrt[3]{\frac{\text{their}3080}{195200}}$ or $\frac{0.385}{\text{their}24.4} = \frac{l^3}{4.5^3}$ oe or M2 for $\frac{\text{their}24.4}{0.385}$ or $\frac{0.385}{\text{their}24.4}$ oe or B2 for 24.4 or 3080 seen or M1 for $195\,200 \div 8000$ or for 0.385×8000						

Question	Answer	Marks	Partial Marks
4(a)	246	3	B2 for $BCS(\text{outh}) = 66$ or $BCA = 48$ and $ACN(\text{orth}) = 66$ or $BCW(\text{est}) = 24$ or $ACS(\text{outh}) = 114$ or B1 for $ABC = 66$ or $BAC = 66$ or $BCA = 48$ or $ACN(\text{orth}) = 66$
4(b)(i)	58	1	
4(b)(ii)	106	1	
4(b)(iii)	47	2	B1 for $PRQ = 27$ or B1FT for SPR , either = 48 or = $106 - \text{their (b)(i)}$ or B1FT for $RPQ = \text{their (b)(i)} - 11$
4(c)	Radius perpendicular to tangent	1	
	Tangents to circle from a/same point oe	1	
	RHS	1	
	68 angles on a [straight] line add up/sum to 180 oe	1	
	56 [base angles of] isosceles triangle	1	
	$OBC = BOT$ Alternate angles	1	Angles and reason required and dependent on OBC and BOT correct
5(a)(i)	2[.00] or 2.002 to 2.003 nfw	3	M2 for $\sqrt{4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4}$ OR M1 for $4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4$ A1 for 4.01[17...] or 4.012
5(a)(ii)	4.1[0] or 4.11 or 4.100 to 4.107 cao	2	M1 for $\tan 64 = \frac{AX}{\text{their (a)(i)}}$ or for $\frac{AX}{\sin 64} = \frac{\text{their (a)(i)}}{\sin(90 - 64)}$ oe
5(a)(iii)	6.96	2	M1 for $\frac{1}{2} \times 4.8 \times 2.9$ oe

Question	Answer	Marks	Partial Marks
5(b)	11.3 or 11.31..	5	M4 for $2 \times \frac{8}{\sin(45)} \times \sin 30$ or B4 for $PM = 5.65[685\dots]$ or 5.66 or better OR B1 for $\text{angle } RPM = 45^\circ$ M2 for $\frac{8}{\sin(\text{their } 45)} \times \sin 30$ or M1 for implicit form
6(a)(i)	Correct curve	3	B1 for correct horizontal placement for 6 plots B1 for correct vertical placement for 6 plots B1 dep on at least B1 for reasonable increasing curve through <i>their</i> 6 points If 0 scored, SC1 for 4 out of 6 points correctly plotted
6(a)(ii)(a)	87 to 89.5	1	
6(a)(ii)(b)	12.5 to 14	2	B1 for $[LQ =] 80.5 \text{ to } 81.5$ or $[UQ =] 94 \text{ to } 94.5$
6(a)(ii)(c)	Strict FT, 200 – <i>their</i> cumul freq reading from <i>their</i> graph at 110 given to nearest integer	2	B1FT for correct cumul freq at 110 seen or for non-integer answer
6(b)(i)	3576	4	M1 for midpoints soi M1 for use of $\sum fx$ where x is in the correct interval including boundaries M1 (dep on 2nd M1) for $\sum fx \div 50$
6(b)(ii)	5 3.2 3	3	B1 for each If 0 scored, SC1 for 3 frequency densities $\frac{12}{600}, \frac{15}{900}, \frac{16}{1500}, \frac{7}{700}$ seen oe to 3sf or better or multiplier 3 or 300
7(a)	Cubic	1	

Question	Answer	Marks	Partial Marks
7(b)(i)	Correct sketch 	2	B1 for one branch correct or an attempt at the correct shape Maximum 1 mark if sketch crosses x -axis or y -axis
7(b)(ii)	$\pm \frac{1}{2}$ nfw	2	M1 for $4x^2 = 1$ oe or B1 for $\frac{1}{2}$ or $-\frac{1}{2}$ nfw
7(c)(i)	Correct sketch through (0, 0) (180, 0) and (360, 0) with max and min at 1 and -1 resp. 	2	B1 for correct sine curve shape, starting at the origin, with minimum of 1 cycle.
7(c)(ii)	199.5 or 199.47... and 340.5...	3	B2 for one correct or M1 for $\sin x = -\frac{1}{3}$ oe If 0 scored, SC1 for two reflex angles with a sum of 540 or 2 non-reflex angles with a sum of 180
8(a)	$4x + 3(x + 27) = 194.75$ or $4x + 3x + 81 = 194.75$	M1	
	16.25 cao	B2	M1 for $7x = k$ where $k < 194.75$ or B1 for answer 16.3
8(b)	$x^2 - 20x - 69 [= 0]$ oe or $y^2 + 116y - 861 [= 0]$ oe	M2	M1 for $x^2 + 4(-8 - 5x) = 37$ oe or for $37 - 4y = \left(\frac{-8 - y}{5}\right)^2$ oe or for $x^2 + 4y = 37$ and $20x + 4y = -32$ subtracted with no more than one error

Question	Answer	Marks	Partial Marks
	$(x + 3)(x - 23) [= 0]$ oe or $(y - 7)(y + 123) [= 0]$ oe	M1	correct method to solve <i>their</i> quadratic e.g. $x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4 \times 1 \times (-69)}}{2 \times 1}$ or $x - 10 = \pm 13$ or $x - 10 = \pm \sqrt{169}$
	$x = -3$ $y = 7$ $x = 23$ $y = -123$ final answer	B2	B1 for one correct pair or two correct x values or two correct y values
8(c)	$2\pi x \times 6x + 2\pi x^2$ or $2\pi x(6x + x)$	M2	or M1 for $2\pi x \times 6x$ or $2\pi x^2$
	<i>Their</i> $(2\pi x \times 6x + 2\pi x^2) = 4\pi r^2$	M1	Dep on at least on M1 earned <i>Their</i> LHS must be an area in terms of x only
	At least one further stage of working leading to $r^2 = \frac{7}{2}x^2$	A1	with no error seen
9(a)(i)	311 or 311.0 to 311.1	3	M2 for $11 \times 11 + 2 \times \frac{1}{4} \times \pi \times 11^2$ oe or M1 for $[2 \times] \frac{1}{4} \times \pi \times 11^2$ or 11×11 oe
9(a)(ii)	78.6 or 78.55 to 78.56...	3	M2 for $4 \times 11 + 2 \times \frac{1}{4} \times 2 \times \pi \times 11$ oe or M1 for $[2 \times] \frac{1}{4} \times 2 \times \pi \times 11$ or 4×11 oe
9(b)	35.2 or 35.3 or 35.239... to 35.28	4	M3 for $[\tan =] \frac{7}{\sqrt{7^2 + 7^2}}$ or $[\sin =] \frac{7}{\sqrt{7^2 + 7^2 + 7^2}}$ or $[\cos =] \frac{\sqrt{7^2 + 7^2}}{\sqrt{7^2 + 7^2 + 7^2}}$ OR M2 for $AG = \sqrt{7^2 + 7^2 + 7^2}$ or for $\sqrt{7^2 + \left(\frac{7}{\sin 45}\right)^2}$ oe or for $AC = \sqrt{7^2 + 7^2}$ or $\frac{7}{\sin 45}$ oe OR M1 for $7^2 + 7^2$ or for implicit trigonometry or identifying correct angle

Question	Answer	Marks	Partial Marks
10(a)	-2.5 -2 -1	3	B1 for each
10(b)	Correct curve 	4	B3 FT for 8 or 7 correct plots B2 FT for 6 or 5 correct plots B1 FT for 4 or 3 correct plots
10(c)	2.3 to 2.4	1	
10(d)	ruled line $y = x - 1.5$	M2	M1 for $y = x - 1.5$ soi or for $2^x - 3 = x - 1.5$ seen. or $y = x + k$ or $y = kx - 1.5$ drawn Do not accept $y = -1.5$
	-1 and 1.55 to 1.7	A2	A1 for each
11(a)	10	3	M2 for $(1 - -7)^2 + (4 - -2)^2$ oe or M1 for $(1 - -7)$ or $(4 - -2)$ oe
11(b)	$\frac{4}{3}$ or $\frac{8}{6}$	2	M1 for $\frac{1 - -7}{4 - -2}$ oe
11(c)	$y = -\frac{3}{4}x - \frac{9}{4}$ or $4y + 3x + 9 = 0$ oe final answers	4	B3 for $-\frac{3}{4}x - \frac{9}{4}$ OR B1 for midpoint $(1, -3)$ M1 for gradient $-\frac{3}{4}$ or $-\frac{1}{\text{their } (b)}$ M1 for substituting <i>their</i> $(1, -3)$ into $y = (\text{their } m)x + c$ or for $\text{their } m = \frac{y - -3}{x - 1}$ oe
12(a)	$4x^3 - 16x$ cao	2	M1 for $4x^3 + kx$ or $kx^3 - 16x$ or $4x^3 - 16x + k$ or $4x^3 - 16$ as final answers

Question	Answer	Marks	Partial Marks
12b	<i>Their</i> $\frac{dy}{dx} = 0$ or stating $\frac{dy}{dx} = 0$	B1	
	Correct method to solve <i>their</i> $4x^3 - 16x = 0$	M1	e.g. $4x(x^2 - 4)$ or $4x(x - 2)(x + 2)$ oe
	$[x =] 0, -2, 2$	A1	Or B1 for $(-2, -11)$ and $(2, -11)$
	$(0, 5) (-2, -11) (2, -11)$	A1	
12(c)	$(0, 5)$ with correct reasoning	2	M1 for any of • correct use of 2nd derivative $12x^2 - 16$ • evaluates correctly both values of y on either side • evaluates correctly the gradient on either side • reasonable correct sketch



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MATHEMATICS

0580/22

Paper 2 (Extended)

February/March 2023

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

1	12	15	27	29	91	93

From the list of numbers, write down

(a) a cube number [1]

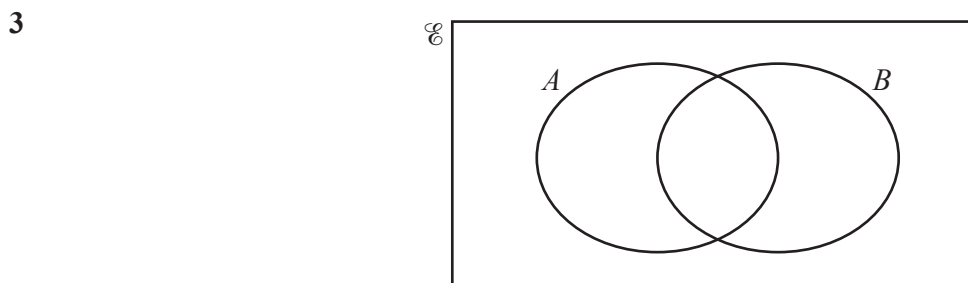
(b) a prime number. [1]

2 $\mathbf{v} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ $\mathbf{y} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$

Find

(a) $\mathbf{v} - \mathbf{y}$ $\begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) $2\mathbf{v}$. $\begin{pmatrix} \\ \end{pmatrix}$ [1]



On the Venn diagram, shade the region $A \cap B$. [1]

4 23, 17, 11, 5, ...

(a) Write down the next number in this sequence. [1]

(b) Find the n th term of this sequence. [2]

- 5 Factorise completely.

$$8g - 2g^2$$

..... [2]

- 6 **Without using a calculator**, work out $\frac{4}{7} \div 8$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

- 7 Solve.

(a) $15t + 8 = 4 - t$

$$t = \text{.....} [2]$$

(b) $\frac{25 - 2u}{3} = 2$

$$u = \text{.....} [2]$$

- 8 Calculate 0.3^2 .
Give your answer in standard form.

..... [2]

- 9 Solve the simultaneous equations.
You must show all your working.

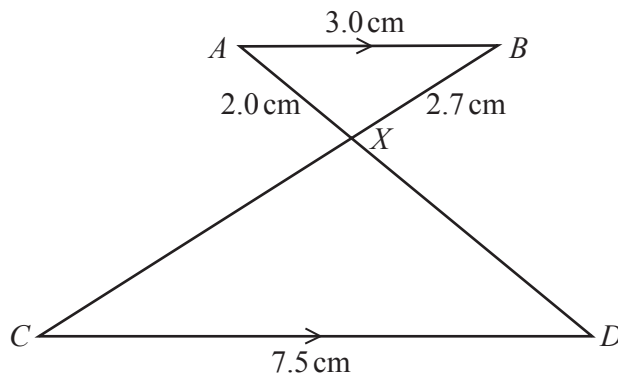
$$3x - 2y = 19$$

$$x + y = 3$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [3]$$

10



NOT TO
SCALE

In the diagram, AB and CD are parallel.
The lines CB and AD intersect at X .
 $AB = 3.0$ cm, $AX = 2.0$ cm, $BX = 2.7$ cm and $CD = 7.5$ cm.

Find the length of BC .

$$BC = \dots\dots\dots \text{ cm } [3]$$

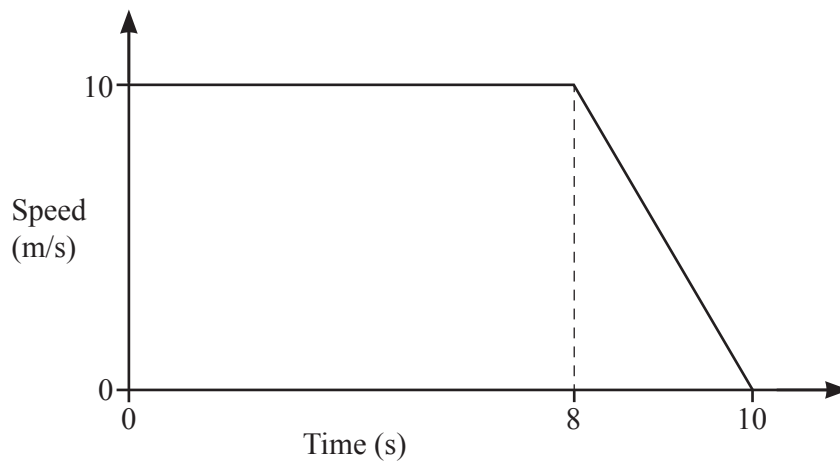
- 11 Find the highest common factor (HCF) of $12x^{12}$ and $16x^{16}$.

..... [2]

- 12 In a regular polygon, the interior angle and the exterior angle are in the ratio interior : exterior = 11 : 1.
Find the number of sides of this regular polygon.

..... [3]

13



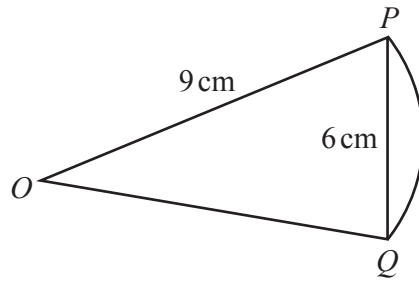
NOT TO
SCALE

The diagram shows the speed–time graph for part of a car journey.

Calculate the total distance travelled during the 10 seconds.

..... m [2]

14



NOT TO
SCALE

The diagram shows a sector of a circle with centre O and radius 9 cm .
The length of the chord PQ is 6 cm .

Calculate the length of the arc PQ .

..... cm [3]

15 Simplify $(3125w^{3125})^{\frac{1}{5}}$.

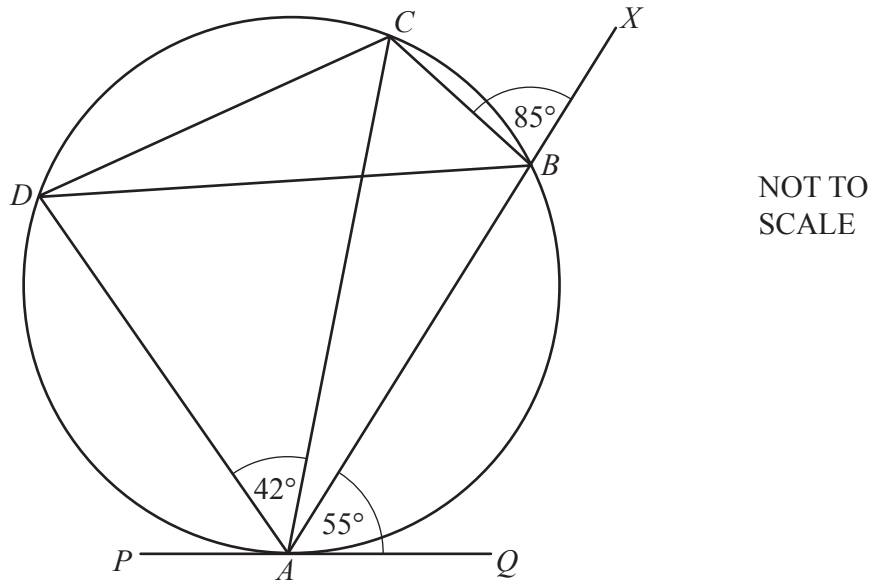
..... [2]

16 y is inversely proportional to x^2 .
When $x = 3$, $y = 2$.

Find y when $x = 2$.

$y =$ [3]

17



$ABCD$ is a cyclic quadrilateral, ABX is a straight line and PQ is a tangent to the circle at A . Angle $CBX = 85^\circ$, angle $BAQ = 55^\circ$ and angle $CAD = 42^\circ$.

Find

(a) angle CBD

Angle $CBD = \dots\dots\dots$ [1]

(b) angle ACB

Angle $ACB = \dots\dots\dots$ [1]

(c) angle ADC

Angle $ADC = \dots\dots\dots$ [1]

(d) angle BCD

Angle $BCD = \dots\dots\dots$ [2]

(e) angle PAD .

Angle $PAD = \dots\dots\dots$ [1]

- 18 Two solids are mathematically similar and have volumes 81 cm^3 and 24 cm^3 .
The surface area of the smaller solid is 44 cm^2 .

Calculate the surface area of the larger solid.

..... cm^2 [3]

- 19 Find the values of x when $6x + y = 10$ and $y = x^2 - 3x + 10$.

$x =$ or $x =$ [3]

20 Find the n th term of each sequence.

(a) $-1, 0, 7, 26, 63, \dots$

..... [2]

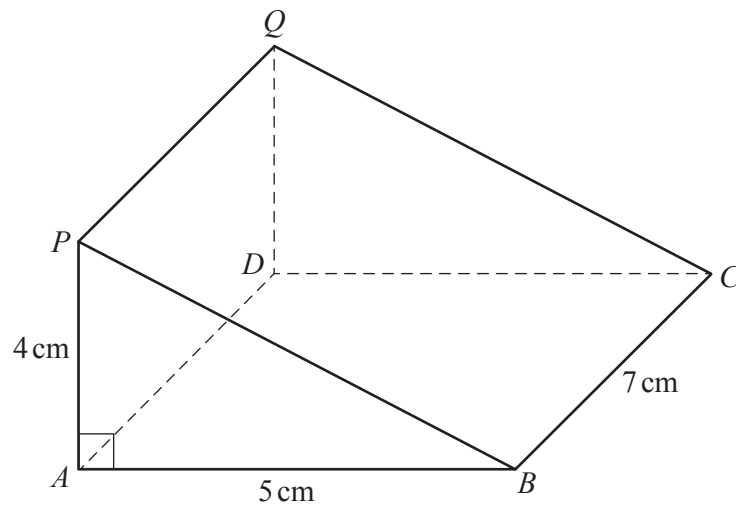
(b) $24, 12, 6, 3, 1.5, \dots$

..... [2]

21 A car travels 14 km, correct to the nearest kilometre.
This takes 12 minutes, correct to the nearest minute.

Calculate the lower bound of the speed of the car.
Give your answer in kilometres per minute.

..... km/min [3]



NOT TO
SCALE

The diagram shows a triangular prism $ABCDQP$ of length 7 cm.
The cross-section is triangle PAB with $PA = 4$ cm, $AB = 5$ cm and angle $PAB = 90^\circ$.

Calculate the angle between the line PC and the base $ABCD$.

..... [4]

23 Simplify.

$$\frac{5x^2 - 19x + 12}{x^2 - 9}$$

..... [4]

24 The probability of Jamie hitting a target is $\frac{1}{3}$.

The probability that he hits the target for the first time on his n th attempt is $\frac{64}{2187}$.

Find the value of n .

$n =$ [2]

Question 25 is printed on the next page.

25 $f(x) = x^3 + 1$

Find $f^{-1}(x)$.

$f^{-1}(x) = \dots\dots\dots [2]$

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

February/March 2023

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the February/March 2023 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of 7 printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

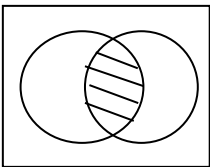
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	27	1	
1(b)	29	1	
2(a)	$\begin{pmatrix} -3 \\ -2 \end{pmatrix}$	1	
2(b)	$\begin{pmatrix} -2 \\ 6 \end{pmatrix}$	1	
3	Correct shading 	1	
4(a)	-1	1	
4(b)	$29 - 6n$ oe final answer	2	B1 for $k - 6n$ or $29 - kn$ or $29 - 6n$ seen then spoiled
5	$2g(4 - g)$ final answer	2	B1 for $2(4g - g^2)$ or for $g(8 - 2g)$ or for $2g(4 - g)$ seen then spoiled
6	$\frac{4}{7} \times \frac{1}{8}$ oe or $\frac{4}{7} \div \frac{56}{7}$ oe	M1	
	$\frac{1}{14}$ cao	A1	
7(a)	$-\frac{1}{4}$ oe	2	M1 for $15t + t = 4 - 8$ oe
7(b)	9.5 oe	2	M1 for $25 - 2u = 3 \times 2$ oe or for $\frac{25}{3} - 2 = \frac{2u}{3}$

Question	Answer	Marks	Partial Marks
8	9×10^{-2}	2	B1 for 0.09 oe or M1 for <i>their</i> decimal correctly converted to standard form if negative power
9	Correctly eliminating one variable	M1	
	$[x =] 5$	A1	
	$[y =] -2$	A1	If M0 scored SC1 for 2 values satisfying one of the original equations.
10	9.45	3	M2 for $\frac{2.7 \times 7.5}{3} + 2.7$ oe OR B2 for 6.75 oe or M1 for $\frac{3}{7.5} = \frac{2.7}{XC}$ oe If 0 scored SC1 for answer 7.7
11	$4x^{12}$ final answer	2	B1 for $4x^k$ or kx^{12} or for $4x^{12}$ seen then spoiled
12	24	3	M2 for $180(n-2) = 11 \times 360$ oe OR M1 for $\frac{180}{11+1} [\times 11]$ oe M1 for $\frac{360}{\text{their } 15}$ or for $\frac{(n-2) \times 180}{n} = (180 - \text{their } 15)$
13	90	2	M1 for a correct area calculation e.g. 8×10 or $0.5 \times 2 \times 10$ or better
14	6.12 or 6.116... to 6.118	3	M1 for $\sin = \frac{3}{9}$ oe or $\cos = \frac{9^2 + 9^2 - 6^2}{2 \times 9 \times 9}$ oe M1 dep for $\frac{\text{their angle}}{360} \times \pi \times 2 \times 9$ dependent on use of trig for <i>their angle</i>
15	$5w^{625}$ final answer	2	B1 for kw^{625} or $5w^k$ final answer or for $5w^{625}$ then spoiled

Question	Answer	Marks	Partial Marks
16	4.5 oe	3	M2 for $2^2 \times y = 3^2 \times 2$ OR M1 for $y = \frac{k}{x^2}$ M1 for $y = \frac{their k}{2^2}$
17(a)	42	1	
17(b)	55	1	
17(c)	85	1	
17(d)	108	2	M1 for [angle $ACD =$] 53 or [angle $BAC =$] 30
17(e)	53	1	
18	99	3	M2 for $44 \times \left(\frac{81}{24}\right)^{\frac{2}{3}}$ oe or M1 for $\left(\frac{81}{24}\right)^{\frac{1}{3}}$ oe or $\left(\frac{24}{81}\right)^{\frac{1}{3}}$ oe or $\left(\frac{44}{Area}\right)^3 = \left(\frac{24}{81}\right)^2$ oe
19	0 and -3	3	B2 for $x^2 + 3x [= 0]$ or better or M1 for $10 - 6x = x^2 - 3x + 10$ oe or for correct simplification of <i>their</i> quadratic to the form $ax^2 + bx + c [= 0]$ or better or finding $y = 28$ and $y = 10$
20(a)	$(n-1)^3 - 1$ oe	2	M1 for any cubic or third differences = 6
20(b)	$24 \times \left(\frac{1}{2}\right)^{n-1}$ oe	2	M1 for $c \times \left(\frac{1}{2}\right)^{an+b}$ oe where a , b and c are constants and $a > 0$
21	1.08	3	M2 for $\frac{13 \text{ to } 14}{12 + 0.5}$ oe or $\frac{14 - 0.5}{12 \text{ to } 13}$ oe or M1 for $14 + 0.5$ oe or $14 - 0.5$ oe or $12 + 0.5$ oe or $12 - 0.5$ oe

Question	Answer	Marks	Partial Marks
22	24.9 or 24.93 to 24.94	4	M3 for $\tan = \frac{4}{\sqrt{5^2+7^2}}$ oe or M2 for $5^2 + 7^2$ oe or $5^2 + 7^2 + 4^2$ oe or M1 for recognition of angle <i>PCA</i>.
23	$\frac{5x-4}{x+3}$ final answer	4	B2 for $(5x-4)(x-3)$ or B1 for $(5x+a)(x+b)$ with $ab = 12$ or $a + 5b = -19$ or for $5x(x-3) - 4(x-3)$ or $x(5x-4) - 3(5x-4)$ B1 for $(x+3)(x-3)$
24	7	2	B1 for answer 6 or M1 for $\left(\frac{2}{3}\right)^k \left(\frac{1}{3}\right)$ shown with $k > 1$ or $\left(\frac{2}{3}\right)^{an+b} \left(\frac{1}{3}\right) = \frac{64}{2187}$ oe or for $3^n = 2187$ soi or $2^{n-1} = 64$ or $3^{n-1} = 729$ or better
25	$\sqrt[3]{x-1}$ or $(x-1)^{\frac{1}{3}}$	2	M1 for $x = y^3 + 1$ or for $y - 1 = x^3$ or better



Cambridge IGCSE™

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MATHEMATICS**0580/42**

Paper 4 (Extended)

February/March 2023**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) (i) Alain and Beatrice share \$750 in the ratio Alain : Beatrice = 8 : 7.

Show that Alain receives \$400.

[1]

- (ii) (a) Alain spends \$150.

Write \$150 as a percentage of \$400.

..... % [1]

- (b) He invests the remaining \$250 at a rate of 2% per year simple interest.

Calculate the amount Alain has at the end of 5 years.

\$ [3]

- (iii) Beatrice invests her \$350 at a rate of 0.25% per **month** compound interest.

Calculate the amount Beatrice has at the end of 5 years.

Give your answer correct to the nearest dollar.

\$ [3]

- (b) Carl, Dina and Eva share 100 oranges.

The ratio Carl's oranges : Dina's oranges = 3 : 5.

The ratio Carl's oranges : Eva's oranges = 2 : 3.

Find the number of oranges Carl receives.

..... [2]

- (c) Fred buys a house.

At the end of the first year, the value of the house increases by 5%.

At the end of the second year, the value of the house increases by 3% of its value at the end of the first year.

The value of Fred's house at the end of the second year is \$60 564.

Calculate how much Fred paid for the house.

\$ [3]

- (d) Gabrielle invests \$500 at a rate of $r\%$ per year compound interest.

At the end of 8 years the value of Gabrielle's investment is \$609.20 .

Find the value of r .

$r =$ [3]

- 2 (a) 100 students take part in a reaction test.
The table shows the results.

Reaction time (seconds)	6	7	8	9	10	11
Number of students	3	32	19	29	11	6

- (i) Write down the mode.

..... s [1]

- (ii) Find the median.

..... s [1]

- (iii) Calculate the mean.

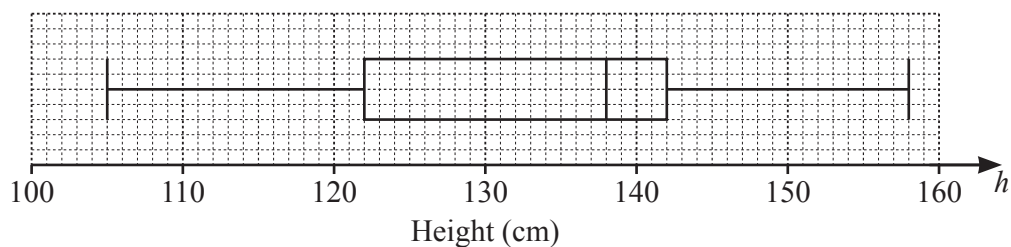
..... s [3]

- (iv) Two students are chosen at random.

Find the probability that both their reaction times are greater than or equal to 9 seconds.

..... [2]

- (b) The box-and-whisker plot shows the heights, h cm, of some students.



- (i) Find the range.

..... cm [1]

- (ii) Find the interquartile range.

..... cm [1]

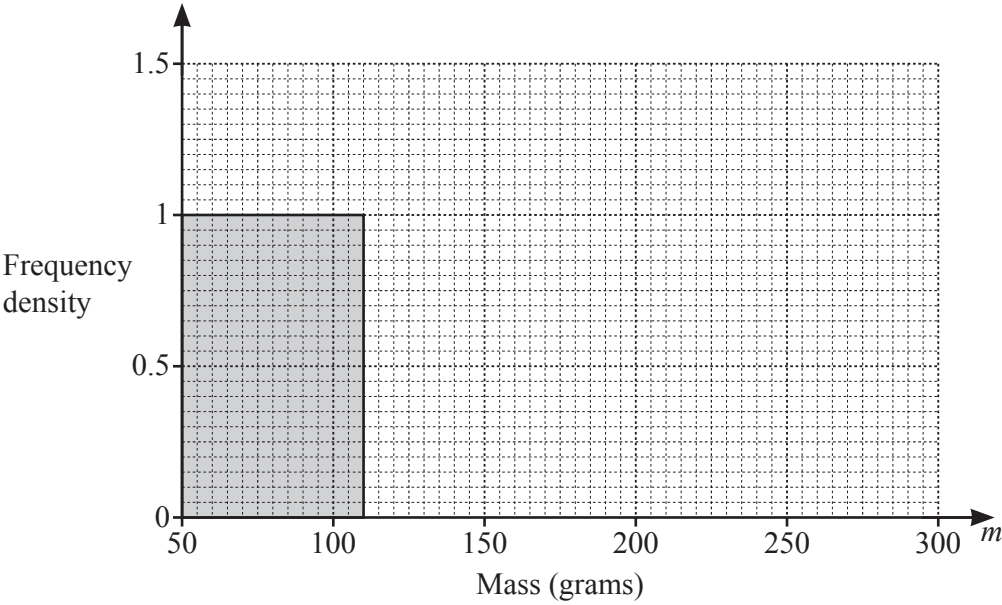
- (c) The mass of each of 200 potatoes is measured.
The table shows the results.

Mass (m grams)	$50 < m \leq 110$	$110 < m \leq 200$	$200 < m \leq 300$
Frequency	60	99	41

- (i) Calculate an estimate of the mean.

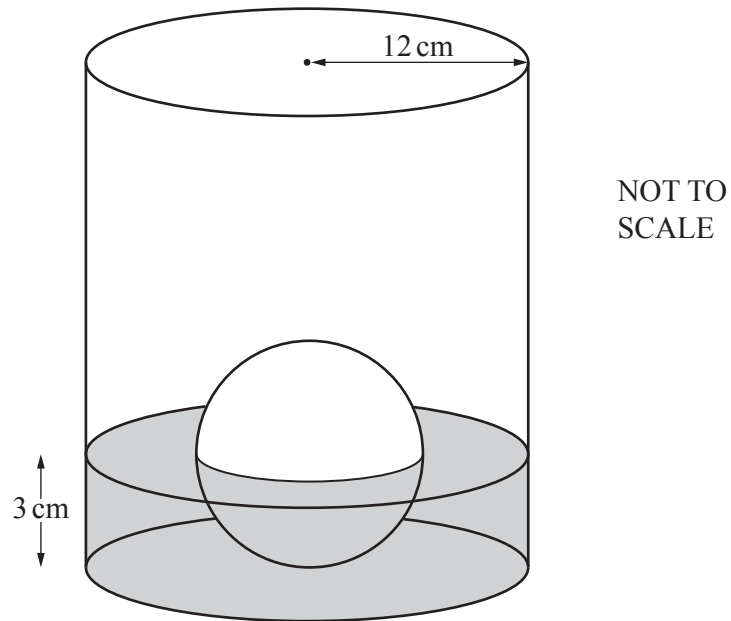
..... g [4]

- (ii) Complete the histogram to show the information in the table.



[2]

3



The diagram shows a cylinder containing water.
 There is a solid metal sphere touching the base of the cylinder.
 Half of the sphere is in the water.

The radius of the cylinder is 12 cm and the radius of the sphere is 3 cm.

- (a) The sphere is removed from the cylinder and the level of the water decreases by h cm.

Show that $h = 0.125$.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

[3]

- (b) The water in the cylinder is poured into another cylinder of radius R cm.
The depth of the water in this cylinder is 18 cm.

Calculate the value of R .

$R = \dots\dots\dots$ [3]

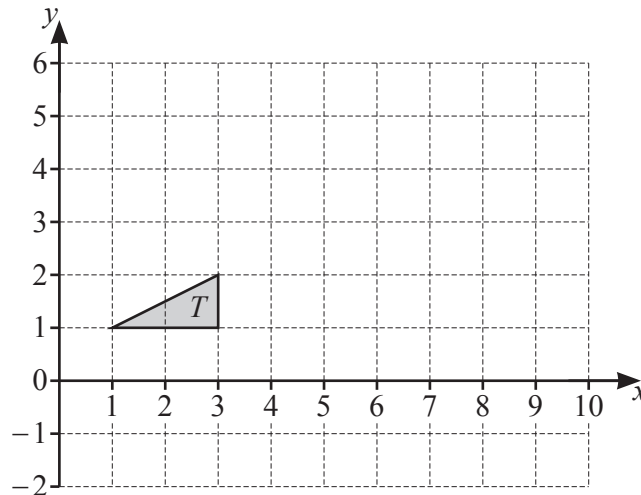
- (c) The sphere is melted down and some of the metal is used to make 30 cubes with
edge length 1.5 cm.

Calculate the percentage of metal **not** used.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$\dots\dots\dots$ % [3]

4 (a)



(i) Enlarge triangle T by scale factor 3, centre $(0, 2)$. [2]

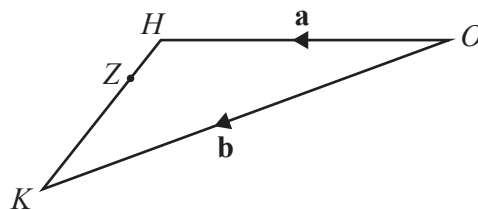
(ii) (a) Rotate triangle T about $(4, 2)$ by 90° clockwise. Label the image P . [2]

(b) Reflect triangle T in the line $x + y = 6$. Label the image Q . [3]

(c) Describe fully the **single** transformation that maps triangle P onto triangle Q .

..... [2]

(b)



NOT TO
SCALE

The diagram shows triangle OHK , where O is the origin.
 The position vector of H is $\mathbf{a}$ and the position vector of K is $\mathbf{b}$.
 Z is the point on HK such that $HZ : ZK = 2 : 5$.

Find the position vector of Z , in terms of $\mathbf{a}$ and $\mathbf{b}$.
 Give your answer in its simplest form.

..... [3]

- 5 (a) Expand and simplify.
 $(2p^2 - 3)(3p^2 - 2)$

..... [2]

(b) $s = \frac{1}{2}(u + v)t$

- (i) Find the value of s when $u = 20$, $v = 30$ and $t = 7$.

$s =$ [2]

- (ii) Rearrange the formula to write v in terms of s , u and t .

$v =$ [3]

- (c) Factorise completely.

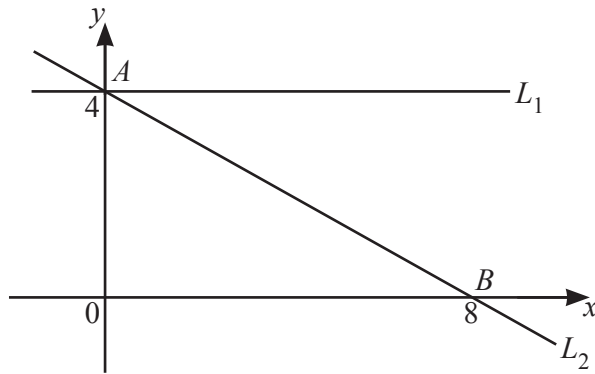
(i) $2qt - 3t - 6 + 4q$

..... [2]

(ii) $x^3 - 25x$

..... [3]

6

NOT TO
SCALE

A is the point $(0, 4)$ and B is the point $(8, 0)$.
 The line L_1 is parallel to the x -axis.
 The line L_2 passes through A and B .

(a) Write down the equation of L_1 .

..... [1]

(b) Find the equation of L_2 .

Give your answer in the form $y = mx + c$.

$y =$ [2]

(c) C is the point $(2, 3)$.

The line L_3 passes through C and is perpendicular to L_2 .

(i) Show that the equation of L_3 is $y = 2x - 1$.

[3]

11

- (ii) L_3 crosses the x -axis at D .

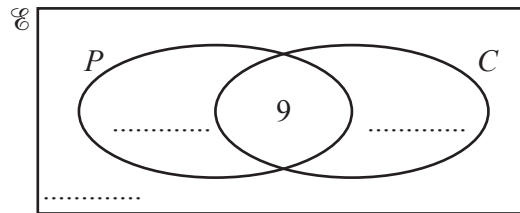
Find the length of CD .

..... [5]

7 $\mathcal{C} = \{\text{students in a class}\}$ $P = \{\text{students who study Physics}\}$ $C = \{\text{students who study Chemistry}\}$

$$n(\mathcal{C}) = 24 \quad n(P) = 17 \quad n(C) = 14 \quad n(P \cap C) = 9$$

(a) Complete the Venn diagram.



[2]

(b) (i) Find $n(P \cap C')$.

..... [1]

(ii) Find $n(P \cup C')$.

..... [1]

(c) Two students are picked from the class at random.

Find the probability that one student studies both subjects and one student studies Chemistry but not Physics.

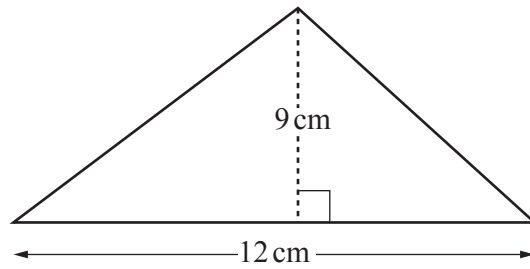
..... [3]

(d) Two of the students who study Physics are picked at random.

Find the probability that they both study Chemistry.

..... [2]

8 (a)

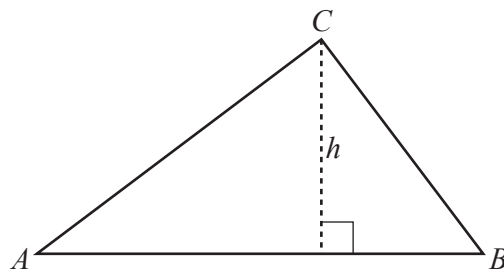


NOT TO
SCALE

Calculate the area of the triangle.

..... cm^2 [2]

(b)



NOT TO
SCALE

$AB = (2x + 3)\text{cm}$ and $h = (x + 5)\text{cm}$.

The area of triangle $ABC = 50\text{cm}^2$.

Find the value of x , giving your answer correct to 2 decimal places.
You must show all your working.

$x =$ [6]

9 $f(x) = x^3 - 3x^2 - 4$

(a) Find the gradient of the graph of $y = f(x)$ where $x = 1$.

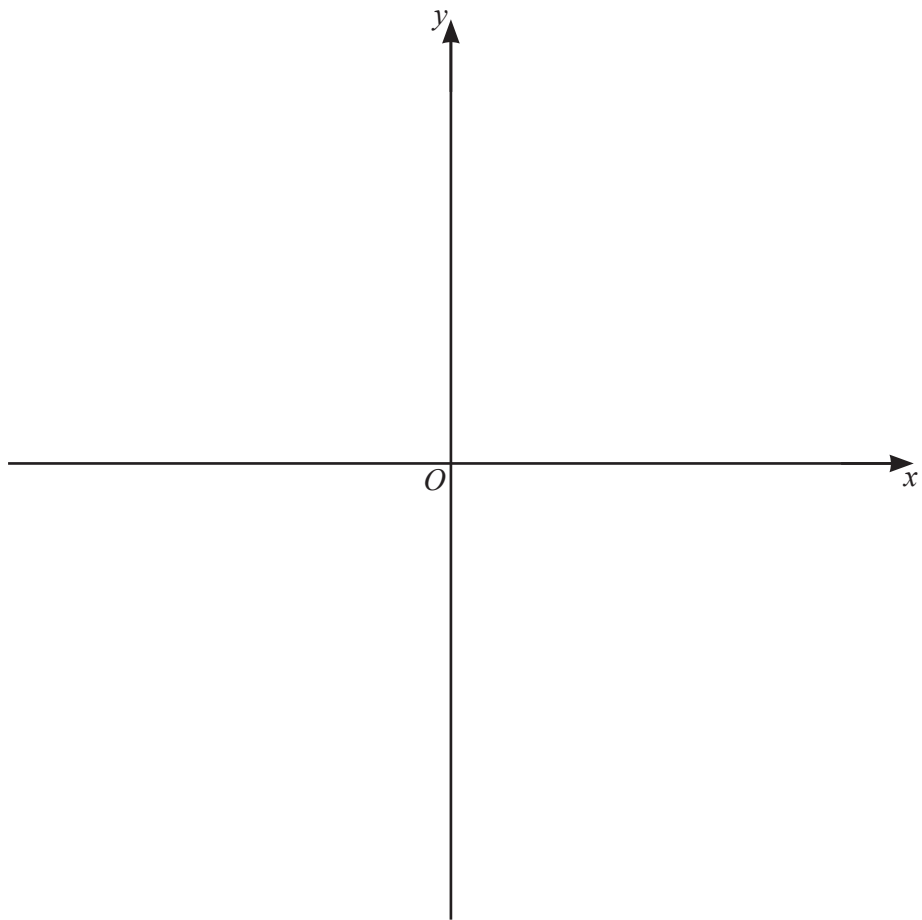
..... [3]

(b) Find the coordinates of the turning points of the graph of $y = f(x)$.

(..... , ...) , (..... , ...) [4]

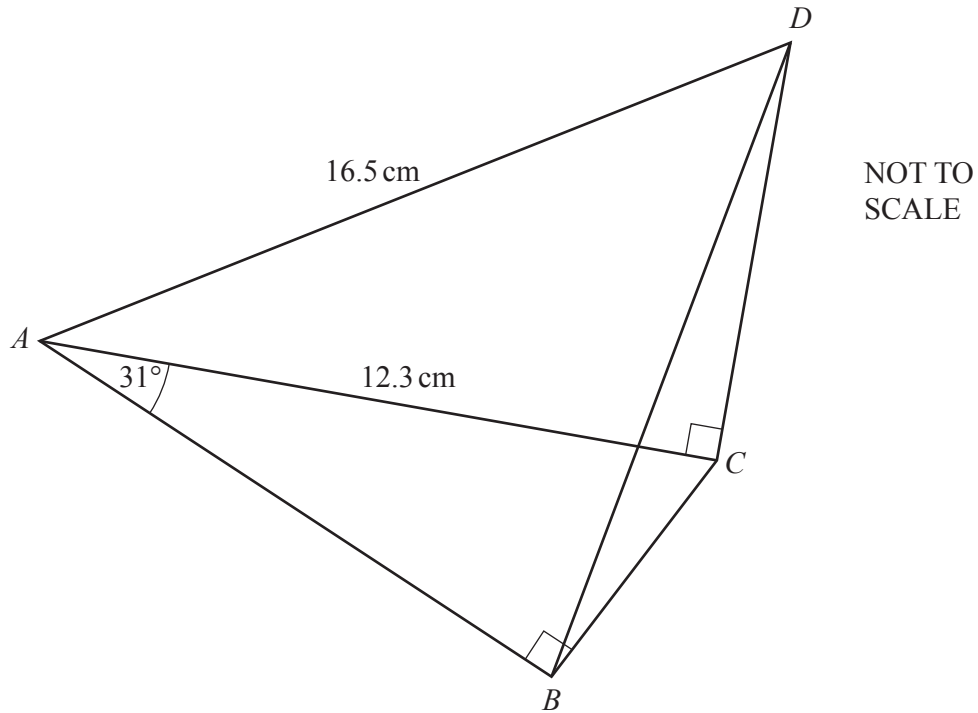
15

(c) Sketch the graph of $y = f(x)$.



[2]

10



The diagram shows a quadrilateral $ABCD$.

$AC = 12.3\text{ cm}$ and $AD = 16.5\text{ cm}$.

Angle $BAC = 31^\circ$, angle $ABC = 90^\circ$ and angle $ACD = 90^\circ$.

(a) Show that $AB = 10.54\text{ cm}$, correct to 2 decimal places.

[2]

(b) Show that angle $DAC = 41.80^\circ$ correct to 2 decimal places.

[2]

(c) Calculate BD .

$BD = \dots\dots\dots\text{cm}$ [3]

(d) Calculate angle CBD .

Angle $CBD = \dots\dots\dots$ [4]

(e) Calculate the shortest distance from C to BD .

$\dots\dots\dots\text{cm}$ [4]

11 $f(x) = 2x - 1$ $g(x) = 3x + 2$ $h(x) = \frac{1}{x}, x \neq 0$ $j(x) = x^2$

(a) Find $j(-1)$.

..... [1]

(b) Find x when $f(x) + g(x) = 0$.

$x =$ [2]

(c) Find $gg(x)$, giving your answer in its simplest form.

..... [2]

(d) Find $hf(x) + gh(x)$, giving your answer as a single fraction in its simplest form.

..... [4]

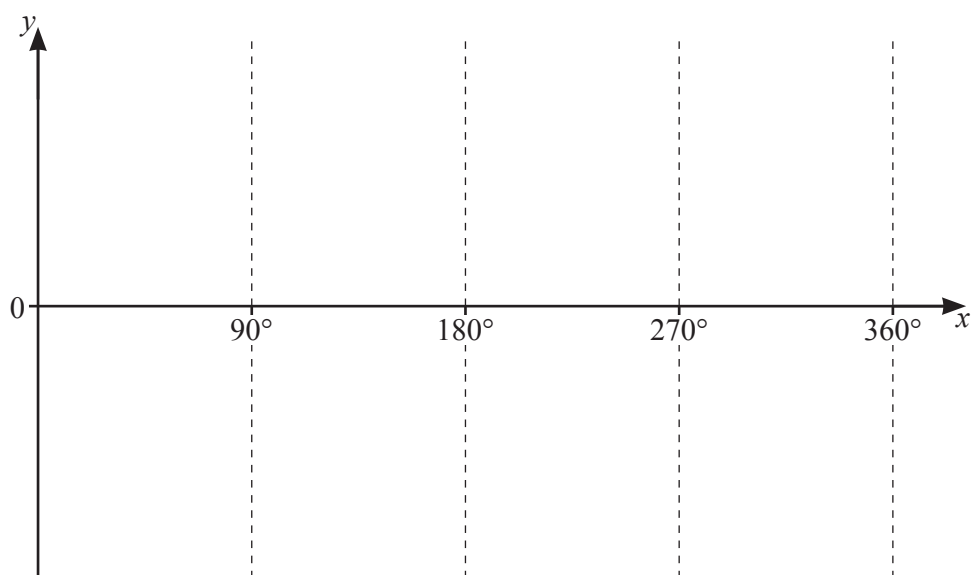
(e) When $pp(x) = x$, $p(x)$ is a function such that $p^{-1}(x) = p(x)$.

Draw a ring around the function that has this property.

$f(x) = 2x - 1$ $g(x) = 3x + 2$ $h(x) = \frac{1}{x}, x \neq 0$ $j(x) = x^2$

[1]

- 12 (a) Sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (b) Find x when $\tan x = \frac{1}{\sqrt{3}}$ and $0^\circ \leq x \leq 360^\circ$.

..... [2]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

February/March 2023

MARK SCHEME

Maximum Mark: 130

Published

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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$\frac{750}{8+7} \times 8$ [= 400]	M1	
1(a)(ii)(a)	37.5	1	
1(a)(ii)(b)	275	3	M2 for $250 + \frac{250 \times 2 \times 5}{100}$ oe or M1 for $\frac{250 \times 2 \times 5}{100}$ oe
1(a)(iii)	407[.00] cao nfw	3	B2 for 406.5 to 406.7 or M1 for $350 \times \left(1 + \frac{0.25}{100}\right)^{60}$ oe isw If 0 scored SC1 for answer 354 or answer 406
1(b)	24	2	M1 for [C : D =] 6 : 10 oe and [C : E =] 6 : 9 oe or for $\frac{6}{6+10+9} [\times 100]$ oe

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Question	Answer	Marks	Partial Marks
1(c)	56 000 nfww	3	M2 for $60564 \div \left(1 + \frac{3}{100}\right) \div \left(1 + \frac{5}{100}\right)$ oe or M1 for $[x \times] \left(1 + \frac{3}{100}\right) \times \left(1 + \frac{5}{100}\right)$ or for $60564 \div \left(1 + \frac{3}{100}\right)$ oe or $60564 \div \left(1 + \frac{5}{100}\right)$ If 0 scored, SC1 for answer 65499 to 65500
1(d)	2.5[0] or 2.499...	3	M2 for $\sqrt[8]{\frac{609.20}{500}}$ oe or M1 for $500 \times (\dots)^8 = 609.2[0]$ oe
2(a)(i)	7	1	
2(a)(ii)	8	1	
2(a)(iii)	8.31	3	M1 for $3 \times 6 + 32 \times 7 + 19 \times 8 + 29 \times 9 + 11 \times 10 + 6 \times 11$ oe M1dep on M1 for $\frac{\sum fx}{100}$
2(a)(iv)	$\frac{23}{110}$ oe	2	M1 for $\frac{k}{100} \times \frac{k-1}{99}$ oe, $k < 100$ or B1 for $\frac{46}{100}$ and $\frac{45}{99}$
2(b)(i)	53	1	
2(b)(ii)	20	1	

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Question	Answer	Marks	Partial Marks
2(c)(i)	151.975	4	M1 for 80, 155, 250 soi M1 for $\sum fx$ where x is in correct interval including boundaries M1 dep for $\frac{\sum fx}{200}$ dep on second M1
2(c)(ii)	Correct histogram completed with widths 110 to 200 and 200 to 300 and heights 1.1 and 0.41	2	B1 for one correct block If 0 scored, SC1 for 1.1 and 0.41 seen
3(a)	$[h =] \frac{\frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3}{\pi \times 12^2} \text{ oe}$ leading to 0.125 or $3 - \frac{\pi \times 12^2 \times 3 - \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3}{\pi \times 12^2} \text{ oe}$ leading to 0.125	M3	M2 for $\pi \times 12^2 \times h = \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 \text{ oe}$ or for $\pi \times 12^2 \times 3 = \pi \times 12^2 \times h + \frac{2}{3} \times \pi \times 3^3 \text{ oe}$ or for $\frac{\frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3}{\pi \times 12^2 \times 3} = \frac{h}{3} \text{ oe}$ or M1 for $\pi \times 12^2 \times h$ or $\frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 \text{ oe}$ or $\pi \times 12^2 \times 3$

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Question	Answer	Marks	Partial Marks
3(b)	4.8[0] or 4.795 to 4.796	3	M2 for $\pi \times 12^2 \times (3 - 0.125) = \pi \times R^2 \times 18$ oe or $\pi \times 12^2 \times 3 - \frac{2}{3} \times \pi \times 3^3 = \pi \times R^2 \times 18$ or B1 for $3 - 0.125$ or for 414π oe
3(c)	10.5 or 10.47 to 10.49	3	M2 for $\frac{\frac{4}{3} \times \pi \times 3^3 - 30 \times 1.5^3}{\frac{4}{3} \times \pi \times 3^3}$ or $\frac{30 \times 1.5^3}{\frac{4}{3} \times \pi \times 3^3} \times 100$ oe or M1 for $\frac{4}{3} \times \pi \times 3^3 - 30 \times 1.5^3$ or $\frac{30 \times 1.5^3}{\frac{4}{3} \times \pi \times 3^3}$ oe
4(a)(i)	Triangle at (3, -1), (9, -1), (9, 2)	2	B1 for correct shape, size and orientation or for correct plots but no triangle
4(a)(ii)(a)	Triangle at (3, 3), (4, 3), (3, 5)	2	B1 for correct shape size and orientation or for rotation about (4, 2) 90° anticlockwise or for correct plots but no triangle
4(a)(ii)(b)	Triangle at (4, 3), (5, 3), (5, 5)	3	B2 for correct shape size and orientation or for correct plots but no triangle or M1 for $x + y = 6$ drawn
4(a)(ii)(c)	Reflection $x = 4$	2	B1 for each

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Question	Answer	Marks	Partial Marks
4(b)	$\frac{5}{7}\mathbf{a} + \frac{2}{7}\mathbf{b}$ final answer	3	B2 for correct unsimplified answer OR M2 for $\overrightarrow{HZ} = \frac{2}{7}(\mathbf{b} - \mathbf{a})$ or $\overrightarrow{KZ} = \frac{5}{7}(\mathbf{a} - \mathbf{b})$ oe or M1 for $\overrightarrow{HK} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{KH} = -\mathbf{b} + \mathbf{a}$ or for a correct route
5(a)	$6p^4 - 13p^2 + 6$ final answer	2	B1 for three of $6p^4 - 9p^2 - 4p^2 + 6$ seen
5(b)(i)	175	2	M1 for $\frac{1}{2}(20 + 30) \times 7$ oe
5(b)(ii)	$\frac{2s - ut}{t}$ or $\frac{2s}{t} - u$ final answer	3	B2 for correct answer but unsimplified e.g. $\frac{s \div t}{0.5} - u$, $\frac{s}{\frac{1}{2}t} - u$, $\frac{s}{0.5t} - u$ OR M1 for correct multiplication by 2 or division by 0.5 M1 for correctly rearranging terms to isolate term in v M1 for correct division by t Max 2 marks if final answer incorrect
5(c)(i)	$(2q - 3)(t + 2)$ final answer	2	B1 for $t(2q - 3) + 2(2q - 3)$ or $2q(t + 2) - 3(t + 2)$

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Question	Answer	Marks	Partial Marks
5(c)(ii)	$x(x+5)(x-5)$ final answer	3	B2 for $(x^2 - 5x)(x+5)$ or $(x^2 + 5x)(x-5)$ or for correct answer seen then spoiled or B1 for $x(x^2 - 25)$
6(a)	$y = 4$ oe	1	
6(b)	$[y =] -\frac{1}{2}x + 4$ final answer	2	B1 for $\text{grad} = -\frac{4}{8}$ oe soi or $[y =] kx + 4$
6(c)(i)	Gradient = $\frac{-1}{\text{their gradient in (b)}}$	M1	Accept e.g. $2 \times -\frac{1}{2} = -1$ oe or states negative reciprocal of $-\frac{1}{2} = 2$
	Substituting (2, 3) in <i>their</i> equation.	M1	$3 = 2 \times \text{their } m + c$
	leading to $y = 2x - 1$	A1	No errors or omissions
6(c)(ii)	3.35 or 3.354...	5	B2 for $\left(\frac{1}{2}, 0\right)$ soi or x-coordinate of $D = \frac{1}{2}$ or M1 for $2x - 1 = 0$ M2 for $(2 - \text{their } \frac{1}{2})^2 + (3 - \text{their } 0)^2$ oe or M1 for $(2 - \text{their } \frac{1}{2})$ and $(3 - \text{their } 0)$ oe

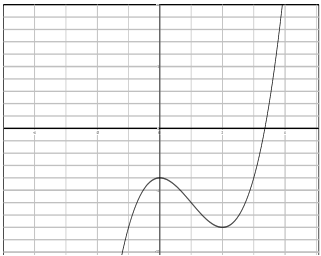
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Question	Answer	Marks	Partial Marks
7(a)	Completed Venn diagram. 	2	B1 for two correct values
7(b)(i)	8	1	FT <i>their (a)</i> <i>their</i> 8 dep < 24
7(b)(ii)	19	1	FT <i>their (a)</i> 24 – <i>their</i> 5 dep on positive answer
7(c)	$\frac{15}{92}$ oe	3	M2 for $[2\times]\frac{9}{24} \times \frac{\text{their } 5}{23}$ oe or M1 for $\frac{9}{24}$ and $\frac{\text{their } 5}{23}$ or $\frac{\text{their } 5}{24}$ and $\frac{9}{23}$ If 0 scored SC1 for answer $\frac{5}{32}$ oe
7(d)	$\frac{9}{34}$ oe	2	B1 for $\frac{9}{17}$ seen
8(a)	54	2	M1 for $\frac{1}{2} \times 12 \times 9$

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Question	Answer	Marks	Partial Marks
8(b)	$2x^2 + 13x - 85 [= 0]$	B3	M1 for $\frac{1}{2}(2x+3)(x+5) [= 50]$ oe B1 for $2x^2 + 10x + 3x + 15$
	$\frac{-13 \pm \sqrt{13^2 - 4(2)(-85)}}{2(2)}$ oe or $-\frac{13}{4} \pm \sqrt{\frac{85}{2} + \left(\frac{13}{4}\right)^2}$ oe	M2	M1 for $\sqrt{13^2 - 4 \times 2 \times -85}$ oe or for $\frac{-13 + \text{or } -\sqrt{p}}{2(2)}$ oe or for $[2]\left(x + \frac{13}{4}\right)^2$
	4.03 cao	B1	
9(a)	-3	3	B2 for $3x^2 - 6x$ or B1 for $3x^2 - kx$ or for $kx^2 - 6x$ or for $3x^2 - 6x + c$
9(b)	(0, -4) and (2, -8)	4	B3 for $x = 0$ and 2 or for (2, -8) OR M1 for <i>their</i> $3x^2 - 6x = 0$ or stating $\frac{dy}{dx} = 0$ oe M1 for correct method to solve <i>their</i> $3x^2 - 6x = 0$

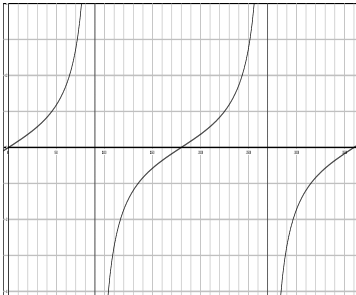
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Question	Answer	Marks	Partial Marks
9(c)	Correct sketch 	2	Max on negative y-axis and min in correct quadrant and extends into first quadrant B1 for positive cubic graph and two turning points
10(a)	$\cos 31 = \frac{AB}{12.3}$ oe	M1	
	10.543...	A1	
10(b)	$\cos = \frac{12.3}{16.5}$ oe	M1	
	41.801 to 41.802	A1	
10(c)	16.7 or 16.8 or 16.74 to 16.75...	3	M2 for $\sqrt{10.54^2 + 16.5^2 - 2 \times 10.54 \times 16.5 \times \cos(31 + 41.8)}$ or for $\sqrt{6.33^2 + 11^2 - 2 \times 6.33 \times 11 \times \cos(180 - 31)}$ OR M1 for $10.54^2 + 16.5^2 - 2 \times 10.54 \times 16.5 \times \cos(31 + 41.8)$ or for $6.33^2 + 11^2 - 2 \times 6.33 \times 11 \times \cos(90 + 90 - 31)$ oe A1 for 280 or 281 or 280.4 to 280.6

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Question	Answer	Marks	Partial Marks
10(d)	18.9 to 20.7... nfw	4	M1 for $\sin 31 = \frac{BC}{12.3}$ oe or better and $\sin 41.8[0] = \frac{CD}{16.5}$ oe M2dep on M1 for $\cos [DBC] = \frac{their(c)^2 + 6.34^2 - 10.998^2}{2 \times their(c) \times 6.34}$ or M1dep on M1 for $10.998^2 = their(c)^2 + 6.34^2 - 2 \times their(c) \times 6.34 \times \cos DBC$
10(e)	2.05 to 2.24... nfw	4	M1 for $\sin 31 = \frac{BC}{12.3}$ oe or better or $\sin 41.8[0] = \frac{CD}{16.5}$ oe M2dep on M1 for $\frac{\text{dist}}{theirBC} = \sin(\text{their angle } CBD)$ or $\frac{\text{dist}}{theirCD} = \sin(\text{their angle } CDB)$ or M1 for recognition of shortest distance
11(a)	1	1	
11(b)	$-\frac{1}{5}$ or -0.2	2	M1 for $2x - 1 + 3x + 2 = 0$ oe isw
11(c)	$9x + 8$ final answer	2	M1 for $3(3x + 2) + 2$

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Question	Answer	Marks	Partial Marks
11(d)	$\frac{4x^2 + 5x - 3}{x(2x - 1)}$ final answer	4	M1 for $\frac{1}{2x-1}$ and $3\left(\frac{1}{x}\right) + 2$ oe B1 for $x + 3(2x-1) + 2x(2x-1)$ oe or better isw B1 for common denominator = $x(2x-1)$ isw If 0 scored, SC1 for answer $\frac{4x^2 + 9x + 3}{x(2x+1)}$
11(e)	h(x) indicated	1	
12(a)	Correct sketch 	2	Condone curve touching asymptotes but not crossing B1 for one section correct or for 3 sections in correct part of graph but with incorrect curvature and no other sections in incorrect part of graph
12(b)	30 and 210 final answer	2	B1 for each If 0 scored SC1 for two answers (one acute and one reflex) with a difference of 180



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MATHEMATICS**0580/21**

Paper 2 (Extended)

October/November 2022**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

- 1 Write down a common multiple of 18 and 24.

..... [1]

- 2 A train journey starts at 23 40 and finishes at 06 50.

Work out the time taken for this journey.

..... h min [1]

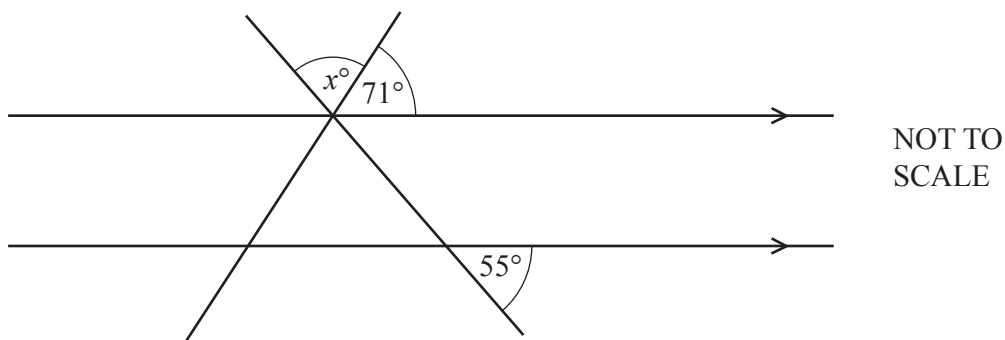
- 3 Write 32 cm as a fraction of 2 m.
Give your answer in its simplest form.

..... [2]

- 4 Divide \$200 in the ratio 7 : 3.

\$, \$ [2]

5



The diagram shows two straight lines intersecting two parallel lines.

Find the value of x .

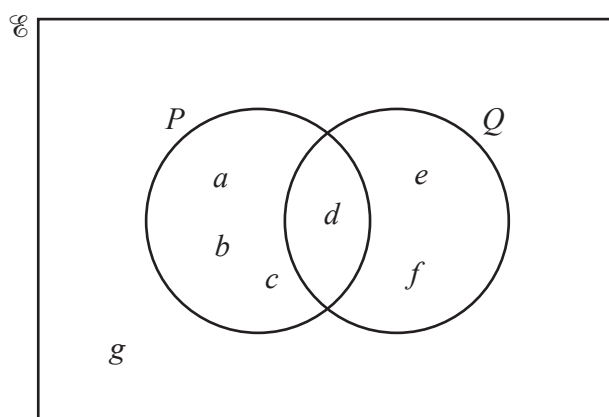
$x =$ [2]

- 6 The price of a computer is \$520.
This price is reduced by 15% in a sale.

Work out the sale price.

\$ [2]

7



The Venn diagram shows the elements of the sets $\mathcal{E}$, P and Q .

Complete the statements.

(a) $P = \{ \dots \}$ [1]

(b) $n(P \cup Q) = \dots$ [1]

- 8 (a) 3, 9, 27, 81, ...

Write down the next term in this sequence.

..... [1]

- (b) 13, 17, 21, 25, ...

Find the n th term of this sequence.

..... [2]

- 9 Without using a calculator, work out $\frac{1}{3} + \frac{5}{6}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [2]

- 10 Simplify $18x^{18} \div 9x^9$.

..... [2]

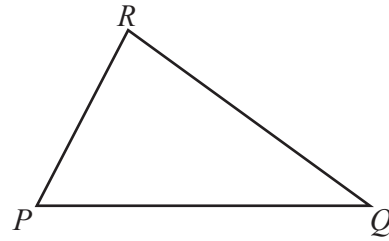
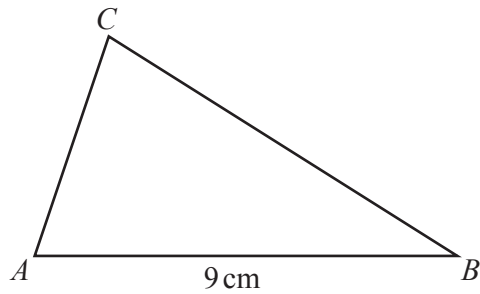
- 11 Solve the simultaneous equations.

$$\begin{aligned}x - 3y &= 7 \\ 2x - 3y &= 11\end{aligned}$$

$x =$

$y =$ [2]

12

NOT TO
SCALE

Triangle PQR is similar to triangle ABC with $\frac{PR}{AC} = \frac{2}{3}$.

$AB = 9\text{ cm}$ and the area of triangle ABC is 18 cm^2 .

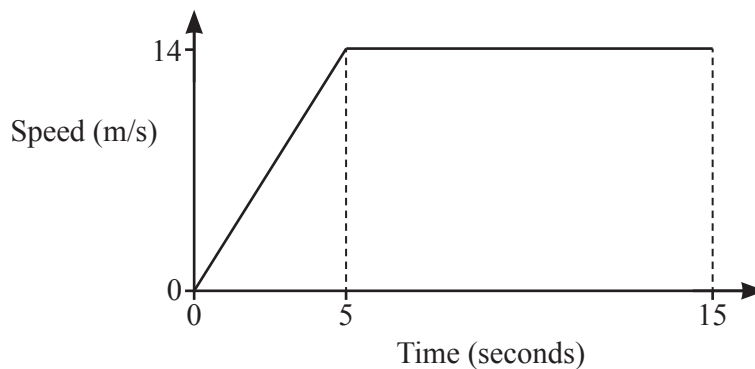
(a) Find the length of PQ .

..... cm [1]

(b) Find the area of triangle PQR .

..... cm^2 [2]

13

NOT TO
SCALE

The diagram shows the speed–time graph of the first 15 seconds of a car journey.

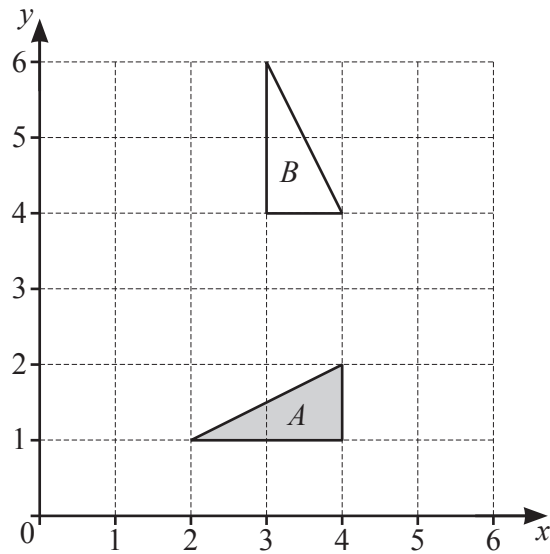
(a) Find the acceleration of the car during the first 5 seconds.

..... m/s^2 [1]

(b) Find the distance travelled during the 15 seconds.

..... m [2]

14



Describe fully the **single** transformation that maps triangle A onto triangle B .

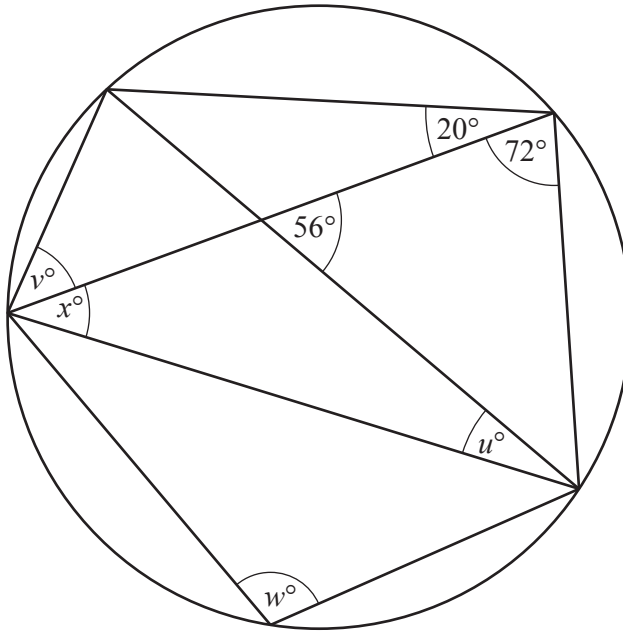
.....
 [3]

15 The perimeter of a sector of a circle with radius 8 cm is 26 cm.

Calculate the angle of this sector.

..... [3]

16

NOT TO
SCALE

The diagram shows a circle and eight chords.

Calculate the values of u , v , w and x .

$u = \dots\dots\dots$

$v = \dots\dots\dots$

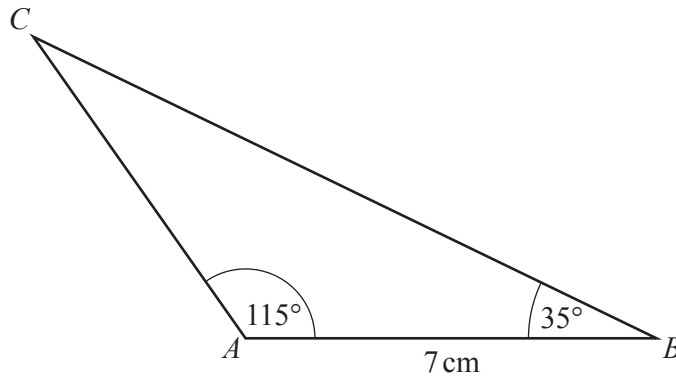
$w = \dots\dots\dots$

$x = \dots\dots\dots$ [4]

17 Simplify $(3125x^{3125})^{\frac{1}{5}}$.

$\dots\dots\dots$ [2]

18

NOT TO
SCALECalculate the length BC . $BC = \dots\dots\dots$ cm [4]

19 Expand and simplify.

$$(2x + 3)(x - 2)^2$$

 $\dots\dots\dots$ [3]

20 Factorise completely.

(a) $1 + x - y - xy$

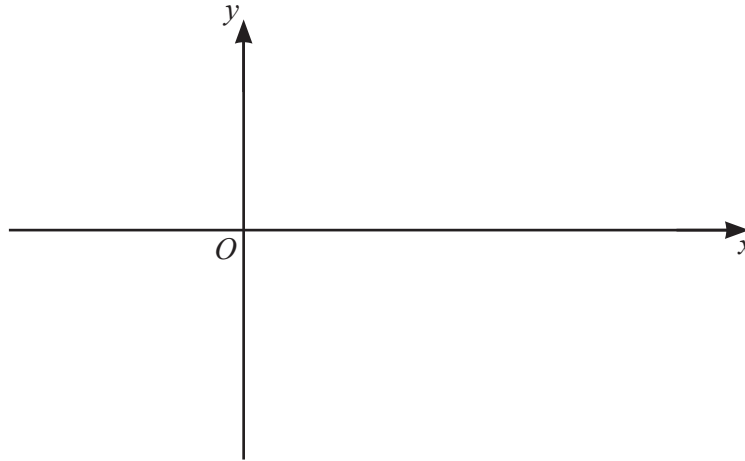
 $\dots\dots\dots$ [2]

(b) $2x^3 - 18xy^2$

 $\dots\dots\dots$ [3]

- 21 The graph of a cubic function has two turning points.
 When $x < 0$ and when $x > 4$ the gradient of the graph is positive.
 When $0 < x < 4$ the gradient of the graph is negative.
 The graph passes through the origin.

Sketch the graph.



[2]

22



- (a) On the diagram, sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$. [2]
- (b) Solve the equation $\cos x = -\frac{1}{2}$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

- 23 y is inversely proportional to $\sqrt{x}$ and x is directly proportional to w^2 .
When $w = 12$, $y = 12$.

Find y in terms of w .

$$y = \dots\dots\dots [3]$$

- 24 Violet and Wilfred recorded their times to run 200 m, correct to the nearest second.
Violet took 36 seconds and Wilfred took 39 seconds.

Work out the upper bound of the difference between their times.

$$\dots\dots\dots \text{ s } [2]$$

25 A bag contains 5 red balls, 4 blue balls and 3 green balls.

- (a) (i) Megan picks a ball at random.

Write down the probability that the ball is red or blue.

..... [1]

- (ii) Megan replaces the ball.
She picks a ball at random, notes the colour and replaces the ball.
She repeats this 60 times.

Calculate the number of times the ball is expected to be red or blue.

..... [1]

- (b) Mick picks 2 of the 12 balls at random, without replacement.

Calculate the probability that the balls are different colours.

..... [4]

- (c) Marie picks balls at random, without replacement, from the 12 balls.
When she picks a green ball she stops.

The probability that she picks a green ball on pick n is $\frac{21}{220}$.

Find the value of n .

$n =$ [2]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 Extended

October/November 2022

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of 7 printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
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Maths-Specific Marking Principles	
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3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
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5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao – correct answer only

dep – dependent

FT – follow through after error

isw – ignore subsequent working

oe – or equivalent

SC – Special Case

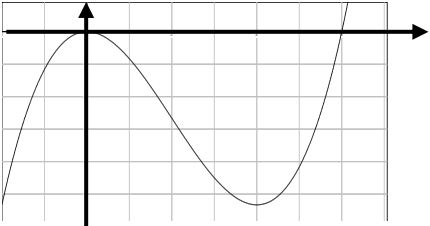
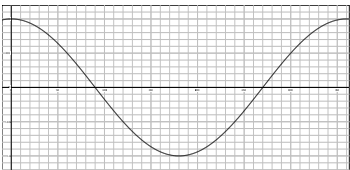
nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1	Any multiple of 72	1	
2	7 h 10 min	1	
3	$\frac{4}{25}$ cao	2	M1 for $\frac{32}{200}$ oe
4	140, 60	2	M1 for $\frac{200}{(7+3)} \times k$ where $k = 1, 7$ or 3
5	54	2	M1 for $180 - 71 - 55$ oe or B1 for 55 or 125 in a relevant correct position on the diagram
6	442	2	M1 for $\frac{100-15}{100} \times 520$ oe or B1 for 78
7(a)	a, b, c, d	1	
7(b)	6	1	
8(a)	243	1	
8(b)	$4n + 9$ oe final answer	2	B1 for $4n + k$ or $jn + 9, j \neq 0$ or for correct answer seen then spoilt
9	$\frac{2}{6} + \frac{5}{6}$ oe	M1	i.e. correct fractions with common denominator $6k$
	$1\frac{1}{6}$ cao	A1	
10	$2x^9$ final answer	2	B1 for kx^9 or $2x^k$ as final answer or $2x^9$ spoiled
11	$[x =] 4$ $[y =] -1$	2	B1 for each
12(a)	6	1	
12(b)	8	2	M1 for $\left(\frac{2}{3}\right)^2$ or $\left(\frac{3}{2}\right)^2$ oe seen
13(a)	2.8 oe	1	
13(b)	175	2	M1 for a correct relevant area calculation e.g. $(15 - 5) \times 14$ or $\frac{1}{2} \times 5 \times 14$ oe or better

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Question	Answer	Marks	Partial Marks
14	Rotation (5, 3) 90° clockwise oe	3	B1 for each
15	71.6 or 71.61 to 71.62	3	M2 for $\frac{\text{angle}}{360} = \frac{26-8-8}{2\pi \times 8}$ or better or M1 for $\frac{\text{angle}}{360} \times 2\pi \times 8$ oe
16	[u =] 20 [v =] 52 [w =] 108 [x =] 36	4	B1 for each
17	$5x^{625}$ final answer	2	B1 for final answer kx^{625} or $5x^k$ or correct answer spoiled
18	12.7 or 12.68 to 12.69	4	M3 for $\frac{7\sin 115}{\sin(180-115-35)}$ or B2 for 8.03... seen OR B1 for [angle C =] 30 M2 for $\frac{7\sin 115}{\sin(\text{their angle } C)}$ or M1 for $\frac{\sin 115}{BC} = \frac{\sin(\text{their angle } C)}{7}$ oe
19	$2x^3 - 5x^2 - 4x + 12$ final answer	3	B2 for correct expansion of the three brackets unsimplified or for simplified four-term expression of correct form with three terms correct or B1 for correct expansion of two of the three given brackets with at least three terms out of four correct
20(a)	$(1+x)(1-y)$ final answer	2	B1 for $1+x-y(1+x)$ or $1-y+x(1-y)$
20(b)	$2x(x+3y)(x-3y)$ final answer	3	B2 for $2x(x^2-9y^2)$ or correctly factorising into two brackets e.g. $(2x^2+6xy)(x-3y), (x^2-3xy)(2x+6y)$ or B1 for $2(x^3-9xy^2)$ or $x(2x^2-18y^2)$ or for $(x+3y)(x-3y)$

Question	Answer	Marks	Partial Marks
21	Correct sketch with maximum at origin and minimum in fourth quadrant 	2	B1 for any cubic with exactly 2 distinct turning points
22(a)	Correct sketch  Correct sketch to go through (0, 1), (360, 1) and (180, -1)	2	To go through (0, 1) and close to (360, 1) and reasonably close to (180, -1) B1 for correct cosine curve shape through (0, 1)
22(b)	120, 240	2	B1 for each or for two values with sum of 360
23	$\frac{144}{w}$ oe	3	M2 for $y = \frac{k}{w}$ oe or M1 for $x = cw^2$ or for $y = \frac{j}{\sqrt{x}}$ oe
24	4 nfw	2	M1 for $39 + 0.5$ or $36 - 0.5$ or better seen $39 - 0.5$ or $36 + 0.5$
25(a)(i)	$\frac{3}{4}$ oe	1	
25(a)(ii)	45	1	FT $60 \times$ <i>their</i> (a)(i) correctly evaluated
25(b)	$\frac{47}{66}$ oe	4	M3 for $1 - \left(\frac{5}{12} \times \frac{4}{11} + \frac{4}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11} \right)$ oe or M2 for $\left(\frac{5}{12} \times \frac{4}{11} + \frac{4}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11} \right)$ oe or $\left(\frac{5}{12} \times \frac{4}{11} + \frac{5}{12} \times \frac{3}{11} + \frac{4}{12} \times \frac{3}{11} \right)$ oe or M1 for $\frac{5}{12} \times \frac{4}{11}$ or $\frac{5}{12} \times \frac{3}{11}$ or $\frac{4}{12} \times \frac{3}{11}$ or $\frac{3}{12} \times \frac{2}{11}$ oe If 0 scored, SC1 for $\frac{47}{72}$ oe

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Question	Answer	Marks	Partial Marks
25(c)	5	2	M1 for correct trial to at least two balls one of which is not green



Cambridge IGCSE™

CANDIDATE
NAME
CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/22**

Paper 2 (Extended)

October/November 2022**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
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- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

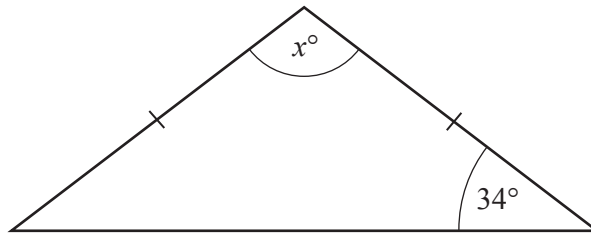
INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

2

1



NOT TO
SCALE

The diagram shows an isosceles triangle.

Find the value of x .

$x =$ [2]

2 Simplify.

$$y \times 27 - y \times 77$$

..... [1]

3 Find the sum of 3^2 and -3^2 .

..... [1]

4 Expand.

$$x(3 + x^2)$$

..... [2]

- 5 Jenna buys 2.4 m of ribbon and 4.8 m of fabric.
The total cost is \$33.48 .
Ribbon costs \$0.85 per metre.

Find the cost of 1 m of fabric.

\$ [3]

- 6 (a) These are the first five terms of a sequence.

27 26 23 18 11

Find the next two terms in the sequence.

....., ... [2]

- (b) The table shows information about two different sequences.

	First five terms of sequence	n th term
Sequence A	3 10 17 24 31	
Sequence B	2 11 26 47 74	

Complete the table.

- 7 Without using a calculator, work out $\frac{5}{9} - \frac{1}{6}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

- 8 Daryl records the number of hours in a week 8 people spend exercising.

5 2 1.5 3 18 4.5 2 4

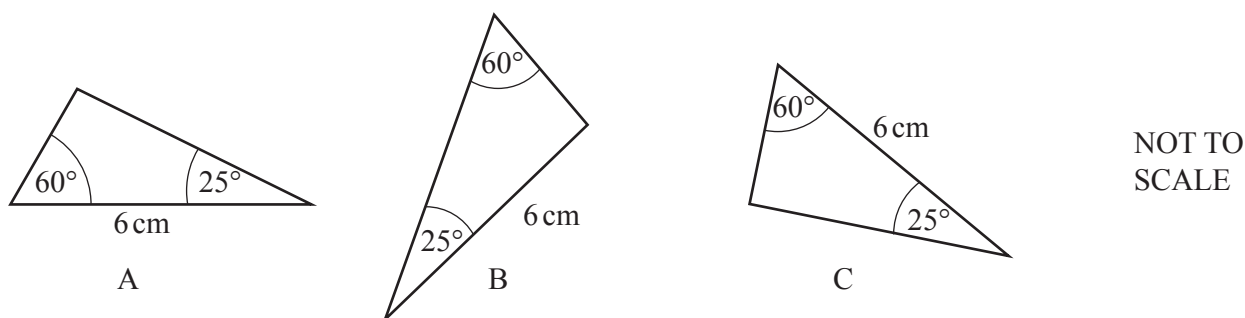
- (a) Find the median.

..... h [2]

- (b) Explain why the mean may not be a suitable average to use.

..... [1]

- 9 The diagram shows three triangles A, B and C.



- (a) Which two of the triangles A, B and C are congruent with each other?

..... [1]

- (b) Draw a ring around the congruence criterion that can be used to support your answer to **part (a)**.

SSS

ASA

SAS

RHS

[1]

10 Calculate.

(a) 2000×1.2^3

..... [1]

(b) $2\frac{1}{8} \times \frac{6}{17}$

..... [1]

(c) $\frac{4.5(\cos 30^\circ)}{\sqrt{3}} - 2$

..... [1]

11 The graph of $y = (x-3)(x+b)(x+2)$ intersects the y -axis at -30 .

(a) Find the value of b .

$b =$ [2]

(b) When $x > 0$ the graph crosses the x -axis once.

Write down the coordinates of this point.

(..... , ...) [1]

12 $x = 3^2 \times 5^2 \times 7 \times 199^{57}$ when written as a product of its prime factors.

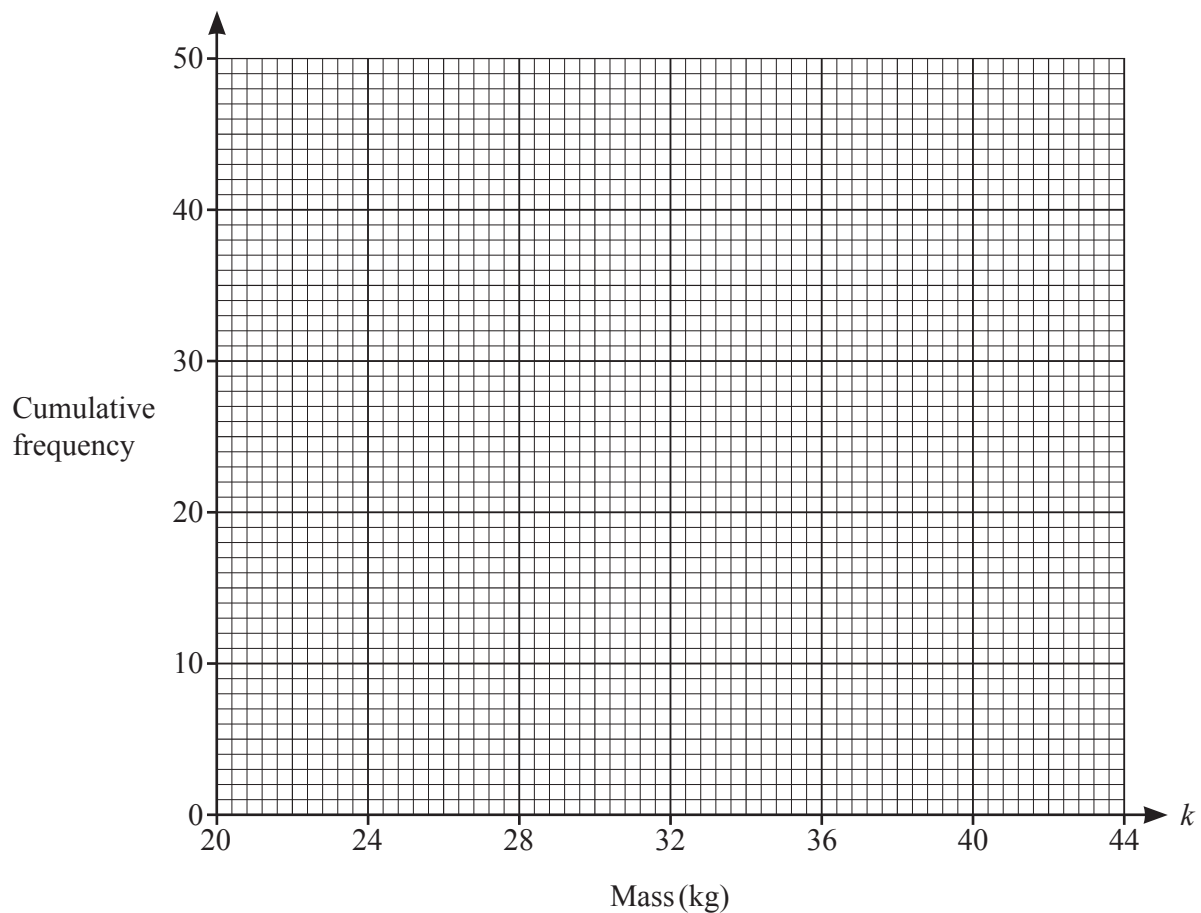
Write $x \div 315$ as a product of its prime factors.

..... [2]

- 13 The table shows information about the mass of each of 50 children.

Mass (k kg)	Cumulative Frequency
$k \leq 20$	0
$k \leq 22$	7
$k \leq 24$	23
$k \leq 28$	35
$k \leq 32$	43
$k \leq 36$	47
$k \leq 42$	50

- (a) Draw a cumulative frequency diagram to show this information.

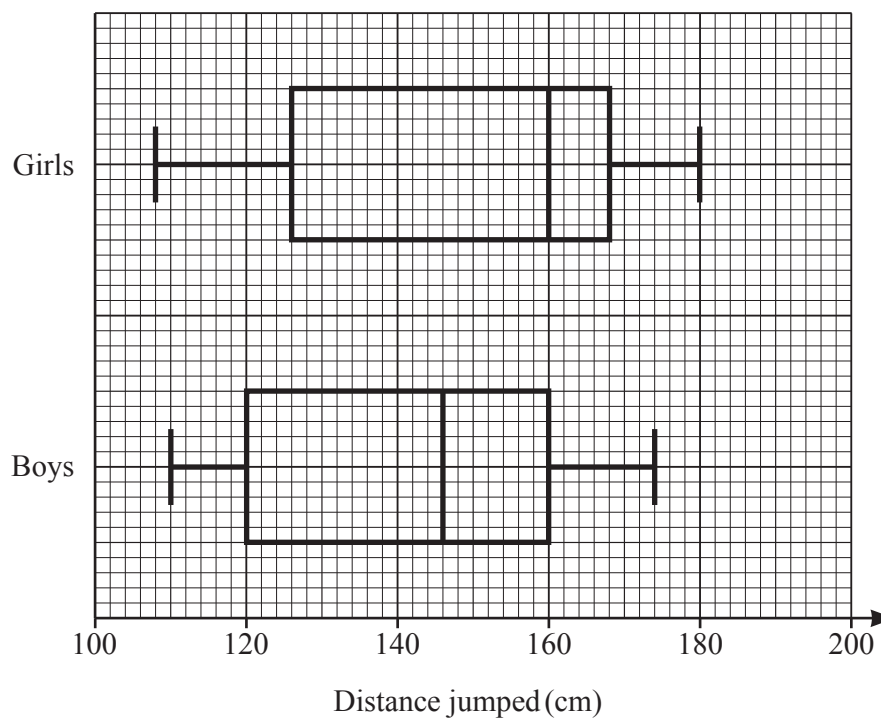


[3]

- (b) Use your graph to find an estimate of the 90th percentile.

..... [1]

- 14 136 girls and 144 boys each measure the distance they jump in centimetres. The box-and-whisker plots show the distributions of these distances.

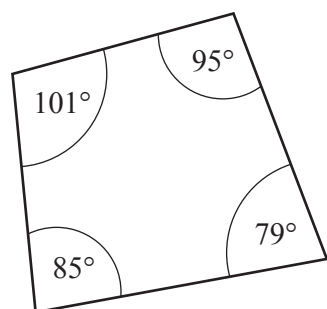


Each child who jumps a distance greater than 160 cm gets a certificate.

Work out an estimate of the total number of children who get a certificate.

..... [2]

15



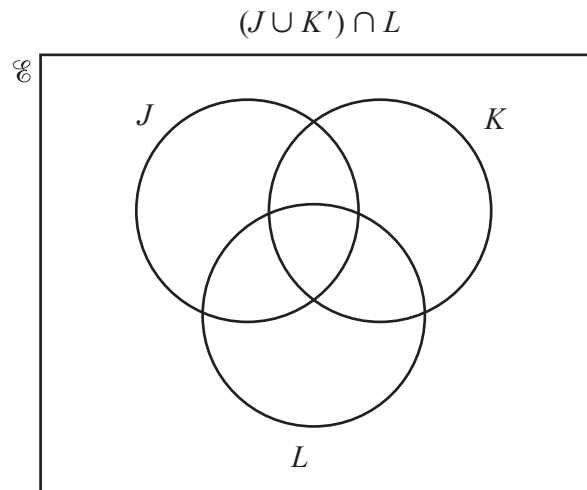
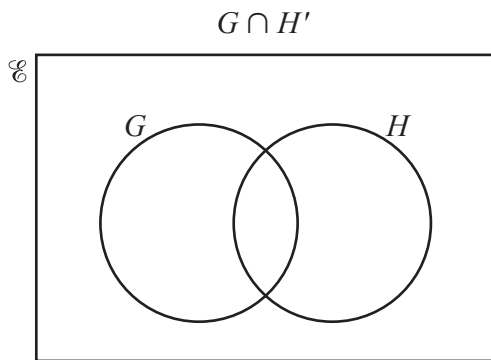
NOT TO
SCALE

The diagram shows a quadrilateral.

Give a geometrical reason why this is a cyclic quadrilateral.

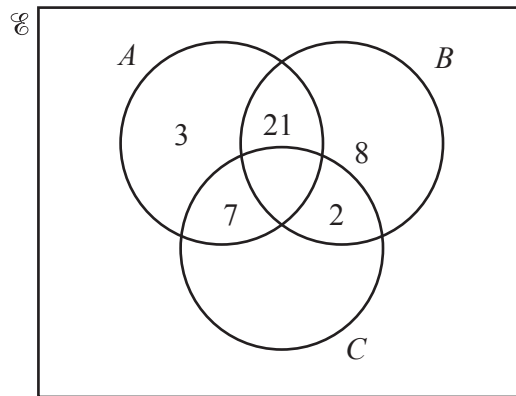
..... [1]

- 16 (a) Shade the region indicated in each Venn diagram.



[2]

- (b) The Venn diagram shows some information about the number of elements in sets A , B , C and $\mathcal{E}$.



Given the following information, complete the Venn diagram.

$$\begin{aligned} n(A \cap B \cap C) &= 1 \\ n(A \cup B \cup C)' &= 17 \\ n(C) &= 42 \end{aligned}$$

[2]

17

$$f(x) = x^2$$

$$g(x) = \frac{x+5}{2}$$

$$h(x) = 7x - 3$$

(a) Find $f(-3)$.

..... [1]

(b) Find $g^{-1}(x)$.

$g^{-1}(x) =$ [2]

(c) Solve $gf(x) = hh^{-1}(63)$ where $x > 0$.

$x =$ [3]

- 18 Write $0.4\dot{1}\dot{9}$ as a fraction in its simplest form.
You must show all your working.

..... [3]

- 19 Katy picks a number at random from the numbers 2, 3 and 5.
She then picks a number at random from the numbers 5, 6, 7 and 9.
When she adds the two numbers the answer is even.

Find the probability that **exactly one** of the numbers picked is a 5.

..... [3]

20 Simplify fully.

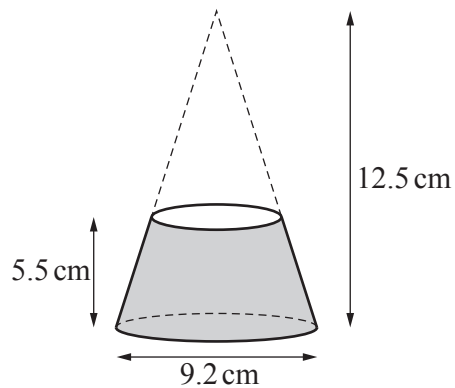
(a) $(81x^{16})^{\frac{3}{4}}$

..... [2]

(b) $\left(\frac{1}{y^2}\right)^{-\frac{1}{2}}$

..... [1]

21



NOT TO
SCALE

A solid is made by cutting a small cone from a larger cone, as shown in the diagram.

The height of the larger cone is 12.5 cm.

The height of the solid is 5.5 cm.

The diameter of the base of the larger cone is 9.2 cm.

Work out the volume of the solid.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [4]

Questions 22 and 23 are printed on the next page.

- 22 The volumes of two mathematically similar objects are 56 cm^3 and 875 cm^3 .
The height of the smaller object is 18 cm.

Find the height of the larger object.

..... cm [3]

- 23 Solve $\frac{4}{x+1} + \frac{2}{2x-5} = 3$.

You must show all your working.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [7]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 Extended

October/November 2022

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of 7 printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
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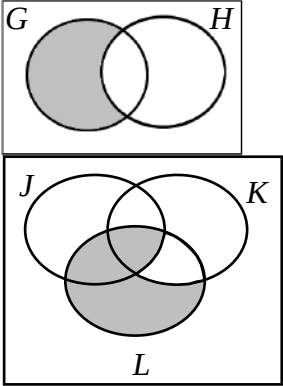
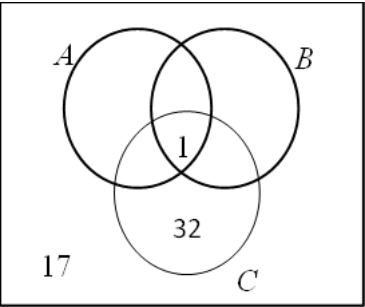
oe – or equivalent

SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1	112	2	M1 for $180 - 34 \times 2$ oe
2	$-50y$	1	
3	0	1	
4	$3x + x^3$ final answer	2	B1 for one correct term from two in final answer or for correct answer then spoilt
5	6.55	3	M2 for $(33.48 - 2.4 \times 0.85)$ oe or M1 for 2.4×0.85
6(a)	2 –9	2	B1 for one correct
6(b)	Sequence A $7n - 4$ oe final answer	2	B1 for $7n + c$ or $kn - 4$ $k \neq 0$ or for correct answer seen then spoilt
	Sequence B $3n^2 - 1$ oe final answer	2	M1 for finding second differences of 6 or has an answer that is a quadratic sequence or for correct answer seen then spoilt
7	$\frac{10}{18}$ and $\frac{3}{18}$	M1	Allow any correct common denominator 18k
	$\frac{7}{18}$ cao	A1	
8(a)	3.5	2	M1 for values in correct order 1.5 2 2 3 4 4.5 5 18 or 3 and 4 identified as middle numbers
8(b)	One extreme value oe	1	
9(a)	A and C	1	
9(b)	ASA	1	
10(a)	3456	1	
10(b)	0.75 or $\frac{3}{4}$ oe	1	
10(c)	0.25 or $\frac{1}{4}$	1	
11(a)	5	2	M1 for $(0 - 3)(0 + b)(0 + 2) = -30$ oe or better

Question	Answer	Marks	Partial Marks
11(b)	(3, 0)	1	
12	5×199^{57}	2	M1 for $[315 =] 3^2 \times 5 \times 7$ oe or $3^2 \times 5^2 \times 7 \div 315 = 5$
13(a)	A correct cumulative frequency diagram	3	B1 for correct horizontal placement for 7 plots B1 for correct vertical placement for 7 plots B1FT dep on at least B1 for reasonable increasing curve or polygon through <i>their</i> 7 points If 0 scored SC1 FT for 6 out of 7 points correctly plotted
13(b)	33 to 34.5	1	FT <i>their</i> increasing cumulative frequency graph
14	104	2	M1 for 0.5×136 oe or 0.25×144 oe
15	Opposite angles add up to 180 oe	1	
16(a)		2	B1 for each
16(b)		2	B1 for 2 correct
17(a)	9	1	
17(b)	$2x - 5$ final answer	2	M1 for correct first step e.g. $x = \frac{y+5}{2}$ or $2y = x + 5$ or $y - \frac{5}{2} = \frac{x}{2}$ or better

Question	Answer	Marks	Partial Marks
17(c)	11	3	M1 for $\frac{x^2+5}{2}$ M1 for $hh^{-1}(63) = 63$ soi
18	$419.\dot{1}\dot{9} - 4.\dot{1}\dot{9}$ oe	M1	
	$\frac{83}{198}$ cao	A2	A1 for $\frac{415}{990}$ oe If M0 scored SC1 for $\frac{k}{990}$ or correct answer with insufficient working
19	$\frac{3}{7}$ oe	3	M1 for clearly identifying the 7 even outcomes 2 6, 3 5, 3 7, 3 9, 5 5, 5 7, 5 9 M1 for clearly identifying the 3 even outcomes with just one five 3 5, 5 7 and 5 9 If 0 scored SC1 for answer $\frac{1}{4}$ oe
20(a)	$27x^{12}$ final answer	2	B1 for kx^{12} or $27x^c$ final answer or for $27x^{12}$ then spoilt
20(b)	$[\pm]y$	1	
21	228 or 228.3 to 228.4	4	M1 for $\frac{1}{3} \times \pi \times \left(\frac{9.2}{2}\right)^2 \times 12.5$ oe M1 for $\frac{9.2}{12.5} = \frac{\text{diameter}}{12.5-5.5}$ oe or better M1 for $\frac{1}{3} \times \pi \times \left(\frac{\text{their } 5.152}{2}\right)^2 \times (12.5-5.5)$ oe oe OR M2 for $\frac{\pi}{3} \times \left(\frac{9.2}{2}\right)^2 \times 12.5 - \frac{\pi}{3} \times r^2 \times (12.5-5.5)$ oe for any $r < 4.6$ If 0 scored SC1 for 913 or 913.3 to 913.5

Question	Answer	Marks	Partial Marks
22	45	3	M2 for $\sqrt[3]{\frac{875}{56}} \times 18$ oe or M1 for $\sqrt[3]{\frac{875}{56}}$ or $\sqrt[3]{\frac{56}{875}}$ oe or $\frac{18^3}{h^3} = \frac{56}{875}$ oe
23	$[0 =] 6x^2 - 19x + 3$	B5	B4 for $8x - 20 + 2x + 2 = 6x^2 + 6x - 15x - 15$ or better OR M2 for $4(2x - 5) + 2(x + 1) = 3(x + 1)(2x - 5)$ oe or M1 for $4(2x - 5) + 2(x + 1)$ or better or common denominator $(x + 1)(2x - 5)$ or better B1 for $2x^2 + 2x - 5x - 5$ or better seen M1 for correctly simplifying <i>their</i> quadratic to the form $[0 =] ax^2 + bx + c$
	Correct method to solve <i>their</i> three term quadratic	M1	e.g. $(6x - 1)(x - 3)$ $\frac{-(-19) \pm \sqrt{(-19)^2 - 4 \times 6 \times 3}}{2 \times 6}$
	$x = 3, x = \frac{1}{6}$ oe	B1	



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MATHEMATICS**0580/23**

Paper 2 (Extended)

October/November 2022**1 hour 30 minutes**

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- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 Marco starts work at 20 45 and finishes at 02 08 the next day.

Find the length of time, in hours and minutes, he works.

..... h min [1]

2

120

121

149

164

216

From this list, write down

(a) a square number

..... [1]

(b) a cube number.

..... [1]

- 3 Calculate.

$$\sqrt{15} + \frac{4.8}{2.2}$$

..... [1]

3

- 4 The mean mass of four men in a rowing team is 97.5 kg.
The modal mass is 101 kg.
The range of the masses is 8 kg.

Find the mass of each of the four men.

..... kg , ... kg , ... kg, ... kg [3]

- 5 **Without using a calculator**, work out $\frac{5}{7} - \frac{2}{3}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

- 6 A spinner can land on the colours green, black or red.
The table shows the probabilities of the spinner landing on green or black.

Colour	Green	Black	Red
Probability	$\frac{2}{5}$	$\frac{1}{4}$	

(a) Complete the table. [2]

(b) Chang spins the spinner 120 times.

Find the expected number of times it lands on green.

..... [1]

- 7 Find the lowest common multiple (LCM) of 36 and 60.

..... [2]

- 8 A is the point $(-3, 5)$ and B is the point $(5, 2)$.

Find the coordinates of the midpoint of the line AB .

(..... , ...) [2]

9 Solve the simultaneous equations.

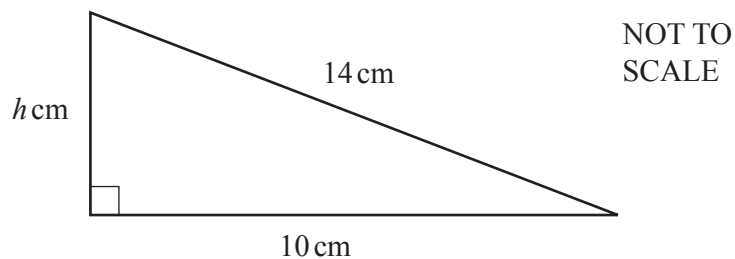
$$3x - 2y = 21$$

$$5x + 2y = 51$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [2]$$

10



The diagram shows a right-angled triangle.

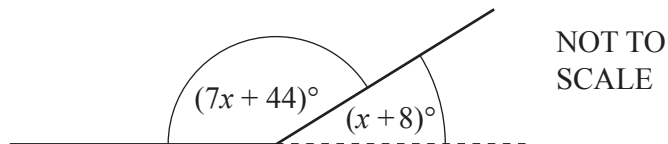
(a) Calculate the value of h .

$$h = \dots\dots\dots [3]$$

(b) Find the perimeter of this triangle.

$$\dots\dots\dots \text{ cm } [1]$$

11



The diagram shows two sides of a regular polygon.

The interior angle of the polygon is $(7x + 44)^\circ$ and the exterior angle is $(x + 8)^\circ$.

Find the number of sides of this polygon.

..... [4]

- 12 Keita invests \$4000 at a rate of 2.6% per year compound interest.

Work out the interest earned on the investment at the end of 3 years.

\$ [3]

- 13 Convert $0.2\dot{4}$ to a fraction.

You must show all your working and give your answer in its simplest form.

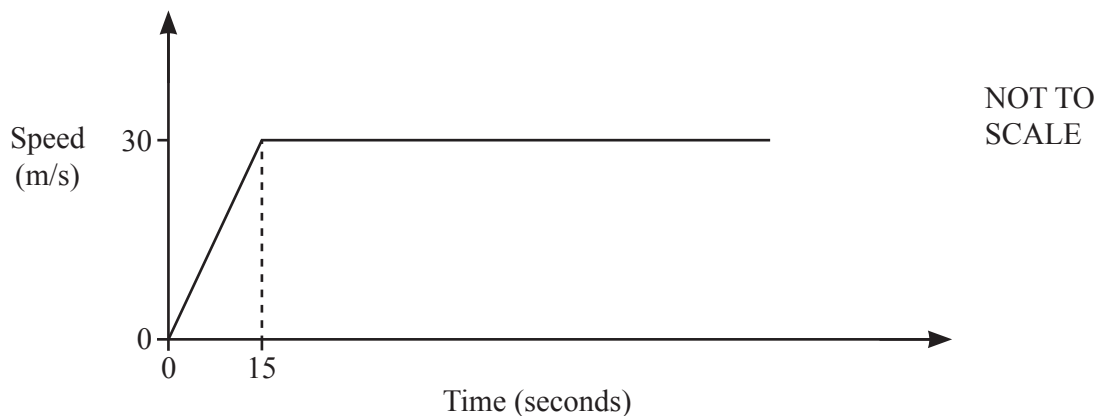
..... [2]

- 14 A map has a scale of 1 : 200 000.

Find the area, in square kilometres, of a lake that has an area of 12.4 cm^2 on the map.

..... km^2 [2]

- 15 The diagram shows the speed–time graph for part of the journey of a car.



The car starts from rest and accelerates at a uniform rate for 15 seconds before reaching a constant speed of 30 m/s.

- (a) Calculate the acceleration for the first 15 seconds.

..... m/s^2 [1]

- (b) After T minutes, the total distance travelled is 45 kilometres.

Find the value of T .

$T =$ min [4]

- 16** A kite is drawn on a coordinate grid.
The diagonals of the kite intersect at the point $(-2, -5)$.

One diagonal has equation $y = 4x + 3$.

Find the equation of the other diagonal of the kite.
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

- 17** y is proportional to the square of $(x - 7)$.
When $x = 12$, $y = 2$.

Find y when $x = 17$.

$y = \dots\dots\dots$ [3]

- 18** Two bottles are mathematically similar.
The small bottle has a capacity of 324 ml and a height of 12 cm.
The large bottle has a capacity of 768 ml.

Calculate the height of the large bottle.

$\dots\dots\dots$ cm [3]

19 $f(x) = 5x - 3, x > 1$

$$g(x) = \frac{10}{x-2}, x \neq 2$$

- (a) Find $gf(x)$.
Give your answer in its simplest form.

..... [2]

- (b) Find $g^{-1}(x)$.

$$g^{-1}(x) = \text{.....} [3]$$

- (c) Find $ff^{-1}(x-1)$.

..... [1]

20 (a)



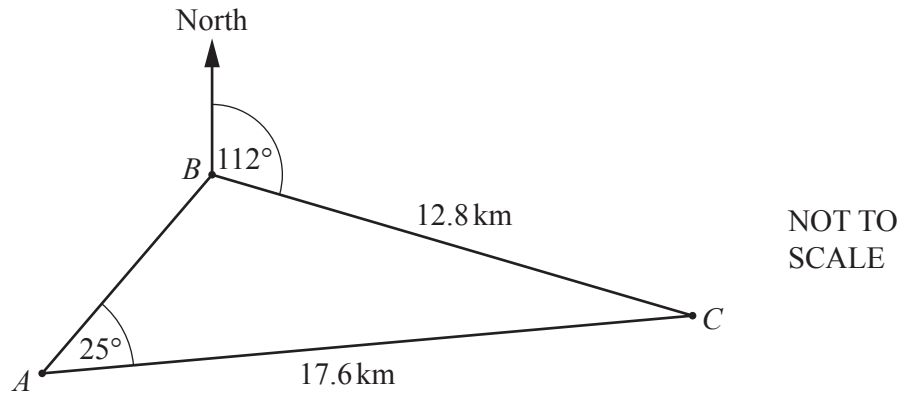
Sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

[2]

(b) Solve $3 - 2 \sin x = \frac{13}{4}$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

21



The diagram shows the positions of three ships A , B and C .
 $AC = 17.6$ km, $BC = 12.8$ km and angle $BAC = 25^\circ$.
The bearing of C from B is 112° and angle ABC is obtuse.

Calculate the bearing of B from A .

..... [5]

Question 22 is printed on the next page.

22 (a) Expand and simplify.

$$(2x - 1)(x + 4)(x - 3)$$

..... [3]

(b) Write as a single fraction in its simplest form.

$$\frac{4}{2x - 3} \div \frac{2x^2 + 14x}{2x^2 + 11x - 21}$$

..... [4]

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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 Extended

October/November 2022

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **6** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao – correct answer only

dep – dependent

FT – follow through after error

isw – ignore subsequent working

oe – or equivalent

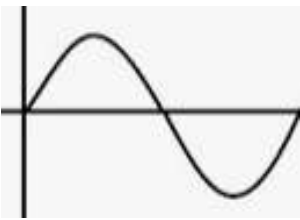
SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1	5[h] 23[min]	1	
2(a)	121	1	
2(b)	216	1	
3	6.05 or 6.054 to 6.055	1	
4	93 95 101 101	3	M1 for 4×97.5 implied by 390 or for four numbers which add to 390 B1 for four numbers with a range of 8 B1 for four numbers with mode of 101 to a maximum of 2 marks
5	$\frac{15}{21}$ and $\frac{14}{21}$ oe	M1	Allow any correct common denominator 21k
	$\frac{1}{21}$ cao	A1	
6(a)	$\frac{7}{20}$ oe or 0.35 or 35%	2	M1 for $1 - \left(\frac{2}{5} + \frac{1}{4}\right)$ oe
6(b)	48	1	
7	180	2	M1 for answer $2 \times 2 \times 3 \times 3 \times 5$ or better or for answer 180k or two correct factor trees, tables or Venn diagram or better or a list of multiples of both 36 and 60 with at least 3 correct of each
8	(1, 3.5)	2	B1 for each
9	[x =] 9 [y =] 3	2	B1 for each answer
10(a)	9.8[0] or 9.797 to 9.798	3	M2 for $14^2 - 10^2$ oe or better or M1 for $10^2 + h^2 = 14^2$ oe or better
10(b)	33.8 or 33.79 to 33.80	1	FT 24 + <i>their</i> (a)
11	15	4	B2 for $x = 16$ soi or M1 for $7x + 44 + x + 8 = 180$ or better M1 for $360 \div (\text{their } x + 8)$ oe
12	320.18	3	B2 for 4320.18 or M1 for $4000 \times \left(1 + \frac{2.6}{100}\right)^3 [-4000]$ oe

Question	Answer	Marks	Partial Marks
13	$2.\dot{4} - 0.2\dot{4}$ oe	M1	
	$\frac{11}{45}$ cao	B1	If 0 scored SC1 for $\frac{k}{90}$.
14	49.6	2	M1 for answer figs 496
15(a)	2	1	
15(b)	25.125	4	M3 for $\frac{15 \times 30}{2} + 30(k - 15) [= \text{figs } 45]$ oe OR B2 for 44 775 or 44.775 OR M1 for $\frac{15 \times 30}{2}$ or $30(k - 15)$ oe B1 for 45 000 or 0.225 or 0.03
16	$[y =] -\frac{1}{4}x - \frac{11}{2}$ oe	3	M1 for $\text{grad} = -\frac{1}{4}$ oe soi M1 for correct substitution shown of $(-2, -5)$ into $y = (\text{their } m)x + c$ oe ($\text{their } m \neq 4$)
17	8	3	
18	16	3	M2 for $12 \times \sqrt[3]{\frac{768}{324}}$ oe or M1 for $\sqrt[3]{\frac{768}{324}}$ or $\sqrt[3]{\frac{324}{768}}$ or $\frac{h^3}{12^3} = \frac{768}{324}$ oe
19(a)	$\frac{2}{x-1}$ final answer	2	M1 for $\frac{10}{5x-3-2}$ or better
19(b)	$\frac{10}{x} + 2$ or $\frac{10+2x}{x}$ final answer	3	M2 for $y - 2 = \frac{10}{x}$ or $x = \frac{10+2y}{y}$ oe or $yx = 10 + 2x$ oe or M1 for $x = \frac{10}{y-2}$ or $y(x-2) = 10$ oe or better
19(c)	$x - 1$	1	

Question	Answer	Marks	Partial Marks
20(a)	 Correct sketch to go through (0, 0), (180, 0) and (360, 0)	2	B1 for correct sine curve shape through the origin
20(b)	187.2 and 352.8	3	B2 for one correct value, if more than two answers given award B2 if any of the correct answers found and may be in the working or M1 for $\sin x = -\frac{1}{8}$ oe soi If 0 scored, SC1 for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
21	076 or 076.4 to 076.5	5	B3 for [angle ABC =] 144 or 144.4 to 144.5 OR M2 for $[\sin ABC =] \frac{17.6 \sin 25}{12.8}$ oe or M1 for $\frac{17.6}{\sin B} = \frac{12.8}{\sin 25}$ oe M1 for 180 – their 35.5 AND M1 for their angle ABC – (180 – 112) oe
22(a)	$2x^3 + x^2 - 25x + 12$ final answer	3	B2 for correct unsimplified expanded expression or for simplified four-term expression of correct form with 3 terms correct or B1 for correct expansion of 2 brackets with at least 3 terms out of 4 correct
22(b)	$\frac{2}{x}$ final answer	4	M1 for $\left[\frac{4}{2x-3} \right] \times \frac{2x^2 + 11x - 21}{2x^2 + 14x}$ oe soi B1 for $(x+7)(2x-3)$ oe factorised B1 for $2x(x+7)$ oe factorised



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CENTRE
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NUMBER

MATHEMATICS**0580/41**

Paper 4 (Extended)

October/November 2022**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1 (a) Calculate the volume of

(i) a solid cylinder with radius 6 cm and height 14 cm,

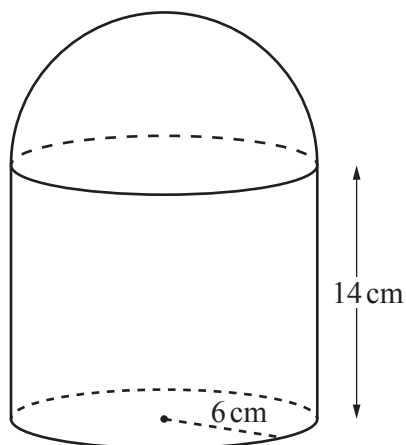
..... cm³ [2]

(ii) a solid hemisphere with radius 6 cm.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm³ [2]

(b)



NOT TO
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The cylinder and hemisphere in **part (a)** are joined to form the solid in the diagram.
The solid is made of steel and 1 cm³ of steel has a mass of 7.85 g.

(i) Show that 1 cm³ of steel has a mass of 0.007 85 kg.

[1]

(ii) Calculate the total mass of the solid.

..... kg [2]

(c) 2000 cm^3 of iron is melted down and some of it is used to make 50 spheres with radius 2 cm.

- (i) Calculate the percentage of iron that is left over.
[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... % [3]

- (ii) The iron left over is then made into a cube.

Calculate the length of an edge of the cube.

..... cm [1]

- (d) A solid cone has radius $3R$ cm and slant height $9R$ cm.

A solid cylinder has radius x cm and height $7x$ cm.

The **total** surface area of the cone is equal to the **total** surface area of the cylinder.

Given that $R = kx$, find the value of k .

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi rl$.]

$k =$ [4]

2 (a) Write

(i) 2994.99 correct to the nearest 10,

..... [1]

(ii) 0.983 correct to 1 decimal place,

..... [1]

(iii) 2090 correct to 2 significant figures.

..... [1]

(b) Write down a prime number between 90 and 100.

..... [1]

(c) Write 2^{-6} as a fraction.

..... [1]

(d) Write 0.007 01 in standard form.

..... [1]

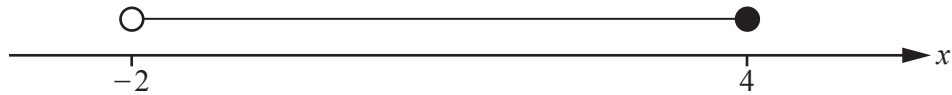
(e) Simplify $1.5 \times 10^x + 1.5 \times 10^{x-1}$ giving your answer in standard form.

..... [2]

(f) Write $0.\dot{3}\dot{7}$ as a fraction.
You must show all your working.

..... [2]

3 (a)



Write down the inequality shown by the number line.

..... [1]

(b) $-3 \leq 2x + 3 < 9$

(i) Solve the inequality.

..... [3]

(ii) Write down all the integer values of x that satisfy the inequality.

..... [2]

(c) Solve the equations.

(i) $3(3-x) - \frac{2(x+2)}{5} = 1$

 $x =$ [4]

(ii) $\frac{5}{x+3} = \frac{3}{x+5}$

 $x =$ [3]

- 4 (a) (i) Zak invests \$500 at a rate of 2% per year simple interest.

Calculate the value of Zak's investment at the end of 5 years.

\$ [3]

- (ii) Yasmin invests \$500 at a rate of 1.8% per year compound interest.

Calculate the value of Yasmin's investment at the end of 5 years.

\$ [2]

- (iii) Zak and Yasmin continue with these investments.

How many **more complete** years is it before the value of Yasmin's investment is greater than the value of Zak's investment?

..... [3]

- (b) Xavier buys a car for \$2500.
The value of the car decreases exponentially at a rate of 10% each year.

Calculate the value of Xavier's car at the end of 5 years.
Give your answer correct to the nearest dollar.

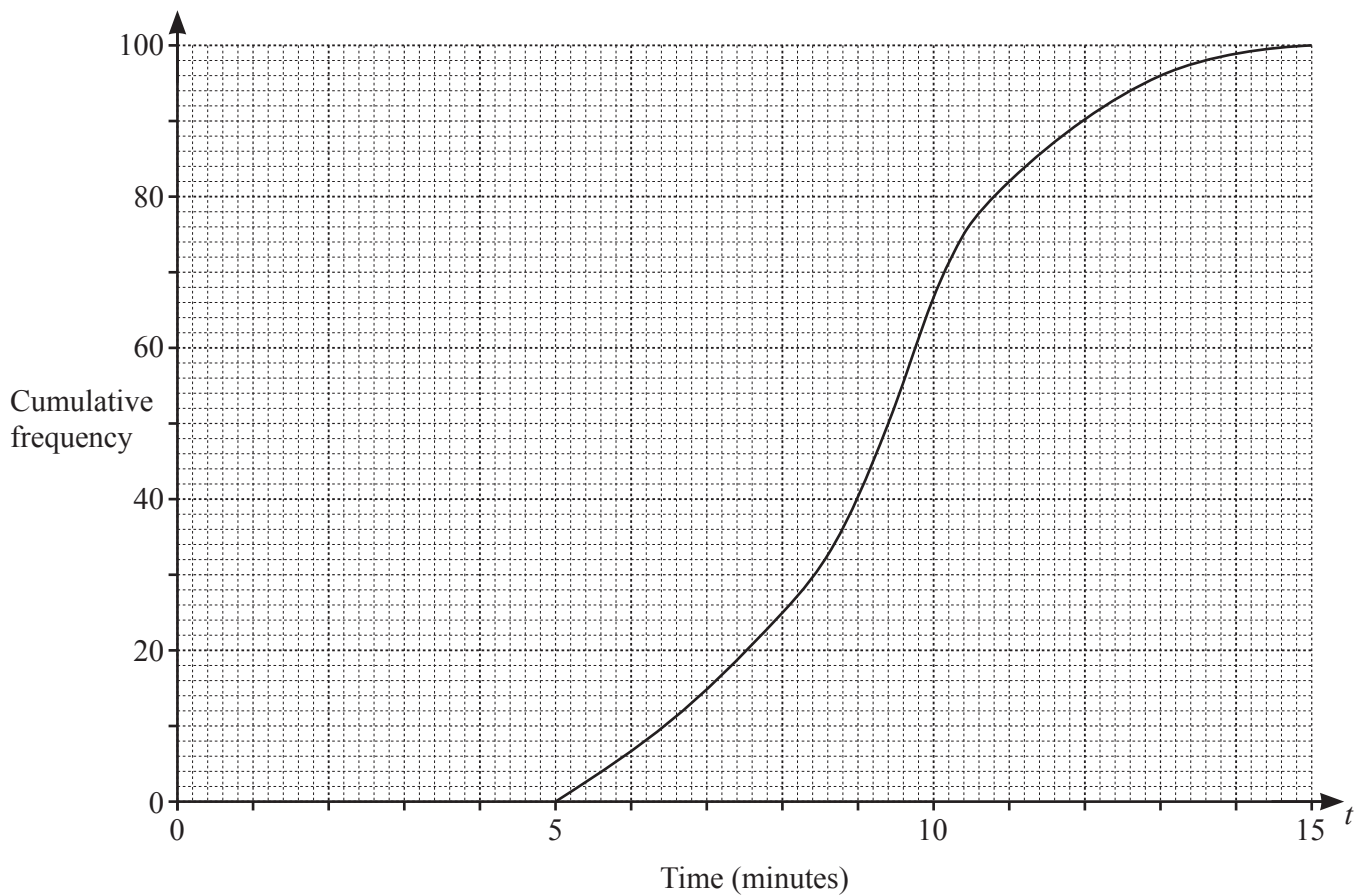
\$ [3]

- (c) The number of a certain type of bacteria increases exponentially at a rate of $r\%$ each day.
After 22 days, the number of this bacteria has doubled.

Find the value of r .

$r =$ [3]

- 5 (a) 100 students each record the time, t minutes, taken to eat a pizza.
The cumulative frequency diagram shows the results.



Find an estimate of

- (i) the median,

..... min [1]

- (ii) the interquartile range,

..... min [2]

- (iii) the number of students taking more than 11 minutes to eat a pizza.

..... [2]

- (b) 150 students each record how far they can throw a tennis ball.
The table shows the results.

Distance (d metres)	$0 < d \leq 20$	$20 < d \leq 30$	$30 < d \leq 35$	$35 < d \leq 45$	$45 < d \leq 60$
Frequency	4	38	40	53	15

- (i) Calculate an estimate of the mean.

..... m [4]

- (ii) A histogram is drawn to show this information.
The height of the bar representing $30 < d \leq 35$ is 12 cm.

Calculate the height of each of the other bars.

Distance (d metres)	Frequency	Height of bar (cm)
$0 < d \leq 20$	4	
$20 < d \leq 30$	38	
$30 < d \leq 35$	40	12
$35 < d \leq 45$	53	
$45 < d \leq 60$	15	

[3]

- (iii) Two students are chosen at random.

Find the probability that they both threw the ball more than 45 m.

..... [2]

6 (a) $\mathbf{p} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Find

(i) $3\mathbf{q}$,

$$\begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(ii) $\mathbf{p} - \mathbf{q}$,

$$\begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(iii) $|\mathbf{p}|$.

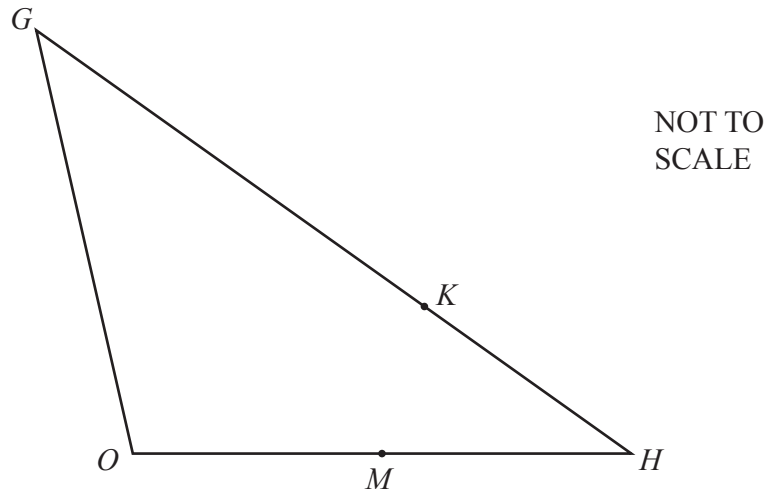
..... [2]

(b) B is the point $(2, 7)$ and $\overrightarrow{AB} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$.

Find the coordinates of A .

(..... , ...) [2]

(c)



In triangle OGH , M is the midpoint of OH and K divides GH in the ratio 5 : 2.

$\overrightarrow{OG} = \mathbf{g}$ and $\overrightarrow{OH} = \mathbf{h}$.

Find $\overrightarrow{MK}$ in terms of $\mathbf{g}$ and $\mathbf{h}$.

Give your answer in its simplest form.

$\overrightarrow{MK} = \dots\dots\dots$ [4]

- 7 $f(x) = 10 - x$ $g(x) = \frac{2}{x}, x \neq 0$ $h(x) = 2^x$ $j(x) = 5 - 2x$
- (a) (i) Find $g\left(\frac{1}{2}\right)$.
 [1]
- (ii) Find $hg\left(\frac{1}{2}\right)$.
 [1]
- (b) Find x when $f(x) = 7$.

 $x =$ [1]
- (c) Find x when $g(x) = h(3)$.

 $x =$ [2]
- (d) Find $j^{-1}(x)$.

 $j^{-1}(x) =$ [2]
- (e) Write $f(x) + g(x) + 1$ as a single fraction in its simplest form.

 [3]

(f) $(f(x))^2 - ff(x) = ax^2 + bx + c$

Find the values of a , b and c .

$$a = \dots\dots\dots$$

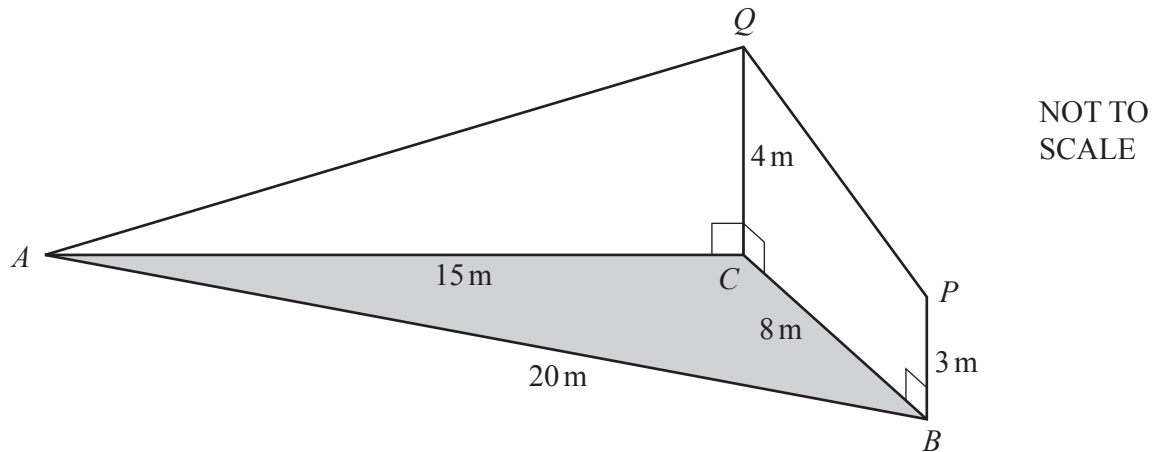
$$b = \dots\dots\dots$$

$$c = \dots\dots\dots [4]$$

(g) Find x when $h^{-1}(x) = 10$.

$$x = \dots\dots\dots [2]$$

8



The diagram shows triangle ABC on horizontal ground.
 $AC = 15$ m, $BC = 8$ m and $AB = 20$ m.

BP and CQ are vertical poles of different heights.

$BP = 3$ m and $CQ = 4$ m.

AQ and PQ are straight wires.

(a) Show that angle $ACB = 117.5^\circ$, correct to 1 decimal place.

[4]

(b) Calculate the area of triangle ABC .

..... m^2 [2]

(c) Calculate the length of AQ .

..... m [2]

(d) Calculate the angle of elevation of Q from P .

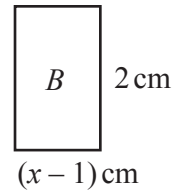
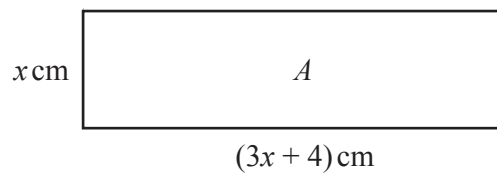
..... [3]

(e) Another straight wire connects A to the midpoint of PQ .

Calculate the angle between this wire and the horizontal ground.

..... [5]

9 (a)

NOT TO
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The total of the areas of rectangles A and B is 20 cm^2 .

(i) Show that $3x^2 + 6x - 22 = 0$.

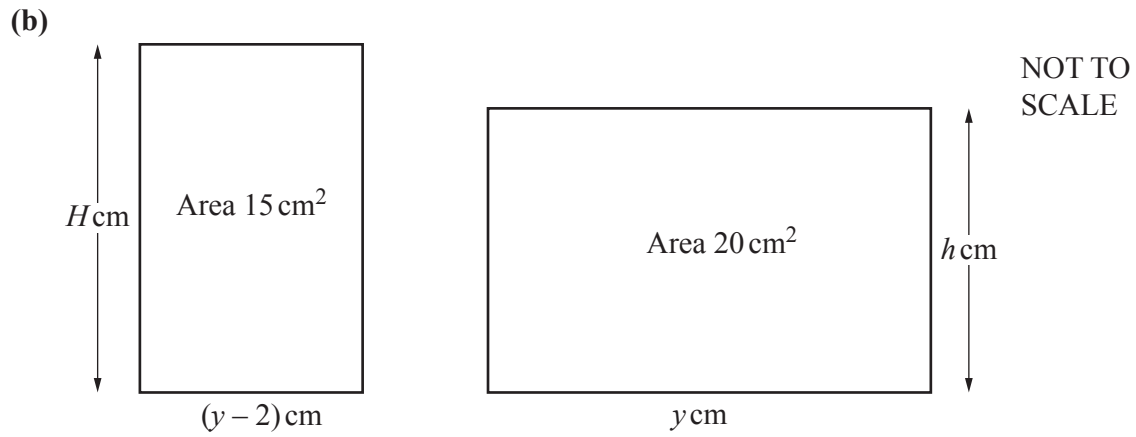
[2]

(ii) Solve the equation $3x^2 + 6x - 22 = 0$, giving your answers correct to 4 significant figures. You must show all your working.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

(iii) Find the perimeter of rectangle B .

$\dots\dots\dots \text{ cm}$ [1]

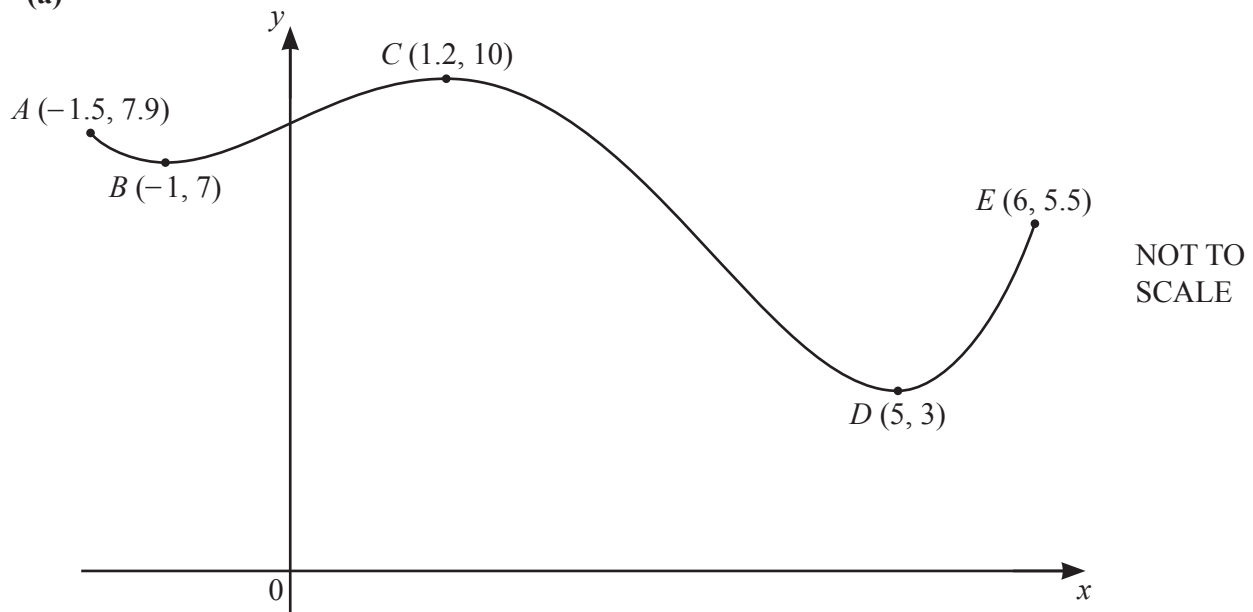


The diagram shows two rectangles where $H - h = 1$.

By forming a quadratic equation and factorising, find the value of y .

$y = \dots\dots\dots$ [7]

10 (a)



The diagram shows a sketch of the graph of $y = f(x)$ for $-1.5 \leq x \leq 6$.
The coordinates of five points on the graph of $y = f(x)$ are shown on the diagram.

- (i) $f(x) = k$ has two solutions in the interval $-1.5 \leq x \leq 6$.

Write down a possible integer value of k .

$k = \dots\dots\dots$ [1]

- (ii) $f(x) = j$ has no solutions in the interval $-1.5 \leq x \leq 6$ when $j < a$ or $j > b$.

Find the maximum value of a and the minimum value of b .

$a = \dots\dots\dots$

$b = \dots\dots\dots$ [2]

- (b) Find the coordinates of the two stationary points on the graph of $y = x^6 - 6x^5$.
You must show all your working.

(..... , ...)

(..... , ...) [5]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 Extended

October/November 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	1580 or 1583 to 1584	2	M1 for $\pi \times 6^2 \times 14$
1(a)(ii)	452 or 452.3 to 452.4...	2	M1 for $\left[\frac{1}{2}\right] \times \frac{4}{3} \times \pi \times 6^3$
1(b)(i)	$7.85 \div 1000 [= 0.00785]$	M1	
1(b)(ii)	16[.0] or 15.95 to 15.99	2	FT { <i>their (a)(i)</i> + <i>their (a)(ii)</i> } $\times 0.00785$ evaluated to 3 sig fig or better M1 for (<i>their (a)(i)</i> + <i>their (a)(ii)</i>) $\times 0.00785$
1(c)(i)	16.2 or 16.21 to 16.23	3	M2 for $\frac{2000 - 50 \times \frac{4}{3} \times \pi \times 2^3}{2000} [\times 100]$ or for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000} \times 100$ or M1 for $\frac{50 \times \frac{4}{3} \times \pi \times 2^3}{2000}$
1(c)(ii)	6.87 or 6.870 to 6.872	1	FT $\sqrt[3]{2000 - \text{their} \left(50 \times \frac{4}{3} \times \pi \times 2^3 \right)}$ evaluated to 3sf or better
1(d)	$\frac{2}{3}$ oe	4	M1 for $[\pi](3R)^2 + [\pi]3R \times 9R$ oe M1 for $2[\pi]x^2 + 2[\pi]x \times 7x$ oe M1 for <i>their</i> area of cone = <i>their</i> area of cylinder seen
2(a)(i)	2990 cao	1	
2(a)(ii)	1.0 cao	1	
2(a)(iii)	2100 cao	1	
2(b)	97	1	
2(c)	$\frac{1}{64}$ final answer	1	
2(d)	$7.01[0] \times 10^{-3}$	1	
2(e)	1.65×10^x	2	M1 for final answer figs 165 or for $15 \times 10^{x-1}$ seen or for 0.15×10^x seen

Question	Answer	Marks	Partial Marks
2(f)	37.7... – 3.7... [= 34] oe	M1	
	$\frac{34}{90}$ oe fraction	B1	
3(a)	$-2 < x \leq 4$ oe	1	
3(b)(i)	$-3 \leq x < 3$ final answer	3	M2 for $-3 \leq x < k$ or for $k \leq x < 3$ or for $-6 \leq 2x < 6$ or for $-\frac{3}{2} - \frac{3}{2} \leq x < \frac{9}{2} - \frac{3}{2}$ or M1 for $-3 - 3 \leq 2x < 9 - 3$ or for $-\frac{3}{2} \leq x + \frac{3}{2} < \frac{9}{2}$ After 0 scored SC1 for $-3 \leq x$ or for $x < 3$
3(b)(ii)	$-3, -2, -1, 0, 1, 2$ final answer	2	FT their (i) as long as negative and positive values B1FT for one error or omission
3(c)(i)	$\frac{36}{17}$ oe	4	B3 for $-15x - 2x = 5 + 4 - 45$ or better OR B2 for $45 - 15x - 2x - 4 = 5$ oe OR M1 for correct removal of fraction or M1 for correct removal of brackets
3(c)(ii)	-8	3	B2 for $5x - 3x = 9 - 25$ or better or M1 for $5(x + 5) = 3(x + 3)$ oe or better
4(a)(i)	550 nfww	3	M2 for $\frac{500 \times 2 \times 5}{100} + 500$ oe or M1 for $\frac{500 \times 2 \times 5}{100}$ oe
4(a)(ii)	546.65	2	M1 for $500 \times \left(1 + \frac{1.8}{100}\right)^5$ oe
4(a)(iii)	8 nfww	3	B2 for final answer 13 OR M2 for trials correctly comparing both investments to 7 and 8 more years or M1 for at least two trials correctly comparing both investments

Question	Answer	Marks	Partial Marks
4(b)	1476 cao	3	B2 for 1480 or 1476.2 ... OR M1 for $2500 \times \left(1 - \frac{10}{100}\right)^5$ oe B1 for their more accurate answer seen correctly rounded to the nearest dollar.
4(c)	3.2[0] or 3.200 to 3.201	3	M2 for $(...) = \sqrt[22]{2}$ oe isw or M1 for $[N] \times (...)^{22} = 2[N]$
5(a)(i)	9.4	1	
5(a)(ii)	2.4	2	B1 for [uq =] 10.4 or [lq =] 8 but not as final answer
5(a)(iii)	18	2	B1 for 82 seen
5(b)(i)	34.65 or $34\frac{13}{20}$	4	M1 for midpoints 10, 25, 32.5, 40, 52.5 soi M1 for Σfx where values of x are in interval or on boundary M1 dep on second M for $\frac{\Sigma fx}{150}$
5(b)(ii)	0.3, 5.7, ..., 7.95, 1.5	3	B2 for any two correct or B1 for one correct or for at least three frequency densities seen 0.2, 3.8, 8, 5.3, 1 oe or M1 for [factor] 1.5
5(b)(iii)	$\frac{7}{745}$ oe	2	M1 for $\frac{15}{150} \times \frac{14}{149}$
6(a)(i)	$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$	1	
6(a)(ii)	$\begin{pmatrix} 3 \\ 2 \end{pmatrix}$	1	
6(a)(iii)	3.61 or 3.605 to 3.606	2	M1 for $2^2 + 3^2$ oe
6(b)	(6, 1)	2	B1 for each

Question	Answer	Marks	Partial Marks
6(c)	$\frac{2}{7}\mathbf{g} + \frac{3}{14}\mathbf{h}$	4	B3 for correct unsimplified expression for $\overrightarrow{MK}$ or B2 for $[\overrightarrow{MK} =] \frac{2}{7}\mathbf{g} + k\mathbf{h}$ or $[\overrightarrow{MK} =] k\mathbf{g} + \frac{3}{14}\mathbf{h}$ or $\overrightarrow{HK} = \frac{2}{7}(\mathbf{g} - \mathbf{h})$ oe or $\overrightarrow{GK} = \frac{5}{7}(\mathbf{h} - \mathbf{g})$ oe or M1 for correct route for $\overrightarrow{MK}$
7(a)(i)	4	1	
7(a)(ii)	16	1	FT $2^{\text{their } 4}$
7(b)	3	1	
7(c)	$\frac{1}{4}$ oe	2	M1 for $\frac{2}{x} = 2^3$ or better
7(d)	$\frac{5-x}{2}$ oe final answer	2	M1 for $x = 5 - 2y$ or $y + 2x = 5$ oe or $\frac{y}{2} = \frac{5}{2} - x$ oe
7(e)	$\frac{11x - x^2 + 2}{x}$ final answer	3	B2 for $\frac{x(10-x) + 2 + x}{x}$ oe single fraction or B1 for $x(10-x) + 2 + x$ oe or M1 for $10 - x + \frac{2}{x} + 1$
7(f)	$[a =] 1$ $[b =] -21$ $[c =] 100$	4	B3 for $x^2 - 21x + 100$ OR M1 for $(10-x)^2 - (10 - (10-x))$ oe or better B2 for $[(10-x)^2] = 100 - 10x - 10x + x^2$ or B1 for three out of four terms of $[(10-x)^2] = 100 - 10x - 10x + x^2$ correct
7(g)	1024	2	M1 for $[x =] h(10)$ oe or better
8(a)	$[\cos =] \frac{15^2 + 8^2 - 20^2}{2 \cdot 15.8}$	M2	M1 for $20^2 = 15^2 + 8^2 - 2 \cdot 15.8 \cos(\quad)$
	117.54 to 117.55	A2	A1 for $-\frac{37}{80}$ or $-\frac{111}{240}$ or $-[0].4625$

Question	Answer	Marks	Partial Marks
8(b)	53.2 or 53.19 to 53.23	2	M1 for $0.5 \times 8 \times 15 \times \sin(117.5)$ oe
8(c)	15.5 or 15.52 to 15.53	2	M1 for $15^2 + 4^2$ oe
8(d)	7.1 or 7.13 or 7.125 to 7.126	3	M2 for $\tan [P] = \frac{4-3}{8}$ oe or for 7.1 or 7.13 or 7.125 to 7.126 seen or M1 for vertical line = $4 - 3$ soi After 0 scored SC1 for correct angle identified
8(e)	11.5 nfww or 11.48 to 11.49...	5	B1 for height of 3.5 soi M2 for $15^2 + 4^2 - 2.15.4 \cos(117.5)$ or M1 for $\cos 117.5 = \frac{15^2 + 4^2 - (...)^2}{2.15.4}$ M1 for $\tan = \frac{3.5}{\text{their } 17.216...}$ oe After M0 scored SC1 for correct angle identified
9(a)(i)	$x(3x + 4) + 2(x - 1)[= 20]$	M1	Correct expression with brackets unexpanded
	Leading to $3x^2 + 6x - 22 = 0$ with no errors or omissions	A1	Must see equated to 20 and brackets expanded first to award A1
9(a)(ii)	$\frac{-6 \pm \sqrt{6^2 - 4(3)(-22)}}{2.3}$ oe or for $= -1 \pm \sqrt{1 + \frac{22}{3}}$ oe	B2	B1 for $\sqrt{6^2 - 4(3)(-22)}$ or $\frac{-6 + \text{or} - \sqrt{k}}{2.3}$ or $(x+1)^2 = k$ oe
	-3.887 and 1.887 cao	B2	B1 for one correct answer or for answers -3.89 or -3.88 or -3.886 or -3.8868 to -3.8867 and 1.88 or 1.89 or 1.886 or 1.8867 to 1.8868 or correct answers seen in working or -1.887 and 3.887 answers
9(a)(iii)	5.77 or 5.773 to 5.774	1	FTdep 2 (positive $x + 1$) evaluated to 3 sig. fig. or more, dep on $x > 1$

Question	Answer	Marks	Partial Marks
9(b)	$y^2 + 3y - 40 [= 0]$ oe	B4	Oe 3 term quadratic M3 for $15y - 20(y - 2) = y(y - 2)$ oe Or M2 for $\frac{15}{y-2} - \frac{20}{y} = 1$ oe Or M1 for $H(y - 2) = 15$ or $hy = 20$ soi
	$(y + 8)(y - 5) [= 0]$ oe	B2	Strict FT a three term quadratic B1FT for $(y + a)(y + b)$ where $ab = -40$ or $a + b = 3$ or $y(y - 5) + 8(y - 5)$ or $y(y + 8) - 5(y + 8)$
	5	B1	
10(a)(i)	4 or 5 or 7 or 8 or 9	1	
10(a)(ii)	$[a =] 3, [b =] 10$	2	B1 for each or for a and b transposed
10(b)	$6x^5 - 30x^4$	B2	B1 for $6x^5$ or $-30x^4$
	their derivative = 0.	M1	
	(0, 0) and (5, -3125)	B2	B1 for (5, -3125) or for $x = 0$ and $x = 5$



Cambridge IGCSE™

CANDIDATE
NAME
CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2022

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) (i) At a football club, season tickets are sold for seated areas and for standing areas.
The cost of season tickets are in the ratio seated : standing = 5 : 3.
The cost of a season ticket for the standing area is \$45.

Find the cost of a season ticket for the seated area.

\$ [2]

- (ii) In 2021, the value of the team's players was \$2.65 million.
In 2022 this value has decreased by 12%.

Find the value in 2022.

\$ million [2]

- (iii) The number of people at a football match is 1455.
This is 6.25% of the total number of people allowed in the stadium.

Find the total number of people allowed in the stadium.

..... [2]

- (iv) The average attendance increased exponentially by 4% each year for the three years from 2016 to 2019.
In 2019 the average attendance was 1631.

Find the average attendance for 2016.

..... [3]

- (b) Another club sells season tickets for individuals and for families.

In 2018, the number of season tickets sold is in the ratio family : individual = 2 : 7.

- (i) The number of family season tickets sold is x .

Write an expression, in terms of x , for the number of individual season tickets sold.

..... [1]

- (ii) In 2019, the number of family season tickets sold increases by 12 and the number of individual season tickets sold decreases by 26.

Complete the table by writing expressions, in terms of x , for the number of tickets sold each year.

Year	Family tickets	Individual tickets
2018	x	
2019		

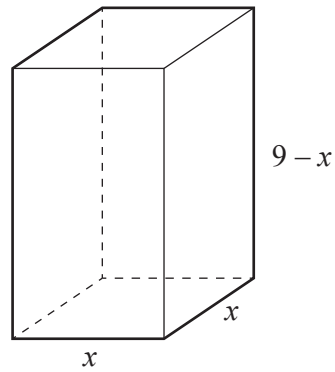
[2]

- (iii) In 2019, the number of individual season tickets sold is 3 times the number of family season tickets sold.

Write an equation in x and solve it to find the number of family tickets sold in 2018.

$x =$ [4]

- 2 All the lengths in this question are measured in centimetres.



NOT TO
SCALE

The diagram shows a solid cuboid with a square base.

- (a) The volume, $V \text{ cm}^3$, of the cuboid is $V = x^2(9 - x)$.
The table shows some values of V for $0 \leq x \leq 9$.

x	0	1	2	3	4	5	6	7	8	9
V	0	8		54	80	100	108	98	64	0

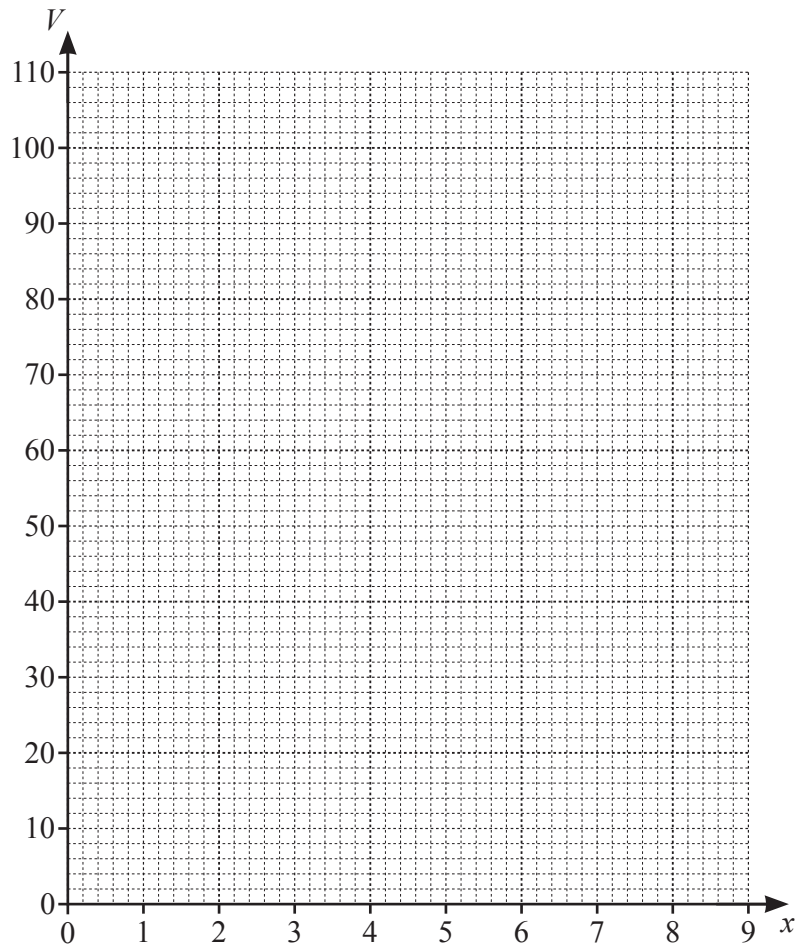
- (i) Complete the table.

[1]

- (ii) On the grid on the opposite page, draw the graph of $V = x^2(9 - x)$ for $0 \leq x \leq 9$. [4]

- (iii) Find the values of x when the volume of the cuboid is 44 cm^3 .

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]



(b) (i) Show that the total surface area of the cuboid is $(36x - 2x^2) \text{ cm}^2$.

[2]

(ii) Find the surface area when the volume of the cuboid is a maximum.

..... cm^2 [3]

- 3 Kai and Ann carry out a survey on the distances travelled, in kilometres, by 200 cars.

Kai completes this frequency table for the data collected.

Distance (d km)	$80 < d \leq 100$	$100 < d \leq 150$	$150 < d \leq 200$	$200 < d \leq 300$	$300 < d \leq 400$
Frequency	7	33	76	52	32

- (a) (i) Calculate an estimate of the mean.

..... km [4]

- (ii) Ann uses this frequency table for the same data.
There is a different interval for the final group.

Distance (d km)	$80 < d \leq 100$	$100 < d \leq 150$	$150 < d \leq 200$	$200 < d \leq 300$	$300 < d \leq 360$
Frequency	7	33	76	52	32

Without calculating an estimate of the mean for this data, find the difference between Ann's and Kai's estimate of the mean.

You must show all your working.

..... km [2]

- (iii) A histogram is drawn showing the information in **Kai's** frequency table.
The height of the block for the interval $200 < d \leq 300$ is 2.6 cm.

Calculate the height of the block for each of the following intervals.

$$80 < d \leq 100 \dots\dots\dots \text{ cm}$$

$$150 < d \leq 200 \dots\dots\dots \text{ cm}$$

$$300 < d \leq 400 \dots\dots\dots \text{ cm} \quad [3]$$

- (b) One car is picked at random.

Find the probability that the car has travelled more than 300 km.

..... [1]

- (c) Two of the 200 cars are picked at random.

Find the probability that

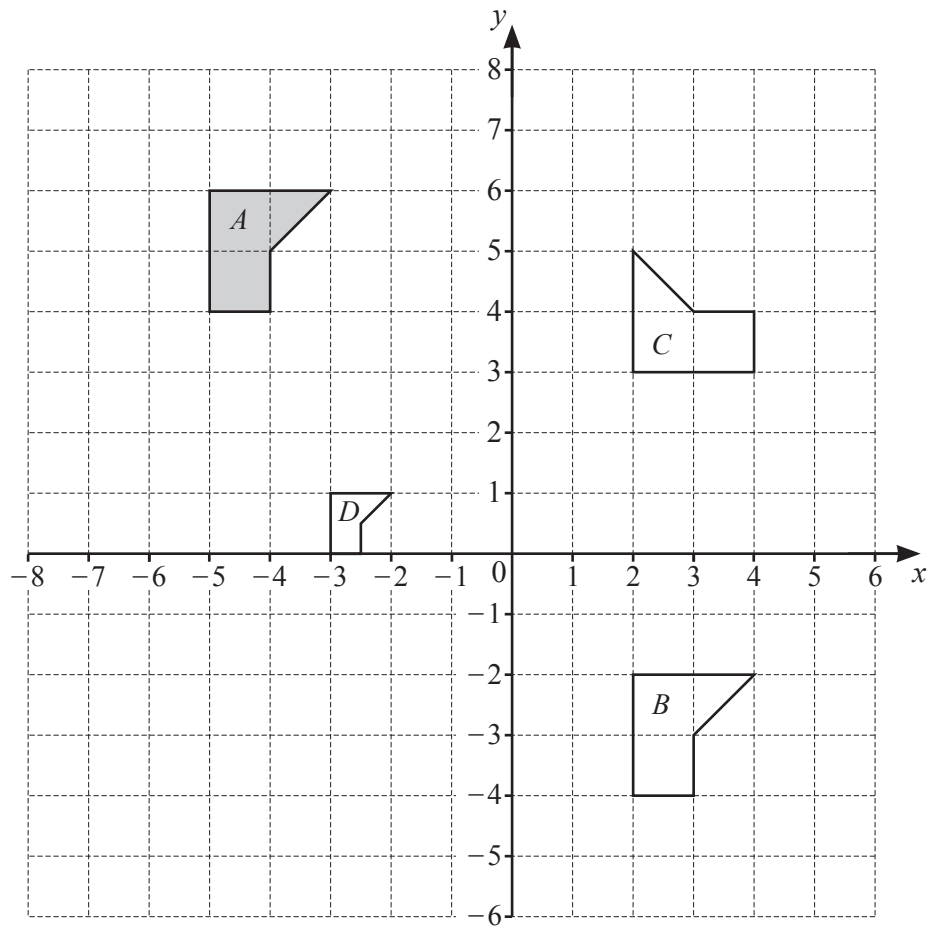
- (i) both cars have travelled 150 km or less,

..... [2]

- (ii) one car has travelled more than 200 km and the other car has travelled 100 km or less.

..... [3]

4



(a) Describe fully the **single** transformation that maps

(i) shape A onto shape B ,

..... [2]

(ii) shape A onto shape C ,

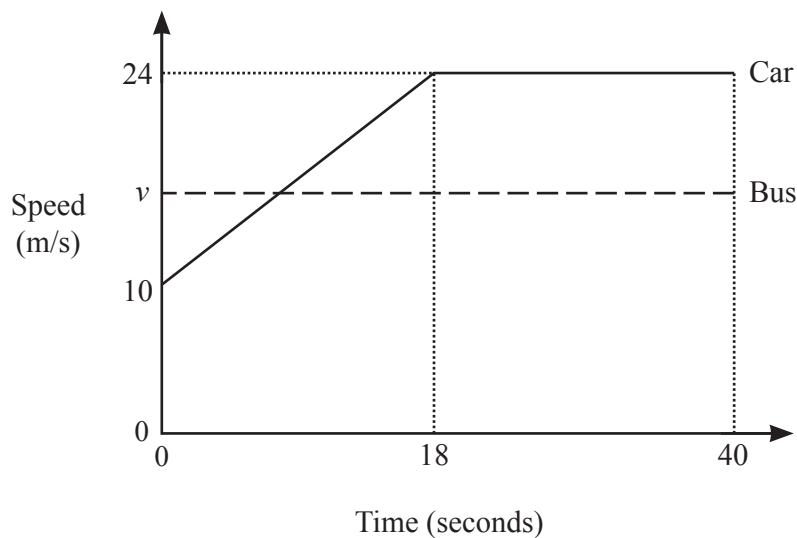
..... [3]

(iii) shape A onto shape D .

..... [3]

(b) On the grid, draw the image of shape A after a reflection in the line $y = x + 8$. [2]

- 5 (a) The diagram shows the speed–time graph for part of a journey for two vehicles, a car and a bus.



NOT TO
SCALE

- (i) Calculate the acceleration of the car during the first 18 seconds.

..... m/s^2 [1]

- (ii) In the first 40 seconds the car travelled 134 m more than the bus.

Calculate the constant speed, v , of the bus.

$v =$ m/s [4]

- (b) A train takes 10 minutes 30 seconds to travel 16 240 m.

Calculate the average speed of the train.

Give your answer in kilometres per hour.

..... km/h [3]

6 (a) Solve.

$$4x + 15 = 9$$

$$x = \dots\dots\dots [2]$$

(b) Factorise.

$$a^2 - 9$$

$$\dots\dots\dots [1]$$

(c) Write as a single fraction in its simplest form.

$$\frac{4a}{5} \div \frac{3ad}{10c}$$

$$\dots\dots\dots [3]$$

(d) $5^n + 5^n + 5^n + 5^n + 5^n = 5^m$

Find an expression for m in terms of n .

$$m = \dots\dots\dots [2]$$

(e) Solve by factorisation.

$$4x^2 + 8x - 5 = 0$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [3]$$

- (f) (i) y is directly proportional to $(x+3)^3$.
When $x = 2$, $y = 13.5$.

Find x when $y = 108$.

$$x = \dots\dots\dots [3]$$

- (ii) g is inversely proportional to the square of d .
When d is halved, the value of g is multiplied by a factor n .

Find n .

$$n = \dots\dots\dots [2]$$

- (g) Expand and simplify.

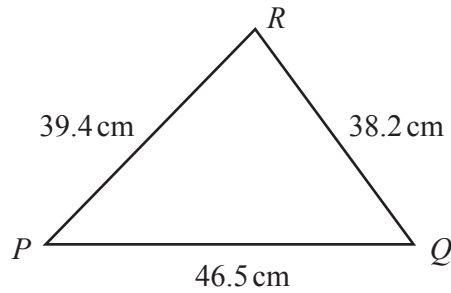
$$(2x+3)(x-1)(x+3)$$

$$\dots\dots\dots [3]$$

- (h) Find the derivative, $\frac{dy}{dx}$, of $y = 3x^2 + 4x - 1$.

$$\dots\dots\dots [2]$$

7 (a)



NOT TO
SCALE

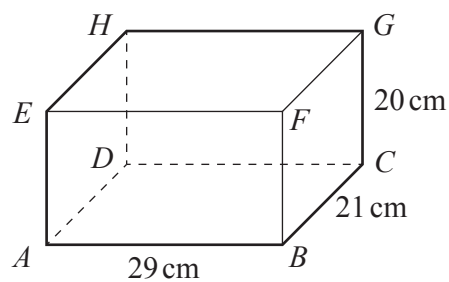
(i) Calculate angle QPR .

Angle $QPR = \dots\dots\dots$ [4]

(ii) Find the shortest distance from Q to PR .

$\dots\dots\dots$ cm [3]

(b) The diagram shows a cuboid.



NOT TO
SCALE

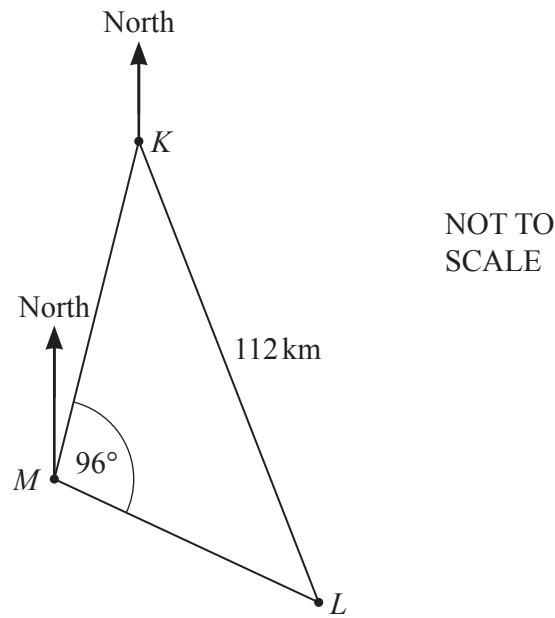
(i) Calculate the length AG .

$AG = \dots\dots\dots$ cm [3]

- (ii) Calculate the angle between AG and the base $ABCD$.

..... [3]

(c)



The diagram shows the positions of a lighthouse, L , and two ships, K and M .
 The bearing of L from K is 155° and $KL = 112$ km.
 The bearing of K from M is 010° and angle $KML = 96^\circ$.

Find the bearing and distance of ship M from the lighthouse, L .

Bearing

Distance km [5]

- 8 AB is a line with midpoint M .
 A is the point $(2, 3)$ and M is the point $(12, 7)$.

(a) Find the coordinates of B .

(..... , ...) [2]

(b) Show that the equation of the perpendicular bisector of AB is $2y + 5x = 74$.

[4]

- (c) The perpendicular bisector of AB passes through the point N .
 The point N has coordinates $(2, n)$.

Find the value of n .

$n = \dots\dots\dots$ [1]

- (d) Points A , M and N form a triangle.

Find the area of the triangle.

$\dots\dots\dots$ [2]

9



(a) On the diagram, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$. [2]

(b) Solve the equation $5 \sin x + 4 = 0$ for $0^\circ \leq x \leq 360^\circ$.

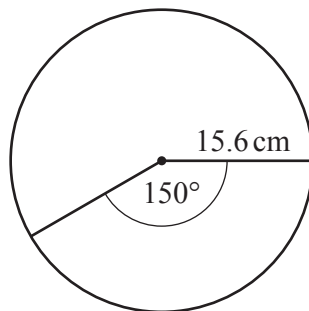
$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- 10 (a) The lengths of the sides of a triangle are 11.4 cm, 14.8 cm and 15.7 cm, all correct to 1 decimal place.

Calculate the upper bound of the perimeter of the triangle.

..... cm [2]

(b)



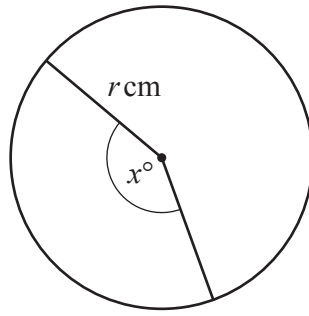
NOT TO
SCALE

The diagram shows a circle, radius 15.6 cm.
The angle of the minor sector is 150° .

Calculate the area of the minor sector.

..... cm^2 [2]

(c)

NOT TO
SCALE

The diagram shows a circle, radius $r \text{ cm}$ and minor sector angle x° .

The **perimeter** of the major sector is three times the **perimeter** of the minor sector.

Show that $x = \frac{90(\pi - 2)}{\pi}$.

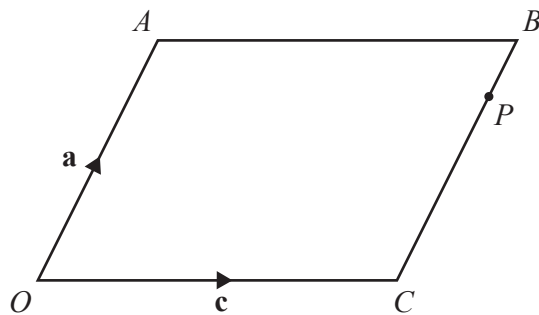
[4]

11 (a) $\left| \begin{pmatrix} 9m \\ 40m \end{pmatrix} \right| = \frac{205}{2}$

Find the two possible values of m .

$m = \dots\dots\dots$ or $\dots\dots\dots$ [3]

(b)



NOT TO
SCALE

$OABC$ is a parallelogram.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

P is the point on CB such that $CP : PB = 3 : 1$.

(i) Find, in terms of $\mathbf{a}$ and/or $\mathbf{c}$, in their simplest form,

(a) $\overrightarrow{AC}$,

$\overrightarrow{AC} = \dots\dots\dots$ [1]

(b) $\overrightarrow{CP}$,

$\overrightarrow{CP} = \dots\dots\dots$ [1]

(c) $\overrightarrow{OP}$.

$\overrightarrow{OP} = \dots\dots\dots$ [1]

- (ii) OP and AB are extended to meet at Q .

Find the position vector of Q .

..... [2]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **14** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

PUBLISHED**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles

1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

PUBLISHED

Question	Answer	Marks	Partial Marks
1(a)(i)	75	2	M1 for $\frac{45}{3}[\times k]$ where k is 1, 5 or 8
1(a)(ii)	2.332 oe	2	M1 for $2.65 [\text{million}] \times \left(1 - \frac{12}{100}\right)$ oe or B1 for 0.318[million] seen
1(a)(iii)	23 280 cao	2	M1 for $\frac{6.25}{100} \times x = 1455$ or better
1(a)(iv)	1450 or 1449 to 1450	3	M2 for $1631 = k \left(1 + \frac{4}{100}\right)^3$ oe or better or B1 for $\left(1 + \frac{4}{100}\right)^3$ oe seen or M1 for $1631 = k \left(1 + \frac{4}{100}\right)^n, n > 0$ oe
1(b)(i)	$\frac{7x}{2}$ oe	1	
1(b)(ii)	$x + 12 \quad \frac{7x}{2} - 26$ oe final answer	2	FT <i>their</i> (b)(i) B1 for $x + 12$ B1 for <i>their</i> $\frac{7x}{2} - 26$

PUBLISHED

Question	Answer	Marks	Partial Marks
1(b)(iii)	$\frac{7x}{2} - 26 = 3(x + 12)$ oe leading to 124	4	M1dep for $their\left(\frac{7x}{2} - 26\right) = 3 \times their(x + 12)$ oe M2dep for isolating x terms, dep on eqn with term in x and constant on each side and with a bracket or fraction. or M1dep for correctly removing brackets or dealing with fractions, dep on eqn with term in x and constant on each side and with a bracket or fraction.
2(a)(i)	28	1	
2(a)(ii)	Correct curve	4	B3FT for 9 or 10 correct points or B2FT for 7 or 8 correct points or B1FT for 5 or 6 correct points
2(a)(iii)	2.5 to 2.8 8.2 to 8.5	2	B1 for each value
2(b)(i)	$2x^2 + 4x(9 - x)$ oe	M1	Accept the sum of individual areas if done in smaller parts
	$2x^2 + 36x - 4x^2$ oe Leading to $36x - 2x^2$	A1	With intermediate step shown and brackets removed with no errors or omissions
2(b)(ii)	144	3	B1 for $x = 6$ identified from graph or using calculus M1 for $36 \times their6 - 2 \times (their 6)^2$

PUBLISHED

Question	Answer	Marks	Partial Marks
3(a)(i)	211.275	4	M1 for mid-points soi (90, 125, 175, 250, 350) M1 for use of Σfm with m in correct interval including both boundaries M1 for (dep on 2nd M1) for $\Sigma fm \div 200$
3(a)(ii)	$32 \times 350 - 32 \times 330$ oe or better, or the reverse of this	M1	
	3.2 or – 3.2 final answer	B1	
3(a)(iii)	1.75 7.6 1.6	3	B2 for two correct heights or B1 for one correct height or 3 correct frequency densities or M1 for scale factor of 5 or 0.2
3(b)	$\frac{4}{25}$ oe	1	
3(c)(i)	$\frac{39}{995}$ oe	2	M1 for $\frac{40}{200} \times \frac{39}{199}$ oe
3(c)(ii)	$\frac{147}{4975}$ oe	3	M2 for $[2 \times] \frac{84}{200} \times \frac{7}{199}$ oe or B1 for $\frac{84}{200}$ and $\frac{7}{199}$ or $\frac{84}{199}$ and $\frac{7}{200}$ oe If 0 scored, SC1 for answer $\frac{147}{5000}$ oe

PUBLISHED

Question	Answer	Marks	Partial Marks
4(a)(i)	Translation $\begin{pmatrix} 7 \\ -8 \end{pmatrix}$ oe	2	B1 for each
4(a)(ii)	Rotation 90° [anticlockwise] oe (0, 8)	3	B1 for each
4(a)(iii)	Enlargement [sf] $\frac{1}{2}$ oe [centre] $(-1, -4)$	3	B1 for each
4(b)	Image at $(-4, 4)$ $(-3, 4)$ $(-2, 5)$ $(-2, 3)$ $(-4, 3)$	2	B1 for the line $y = x + 8$ drawn so long enough to be fit for purpose or correct size and orientation but wrong position

PUBLISHED

Question	Answer	Marks	Partial Marks
5(a)(i)	$\frac{14}{18}$ oe	1	
5(a)(ii)	17.5	4	M3 for $\frac{1}{2}(10 + 24)18 + 22 \times 24 - 134 = 40v$ oe or M2 for $\frac{1}{2}(10 + 24)18 + 22 \times 24$ oe or B2 for [distance covered by bus =] 700 or M1 for correct method for any partial area for the car or for 40v
5(b)	92.8 or $92\frac{4}{5}$	3	M1 for $\frac{\text{figs}162[4]}{\text{their}10\text{ min }30\text{sec}}$ oe M1 for correct conversion to km/h, e.g. $\times \frac{60}{1000}$

PUBLISHED

Question	Answer	Marks	Partial Marks
6(a)	-1.5 or $-1\frac{1}{2}$ or $-\frac{3}{2}$	2	M1 for $4x = 9 - 15$ or $x + \frac{15}{4} = \frac{9}{4}$
6(b)	$(a - 3)(a + 3)$ final answer	1	
6(c)	$\frac{8c}{3d}$ final answer	3	B2 for $\frac{8ac}{3ad}$ or $\frac{40c}{15d}$ or $\frac{4}{1} \times \frac{2c}{3d}$ seen or for correct answer seen then spoiled or M1 for $\frac{4a}{5} \times \frac{10c}{3ad}$ or $\frac{8ac}{10c} \div \frac{3ad}{10c}$ oe
6(d)	$n + 1$ final answer	2	M1 for 5×5^n or 5^{n+1} seen
6(e)	$(2x - 1)(2x + 5) [= 0]$ oe	B2	M1 for $2x(2x + 5) - [1](2x + 5) [= 0]$ or $2x(2x - 1) + 5(2x - 1) [= 0]$ or for $(2x + m)(2x + n) [= 0]$ with and $mn = -5$ or $n + m = 4$
	$\frac{1}{2}$ or 0.5 and -2.5 or $-2\frac{1}{2}$ or $-\frac{5}{2}$	B1	
6(f)(i)	7	3	M1 for $y = k(x + 3)^3$ or better M1 for $108 = \text{their } k(x + 3)^3$
6(f)(ii)	4	2	M1 for $\left(\frac{1}{2}\right)^2$ oe or $\frac{k}{\frac{1}{4}d^2}$ oe seen or better

PUBLISHED

Question	Answer	Marks	Partial Marks
6(g)	$2x^3 + 7x^2 - 9$ final answer	3	B2 for correct expansion unsimplified or for simplified 4 term expression of correct form with 3 terms correct or B1 for one pair of brackets expanded with at least 3 terms out of 4 correct
6(h)	$6x + 4$	2	B1 for $6x$ or 4 or $6x + 4$ with one extra term seen

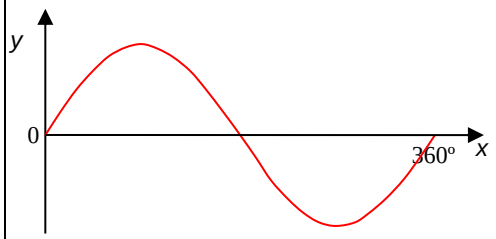
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Question	Answer	Marks	Partial Marks
7(a)(i)	52.[0] or 52.01...	4	M2 for $[\cos P =] \frac{39.4^2 + 46.5^2 - 38.2^2}{2 \times 39.4 \times 46.5}$ oe or M1 for $38.2^2 = 39.4^2 + 46.5^2 - 2 \times 39.4 \times 46.5 \times \cos P$ oe A1 for 0.616 or 0.6155...
7(a)(ii)	36.6 or 36.64 to 36.65	3	M2 for $\frac{d}{46.5} = \sin(\text{their } 52.01)$ oe or M1 for recognition that the line from Q is perpendicular to PR
7(b)(i)	41.[0] or 41.01... nfw	3	M2 for $29^2 + 21^2 + 20^2$ oe or better or M1 for $29^2 + 21^2$ oe or $29^2 + 20^2$ oe or $21^2 + 20^2$ oe or better
7(b)(ii)	29.2 or 29.18 to 29.2	3	M2 for $\sin[GAC] = \frac{20}{\text{their } AG}$ oe or M1 for angle GAC identified
7(c)	bearing 286	B2	B1 for angle $MLK = 49$ or for angle $MKL = 35$ correctly identified or angle from North to $ML = 106$
	distance 64.6 or 64.59...	B3	M2 for $\frac{112 \times \sin(\text{their } 35)}{\sin(96)}$ oe or M1 for the implicit form

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Question	Answer	Marks	Partial Marks
8(a)	(22, 11)	2	B1 for each value
8(b)	$\frac{their11-3}{their22-2}$ oe or better	M1	
	$-\frac{1}{their\ m}$	M1	
	Substitution of (12, 7) into $y = (their\ m)x + c$	M1	Accept $y - 7 = their\ m(x - 12)$ oe
	leading to $2y + 5x = 74$ final answer	A1	Without error or omission
8(c)	32	1	
8(d)	145	2	M1 for $\frac{1}{2} \times (their\ 32 - 3) \times 10$ oe or $\frac{1}{2} \times \sqrt{(7-3)^2 + (12-2)^2} \times \sqrt{(their32-7)^2 + (2-12)^2}$ oe

PUBLISHED

Question	Answer	Marks	Partial Marks
9(a)	Correct sketch to go through (0, 0), and (360, 0) 	2	M1 for correct sine curve shape through the origin or for almost correct sketch fitting all tramlines but with an omission at either end or incorrect curvature in one place only
9(b)	233.1 or 233.13... and 306.9 or 306.86 to 306.87	3	B2 for one correct angle or M1 for $\sin x = -0.8$ oe If 0 scored SC1 for 2 reflex angles that add to 540 or two non-reflex angles that add to 180
10(a)	42.05 final answer	2	M1 for $11.4 + 0.05$ oe or $14.8 + 0.05$ oe or $15.7 + 0.05$ oe
10(b)	319 or 318.5 to 318.6	2	M1 for $\frac{150}{360} \times \pi \times 15.6^2$ oe
10(c)	$\frac{360-x}{360} \times 2\pi r + 2r = 3 \left(\frac{x}{360} \times 2\pi r + 2r \right)$ oe	M2	M1 for $\frac{x}{360} \times 2\pi r$ oe seen or $\frac{360-x}{360} \times 2\pi r$ oe seen
	$\frac{4x}{360} \times 2\pi[r] = 2\pi[r] - 4[r]$ oe	M1	i.e. M mark for isolating and collecting terms in x
	Leading to $\frac{90(\pi-2)}{\pi}$	A1	With no errors or omissions

PUBLISHED

Question	Answer	Marks	Partial Marks
11(a)	2.5 and – 2.5 oe	3	M2 for $1681m^2 = \frac{42025}{4}$ oe or M1 for $(9m)^2 + (40m)^2$ oe
11(b)(i)(a)	c – a final answer	1	
11(b)(i)(b)	$\frac{3}{4}$ a final answer	1	
11(b)(i)(c)	c + $\frac{3}{4}$ a final answer	1	FT c + <i>their (b)(i)(b)</i> , must be a vector in terms of a and/or c in its simplest form
11(b)(ii)	a + $\frac{4}{3}$ c oe	2	B1 for $[\overrightarrow{BQ} =] \frac{1}{3} \mathbf{c}$ or $[\overrightarrow{AQ} =] \frac{4}{3} \mathbf{c}$ or M1 for a correct route or for answer a + $k\mathbf{c}$ oe, where $k > 1$



Cambridge IGCSE™

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NUMBER

MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2022

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) Here are the ingredients needed to make a pasta bake to serve 12 people.

250 g butter 600 g pasta 460 g mushrooms 280 g cheese 800 ml milk

- (i) Find the mass of the cheese as a percentage of the mass of the mushrooms.

..... % [1]

- (ii) Find the mass of butter needed to make a pasta bake to serve 18 people.

..... g [2]

- (iii) Monica has 2.2 litres of milk and 1.5 kg of each other ingredient.

Calculate the greatest number of people she can serve with pasta bake.

..... [3]

- (b) In 2019, a packet of pasta cost \$2.40.
This was an increase of 25% of the cost of a packet in 2018.

(i) Work out the cost in 2018.

\$ [2]

- (ii) In 2020, the cost of a packet increased by 15% from the cost in 2019.

Work out the total percentage increase in the cost of a packet from 2018 to 2020.

..... % [3]

(c)



Pasta is sold in packets with width 11.5 cm, correct to the nearest 0.5 cm.

A shop places these packets in a single line on a shelf of length 2 m, correct to the nearest 0.1 m.

Find the maximum number of these packets that will fit along this shelf.

You must show all your working.

..... [3]

2 (a) Simplify fully.

(i) $p^3 \times p^{11}$

..... [1]

(ii) $\frac{18m^6}{3m^2}$

..... [2]

(iii) $\left(\frac{27x^9y^{27}}{64}\right)^{-\frac{1}{3}}$

..... [3]

(b) A sequence has n th term $3n^2$.

Write down the first 3 terms of this sequence.

....., ..., ... [2]

(c) Find the n th term for each of these sequences.

(i) 13, 16, 19, 22, 25, ...

..... [2]

(ii) 3, 17, 55, 129, 251, ...

..... [2]

(d) Solve.

$$\frac{3x-22}{4} = 23$$

$$x = \dots\dots\dots [3]$$

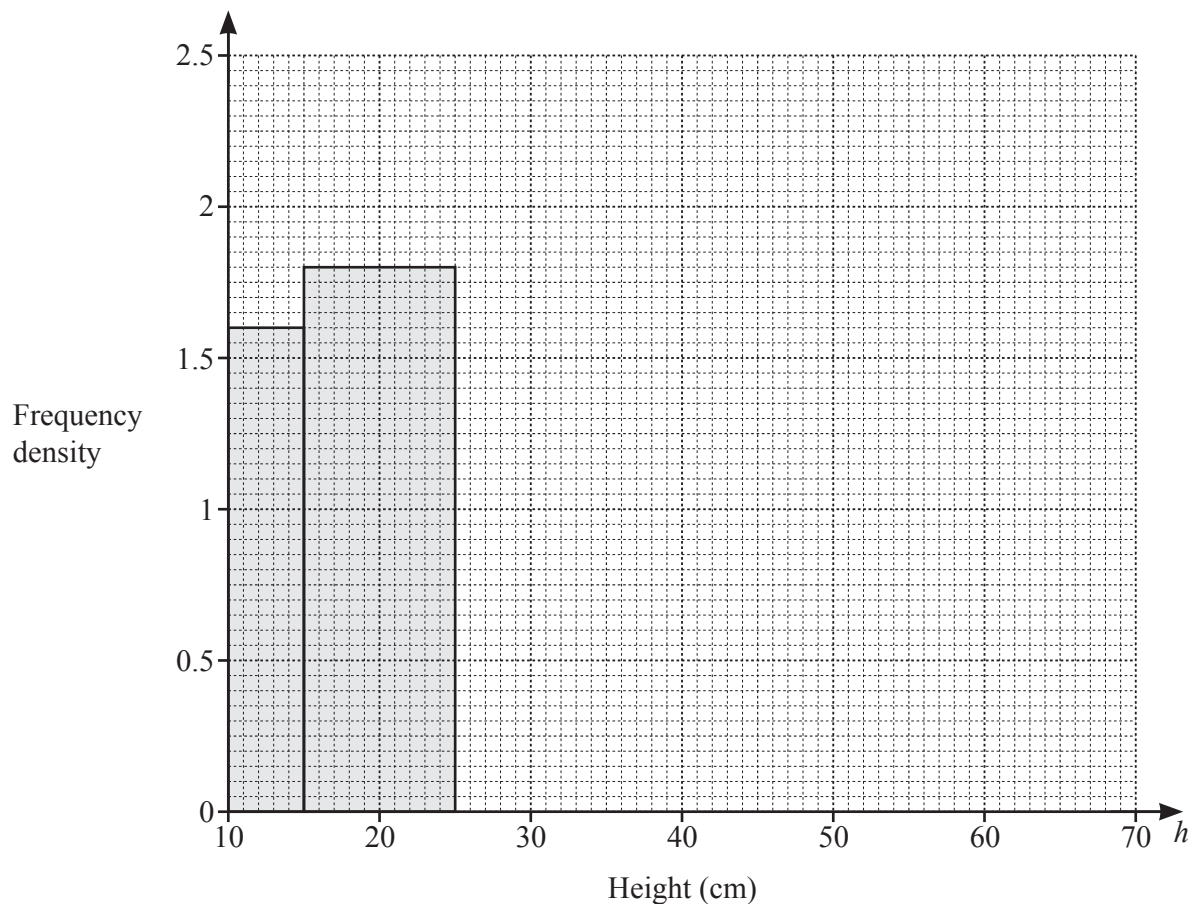
(e) Use the quadratic formula to solve $3x^2 + 8x - 20 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$$x = \dots\dots\dots, x = \dots\dots\dots [4]$$

- 3 The height, h cm, of each of 100 plants is recorded.
The table shows information about the heights of these plants.

Height (h cm)	$10 < h \leq 15$	$15 < h \leq 25$	$25 < h \leq 40$	$40 < h \leq 60$	$60 < h \leq 70$
Frequency	8	18	28	33	13

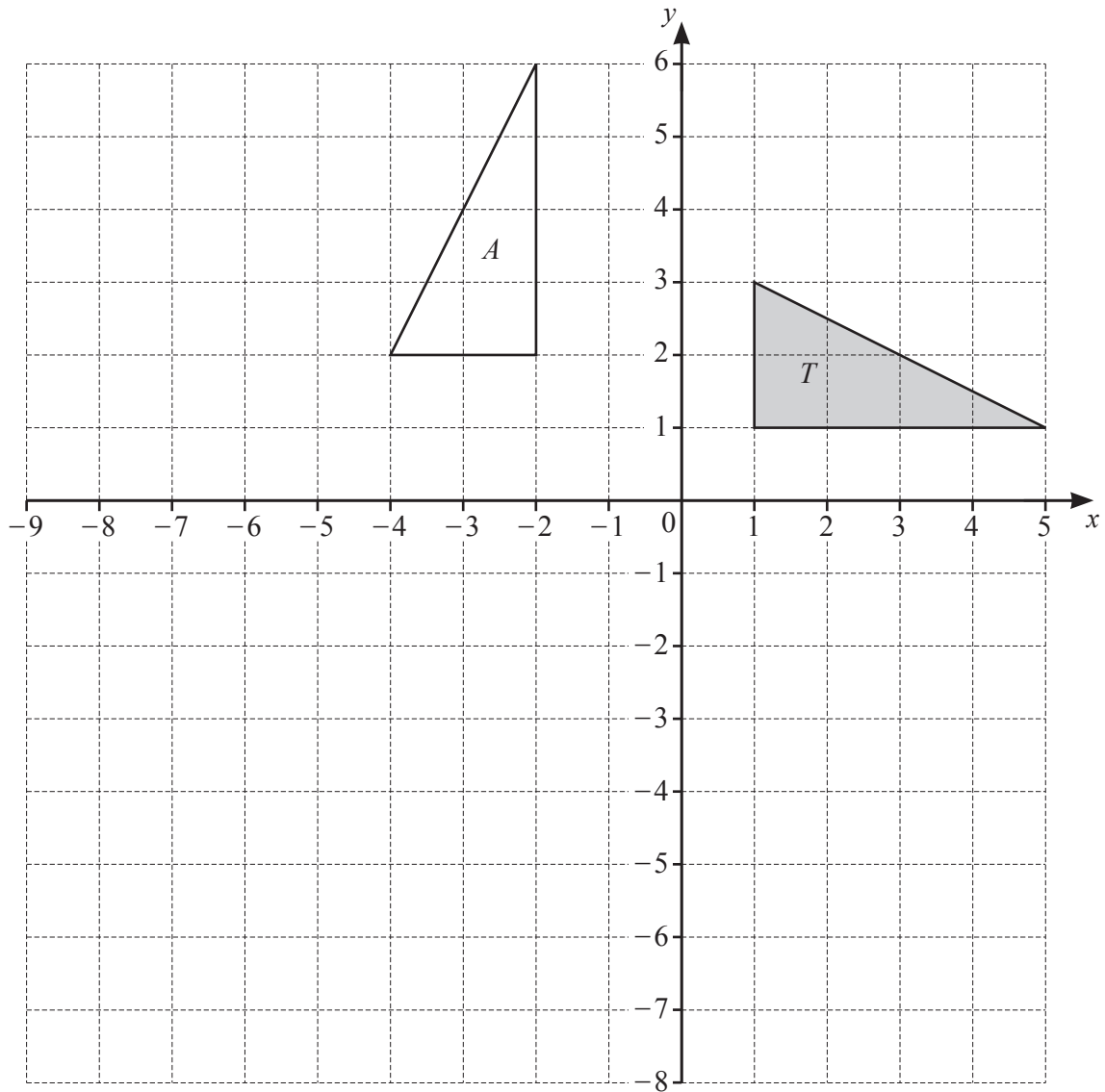
- (a) Complete the histogram to show this information.
The first two blocks have been drawn for you.



[3]

- (b) Calculate an estimate of the mean height.

..... cm [4]

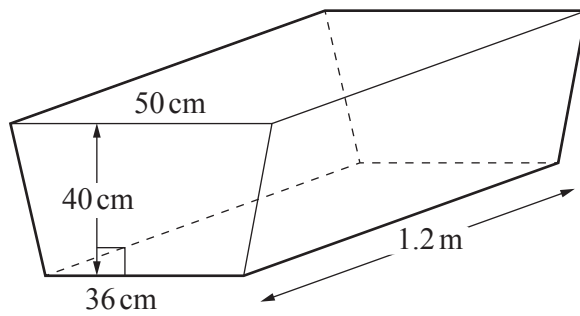


- (a) Draw the reflection of triangle T in the line $y = -2$. [2]
- (b) Draw the enlargement of triangle T with scale factor $\frac{1}{2}$ and centre of enlargement $(-5, -3)$. [2]
- (c) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....

..... [3]

5

NOT TO
SCALE

The diagram shows a water trough in the shape of a prism.
The prism has a cross-section in the shape of an isosceles trapezium.
The trough is completely filled with water.

- (a) Show that the volume of water in the trough is 206.4 litres.

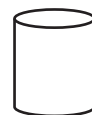
[3]

- (b) The water from the trough is emptied at a rate of 600 ml per second.

Calculate the time taken, in minutes and seconds, for the trough to be emptied.

..... minutes seconds [3]

- (c) All the water from the trough is emptied into a vertical cylindrical tank.
The depth of the water in the tank is 84 cm.



- (i) Calculate the radius of the tank.

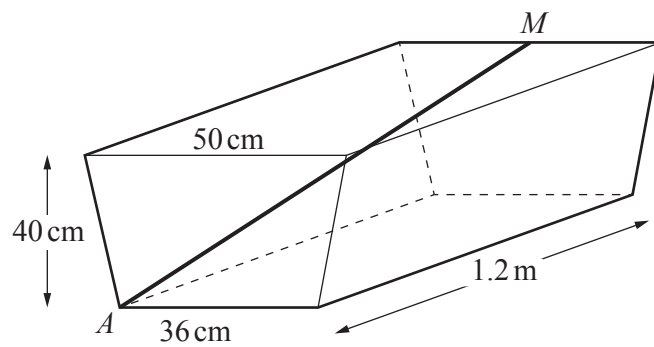
..... cm [3]

- (ii) The tank is 60% full.

Calculate the height of the tank.

..... cm [2]

(d)



NOT TO
SCALE

A steel rod AM is placed inside the empty water trough as shown in the diagram.
 A is a vertex at the base of the isosceles trapezium and M is the midpoint of the top edge on the opposite face.

Calculate the length of the steel rod, AM .

$AM =$ cm [4]

6 (a) $P = 5k^2 - 7$

(i) Find the value of P when $k = 3$.

$P = \dots\dots\dots$ [2]

(ii) Rearrange the formula to make k the subject.

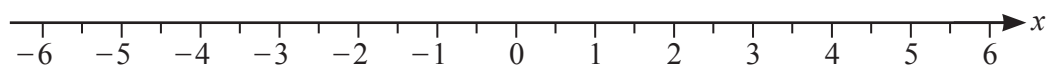
$k = \dots\dots\dots$ [3]

(b) (i) Solve.

$$x - 3 \leq 5x + 7$$

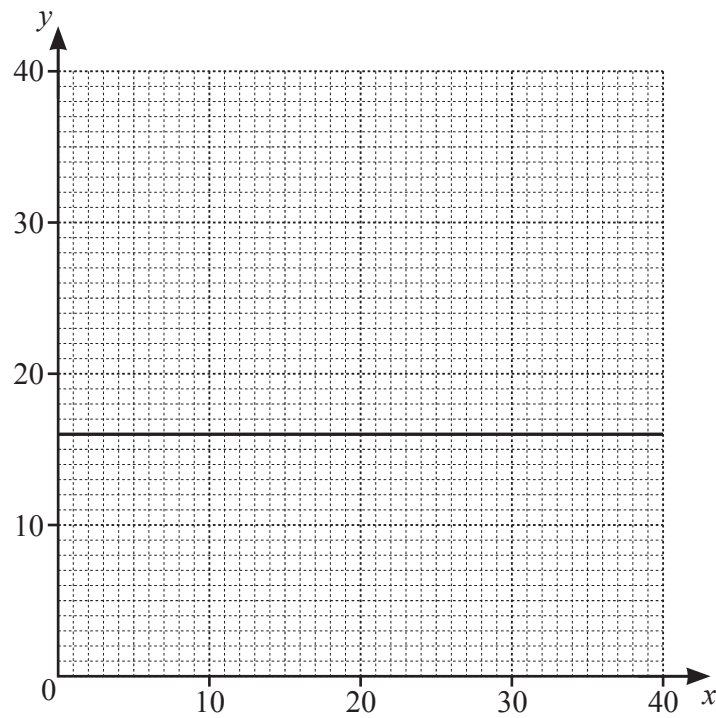
$\dots\dots\dots$ [2]

(ii) Show your answer to **part (b)(i)** on the number line.



[1]

- (c) The line $y = 16$ is drawn on the grid.



The region R satisfies the following inequalities.

$$y \geq 16 \quad x > 2 \quad 2x + 3y \geq 72 \quad y \leq 32 - x$$

- (i) By drawing three more lines and shading the region **not required**, find and label region R . [6]
- (ii) Find the integer coordinates (x, y) in the region R that give the maximum value of $2x + y$.

(..... , ...) [2]

- 7 Regan is playing a game with these six number cards.

 -3 -2 2 3 5 7

- (a) She takes two cards at random, without replacement, and **multiplies** the two numbers to give a score.

Find the probability that

- (i) the score is 35

..... [3]

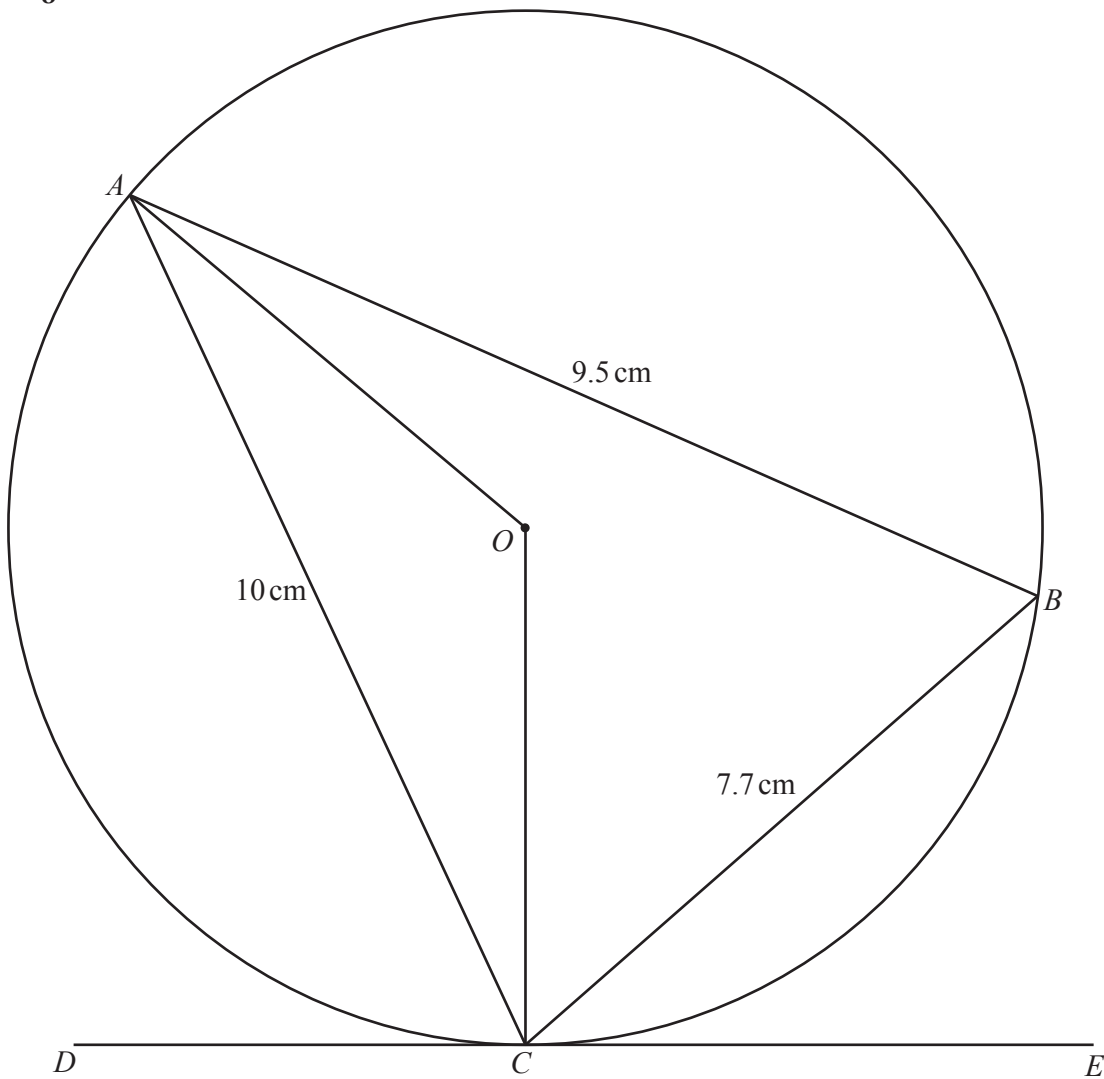
- (ii) the score is a positive number.

..... [3]

- (b) Regan now takes three cards at random from the six cards, without replacement, and **adds** the three numbers to give a total.

Find the probability that her total is 5.

..... [4]

NOT TO
SCALE

A , B and C are points on the circle, centre O .
 DE is a tangent to the circle at C .
 $AC = 10\text{ cm}$, $AB = 9.5\text{ cm}$ and $BC = 7.7\text{ cm}$.

(a) Show that angle $ABC = 70.2^\circ$, correct to 1 decimal place.

[4]

(b) Find

(i) angle AOC

Angle $AOC = \dots\dots\dots$ [1]

(ii) angle ACO

Angle $ACO = \dots\dots\dots$ [1]

(iii) angle ACD .

Angle $ACD = \dots\dots\dots$ [1]

(c) Calculate the radius, OC , of the circle.

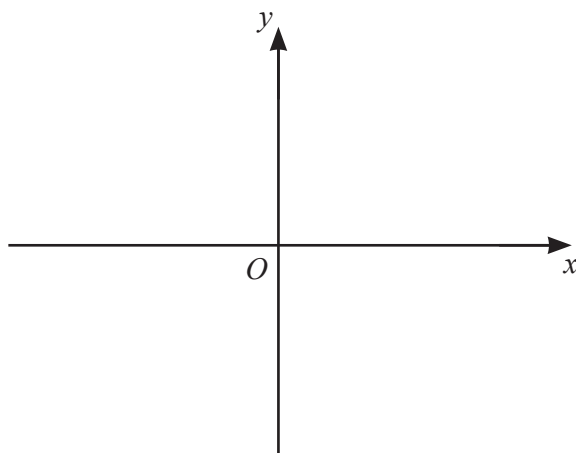
$OC = \dots\dots\dots$ cm [3]

(d) Calculate the area of triangle ABC as a percentage of the area of the circle.

$\dots\dots\dots$ % [4]

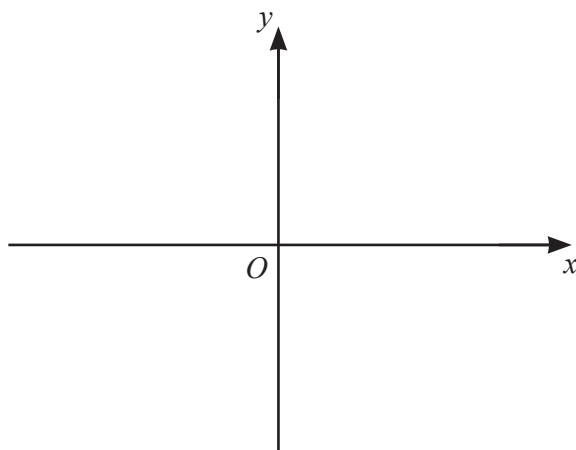
- 9 (a) Sketch the following graphs.
On each sketch, indicate any intercepts with the axes.

(i) $3x - 4y = 12$



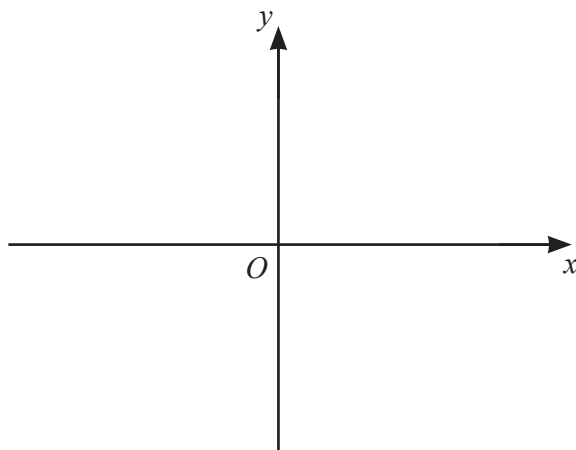
[2]

(ii) $y = x^2 - 3x - 4$



[4]

(iii) $y = 6^x$



[2]

- (b) (i) Find the derivative, $\frac{dy}{dx}$, of $y = 5 + 8x - \frac{4}{3}x^3$.

..... [2]

- (ii) Find the gradient of $y = 5 + 8x - \frac{4}{3}x^3$ at $x = -1$.

..... [2]

- (iii) A tangent is drawn to the graph of $y = 5 + 8x - \frac{4}{3}x^3$.

The gradient of the tangent is -28 .

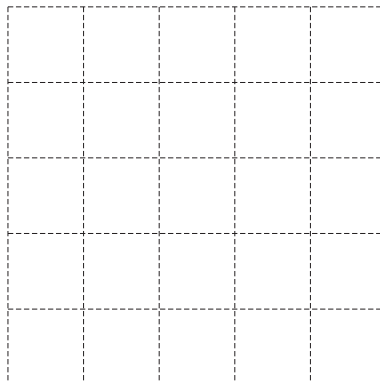
Find the coordinates of the two possible points where this tangent meets the graph.

(..... , ...)

(..... , ...) [5]

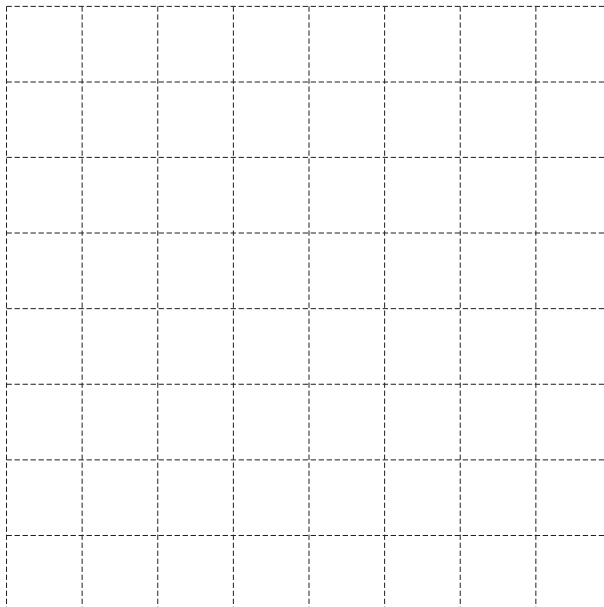
10 (a) $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

(i) On the grid, draw and label vector $2\mathbf{a}$.



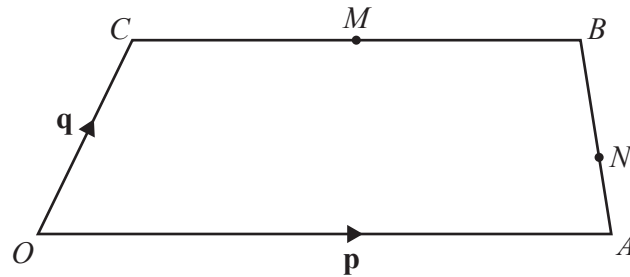
[1]

(ii) On the grid, draw and label vector $(\mathbf{a} - \mathbf{b})$.



[2]

(b)



NOT TO
SCALE

$OABC$ is a trapezium with OA parallel to CB .

M is the midpoint of CB and N is the point on AB such that $AN : NB = 1 : 2$.

O is the origin, $\overrightarrow{OA} = \mathbf{p}$, $\overrightarrow{OC} = \mathbf{q}$ and $\overrightarrow{CB} = \frac{3}{4}\mathbf{p}$.

(i) Find, in terms of $\mathbf{p}$ and/or $\mathbf{q}$, in its simplest form

(a) $\overrightarrow{OB}$

$\overrightarrow{OB} = \dots\dots\dots$ [1]

(b) $\overrightarrow{AB}$

$\overrightarrow{AB} = \dots\dots\dots$ [2]

(c) $\overrightarrow{MN}$.

$\overrightarrow{MN} = \dots\dots\dots$ [3]

(ii) OA and MN are extended to meet at G .

Find the position vector of G in terms of $\mathbf{p}$.

$\dots\dots\dots$ [2]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **13** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles

1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

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Question	Answer	Marks	Partial Marks
1(a)(i)	60.9 or 60.86 to 60.87	1	
1(a)(ii)	375	2	M1 for $\frac{250}{12} [\times 18]$ oe
1(a)(iii)	30 nfw	3	M1 for $2200 \div 800 [\times 12]$ oe M1 for $1500 \div 600 [\times 12]$ oe
1(b)(i)	1.92	2	M1 for $k \times \left(1 + \frac{25}{100}\right) = 2.4[0]$ oe or better
1(b)(ii)	43.75 or $43\frac{3}{4}$	3	M2 for $\left(\left(1 + \frac{25}{100}\right) \times \left(1 + \frac{15}{100}\right) [-1]\right) [\times 100]$ oe or $\left(1 + \frac{25}{100}\right) \times \left(1 + \frac{15}{100}\right) \times 100 [-100]$ or for $\frac{2.40 \times \left(1 + \frac{15}{100}\right)}{\text{their (b)(i)}} \times 100 [-100]$ oe or M1 for $2.40 \times \left(1 + \frac{15}{100}\right)$ or $\left(1 + \frac{25}{100}\right) \times \left(1 + \frac{15}{100}\right)$ oe
1(c)	18 nfw	3	M2 for $\frac{200 \text{ to } 210}{11.5 - 0.25}$ or $\frac{200 + 5}{11 \text{ to } 11.5}$ oe or M1 for $200 + 5$, $200 - 5$, $11.5 + 0.25$ or $11.5 - 0.25$

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Question	Answer	Marks	Partial Marks
2(a)(i)	p^{14} final answer	1	
2(a)(ii)	$6m^4$ final answer	2	B1 for $6m^k$ or km^4 in final answer or correct answer seen and spoilt
2(a)(iii)	$\frac{4}{3x^3y^9}$ or $\frac{4x^{-3}y^{-9}}{3}$ final answer	3	B2 for correct answer seen and spoilt or 2 correct elements in final answer or B1 for one of $\frac{4}{3}$ or $\frac{3}{4}$ oe or x^3 or y^9 seen
2(b)	3, 12, 27	2	B1 for 12 or 27
2(c)(i)	$3n + 10$ oe final answer	2	B1 for $3n + k$ oe or $jn + 10$ oe ($j \neq 0$) or for correct expression shown in working and then spoilt
2(c)(ii)	$2n^3 + 1$ oe final answer	2	B1 for 3rd diff = 12 (both needed) or for cubic answer or for correct expression shown in working and then spoilt
2(d)	38	3	M2 for $3x = 4 \times 23 + 22$ or M1 for $3x - 22 = 4 \times 23$ or for $\frac{3x}{4} = 23 + \frac{22}{4}$ oe
2(e)	$\frac{-8 \pm \sqrt{8^2 - 4(3)(-20)}}{2 \times 3}$ or $\frac{-8}{2 \times 3} \pm \sqrt{\frac{8^2}{4 \times 3^2} - \frac{(-20)}{3}}$ or better	B2	B1 for $\sqrt{8^2 - 4(3)(-20)}$ oe or $\frac{-8 + \sqrt{q}}{2 \times 3}$ oe or $\frac{-8 - \sqrt{q}}{2 \times 3}$ oe or both
	– 4.24, 1.57 final answers	B2	B1 for each If B0 , SC1 for answers – 4.2 or –4.23 or –4.240 to – 4.239 and 1.6 or 1.572 to 1.573 or – 4.24 and 1.57 seen in working or for –1.57 and 4.24 as final answer

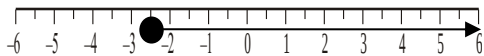
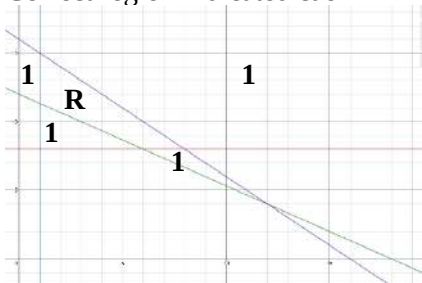
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Question	Answer	Marks	Partial Marks
3(a)	Correct histogram	3	B1 for each correct block If 0 scored, SC1 for two of $\frac{28}{15}$, $\frac{33}{20}$, $\frac{13}{10}$ or 1.87 or 1.866 to 1.867, 1.65, 1.3
3(b)	38.65	4	M1 for 12.5, 20, 32.5, 50, 65 soi M1 for $\sum fx$ where x is in the correct interval including boundaries M1dep for $\sum fx \div 100$
4(a)	Triangle drawn at (1, – 5), (1, – 7), (5, – 5)	2	B1 for reflection in any horizontal line If 0 scored, SC1 for reflection in $x = -2$
4(b)	Triangle drawn at (– 2, 0), (– 2, – 1), (0, – 1)	2	B1 for correct size and orientation but wrong position
4(c)	Rotation 90 [anticlockwise] oe [centre] (– 1, 0)	3	B1 for each

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Question	Answer	Marks	Partial Marks
5(a)	$\left(\frac{(36+50)\times 40}{2}\right)\times 120 \text{ oe}$ or $\left(\frac{(0.36+0.5)\times 0.4}{2}\right)\times 1.2 \text{ oe}$	M2	M1 for $\frac{(36+50)\times 40}{2}$ oe or $\frac{(0.36+0.5)\times 0.4}{2}$ oe
	206400 ÷ 1000 = 206.4 or 0.2064 × 1000 = 206.4 nfw	A1	Must see an explicit conversion
5(b)	5 [minutes] 44 seconds	3	B2 for 344 [seconds] oe 5.73...[mins] or M1 for figs 206.4 ÷ figs 6 oe
5(c)(i)	28[.0] or 27.96 to 27.97	3	M2 for $[r^2=] \frac{\text{figs } 2064}{(\text{figs } 84)\pi}$ or M1 for $\pi r^2 \times \text{figs } 84 = \text{figs } 2064$
5(c)(ii)	140 cao	2	M1 for $0.6h = 84$ oe ALT method M1 for $\pi \times (\text{their } \mathbf{(c)(i)})^2 \times h = \text{figs } 206400 \div 0.6$ oe
5(d)	128 or 127.7 to 127.8	4	B3 for $40^2 + 120^2 + 18^2$ oe OR B1 for horizontal length 18 soi M1 for any correct attempt at 2-dimensional Pythagoras' $18^2 + 120^2$, $120^2 + 40^2$, $18^2 + 40^2$

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Question	Answer	Marks	Partial Marks
6(a)(i)	38	2	M1 for $5 \times 3^2 - 7$ oe
6(a)(ii)	$[\pm]\sqrt{\frac{P+7}{5}}$ oe final answer	3	M1 for $P + 7 = 5k^2$ or $\frac{P}{5} = k^2 - \frac{7}{5}$ M1 for $k^2 = \dots\dots$ FT <i>their</i> first step M1 for square root to final answer Max M2 for incorrect answer
6(b)(i)	$x \geq -2.5$ final answer	2	M1 for $-4x \leq 7 + 3$ or better
6(b)(ii)		1	FT <i>their</i> inequality in (b)(i)
6(c)(i)	$x = 2$ broken line	B1	
	$y = 32 - x$ solid line	B1	
	$2x + 3y = 72$ solid line	B2	B1 for line passing through (0, 24) or (36, 0)
	Correct region indicated cao 	B2	B1 for region satisfying 3 of the inequalities
6(c)(ii)	(16, 16)	2	M1 for substitution into $2x + y$ for any integer point in <i>their</i> region

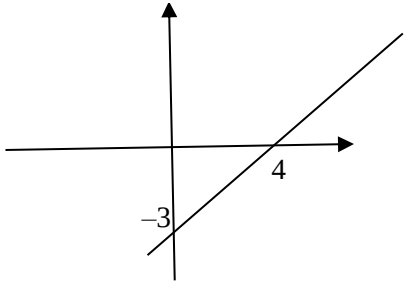
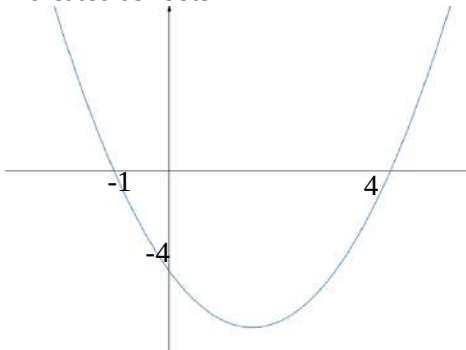
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Question	Answer	Marks	Partial Marks
7(a)(i)	$\frac{1}{15}$ oe	3	M2 for $2 \times \frac{1}{6} \times \frac{1}{5}$ oe or M1 for $\frac{1}{6} \times \frac{1}{5}$ oe or list or indication of 2 correct pairs If 0 scored, SC1 for answer $\frac{1}{18}$
7(a)(ii)	$\frac{7}{15}$ oe	3	M2 for $\left(\frac{4}{6} \times \frac{3}{5}\right) + 2\left(\frac{1}{6} \times \frac{1}{5}\right)$ oe or $14\left(\frac{1}{6} \times \frac{1}{5}\right)$ oe or $1 - 2\left(\frac{2}{6} \times \frac{4}{5}\right)$ or M1 for $\left(\frac{4}{6} \times \frac{3}{5}\right)$ or $2\left(\frac{1}{6} \times \frac{1}{5}\right)$ oe or $2\left(\frac{2}{6} \times \frac{4}{5}\right)$ or correct identification of 14 pairs If 0 scored, SC1 for answer $\frac{5}{9}$
7(b)	$\frac{1}{10}$ oe nfw	4	M3 for $6\left(\frac{1}{6} \times \frac{1}{5} \times \frac{1}{4}\right) + 6\left(\frac{1}{6} \times \frac{1}{5} \times \frac{1}{4}\right)$ oe or M2 for $6\left(\frac{1}{6} \times \frac{1}{5} \times \frac{1}{4}\right)$ oe or $2\left(\frac{1}{6} \times \frac{1}{5} \times \frac{1}{4}\right)$ oe or M1 for $k\left(\frac{1}{6} \times \frac{1}{5} \times \frac{1}{4}\right)$ where k is an integer and $1 \leq k \leq 12$ but not $k = 2$ or $k = 6$ or identifies $-2, 2$ and 5 or $-3, 3$ and 5 as the 3 cards needed If 0 scored, SC1 for answer $\frac{1}{18}$

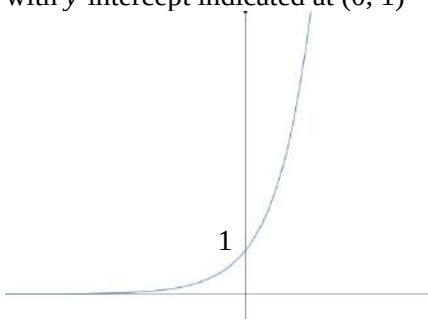
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Question	Answer	Marks	Partial Marks
8(a)	$[\cos B =] \frac{9.5^2 + 7.7^2 - 10^2}{2 \times 9.5 \times 7.7}$ oe	M2	M1 for $10^2 = 9.5^2 + 7.7^2 - 2 \times 9.5 \times 7.7 \cos B$ oe or better
	70.206 to 70.207 or 70.21 to 70.22	A2	A1 for $\frac{2477}{7315}$ oe or 0.339 or 0.3386....
8(b)(i)	140.4	1	
8(b)(ii)	19.8	1	FT $(180 - \text{their (b)(i)}) \div 2$
8(b)(iii)	70.2	1	FT $90 - \text{their (b)(ii)}$
8(c)	5.31 or 5.314 to 5.315	3	M2 for $\frac{5}{\cos \text{their (b)(ii)}}$ oe or M1 for $\frac{5}{r} = \cos(\text{their (b)(ii)})$ oe
8(d)	38.8 or 38.9 or 38.78 to 38.85	4	M3 for $\frac{0.5 \times 9.5 \times 7.7 \times \sin 70.2}{\pi \times (\text{their (c)})^2} [\times 100]$ OR M1 for $0.5 \times 9.5 \times 7.7 \times \sin 70.2$ M1 for $\pi \times (\text{their (c)})^2$

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Question	Answer	Marks	Partial Marks
9(a)(i)	Correct sketch of $3x - 4y = 12$ with $y = -3$ and $x = 4$ indicated on axes 	2	B1 for line with positive gradient
9(a)(ii)	Correct sketch of $y = x^2 - 3x - 4$ with $(0, -4)$ indicated as y – intercept and $x = -1$ and $x = 4$ indicated as roots  Minimum in fourth quadrant, not at $x = 0$	4	B3 for correct sketch with one value omitted or incorrect or for a poor sketch with all 3 intercepts correct. or B2 for roots $x = -1$ and $x = 4$ soi with no extra roots or for correct shape with $y = -4$ indicated or B1 for correct shape or for $(x - 4)(x + 1)$ shown or for incorrect sketch with $(0, -4)$ indicated as y – intercept

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Question	Answer	Marks	Partial Marks
9(a)(iii)	Correct sketch of $y = 6^x$ with y-intercept indicated at (0, 1) 	2	B1 for increasing exponential graph seen on both sides of the y-axis.
9(b)(i)	$8 - 4x^2$ [+ 0]	2	B1 for two terms correct and one extra incorrect term or for one of two terms correct or for correct answer seen and spoilt
9(b)(ii)	4	2	M1 for substitution of $x = -1$ into <i>their</i> (b)(i)
9(b)(iii)	(3, -7) and (-3, 17)	5	B4 for (3, -7) or (-3, 17) or B3 for $x = \pm 3$ or M2 for $x^2 = 9$ or $k(x - 3)(x + 3) = 0$ oe or for correct method for solving <i>their</i> (b)(i) = - 28 or M1 for <i>their</i> (b)(i) = - 28

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Question	Answer	Marks	Partial Marks
10(a)(i)	2a drawn correctly with direction arrow	1	
10(a)(ii)	a – b drawn correctly with direction arrow	2	B1 for $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ seen or implied or M1 for correctly drawing <i>their</i> a – b with an arrow
10(b)(i)(a)	$\mathbf{q} + \frac{3}{4} \mathbf{p}$ final answer	1	
10(b)(i)(b)	$\mathbf{q} - \frac{1}{4} \mathbf{p}$ final answer	2	M1 for a correct route
10(b)(i)(c)	$\frac{13}{24} \mathbf{p} - \frac{2}{3} \mathbf{q}$ final answer	3	M2 for $\frac{3}{8} \mathbf{p} - \frac{2}{3}$ (<i>their</i> (b)(i)(b)) oe or for $-\frac{3}{8} \mathbf{p} - \mathbf{q} + \mathbf{p} + \frac{1}{3}$ (<i>their</i> (b)(i)(b)) oe or M1 for a correct route or for $\overrightarrow{BN} = -\frac{2}{3}$ (<i>their</i> (b)(i)(b)) or $\overrightarrow{AN} = \frac{1}{3}$ (<i>their</i> (b)(i)(b)) or final answer $k\mathbf{p} - \frac{2}{3} \mathbf{q}$ oe or $\frac{13}{24} \mathbf{p} - k\mathbf{q}$ oe
10(b)(ii)	$\frac{19}{16} \mathbf{p}$ oe final answer	2	$\overrightarrow{AG} = \frac{3}{8} \mathbf{p} \div 2$ soi M1 for or for answer $k\mathbf{p}$ oe



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MATHEMATICS**0580/21**

Paper 2 (Extended)

May/June 2022**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

2

- 1 Write down a prime number between 30 and 40.

..... [1]

- 2 Calculate $4^5 - 5^4$.

..... [1]

- 3 Jason starts a run at 10.05 am and finishes at 1.02 pm.

Work out the time Jason takes to complete the run.

..... h min [1]

- 4 Calculate $\frac{1-0.7}{0.45-0.38}$, giving your answer correct to 4 significant figures.

..... [2]

- 5 Kirsty changes \$380.80 into pounds (£) when £1 = \$1.19.

Calculate the amount Kirsty receives.

£ [2]

- 6 Write 180 as a product of its prime factors.

..... [2]

3

- 7 Without using a calculator, work out $\frac{3}{7} - \frac{2}{21}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

8 $s = \frac{1}{2}at^2$

- (a) Work out the value of s when $a = 0.9$ and $t = 4$.

$s =$ [1]

- (b) Rearrange the formula to find t in terms of s and a .

$t =$ [2]

- 9 Factorise completely.

$$14xy - 7y^2$$

..... [2]

4

10 22, 17, 12, 7, 2, ...

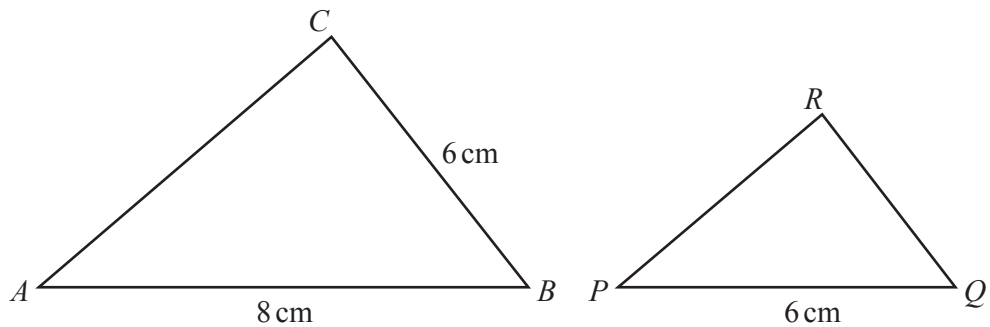
(a) Find the next term of the sequence.

..... [1]

(b) Find the n th term of the sequence.

..... [2]

11



NOT TO
SCALE

Triangle ABC is mathematically similar to triangle PQR .

(a) Calculate QR .

$QR =$ cm [2]

(b) The two triangles are the cross-sections of two mathematically similar prisms.
The volume of the larger prism is 320 cm^3 .

Calculate the volume of the smaller prism.

..... cm^3 [2]

- 12 The interior angles of a pentagon are in the ratio $4 : 5 : 5 : 7 : 9$.

Find the size of the largest angle.

..... [3]

- 13 Work out $2 \times 10^{100} - 2 \times 10^{98}$, giving your answer in standard form.

..... [2]

- 14 A train passes through a station at a speed of 108 km/h.
The length of the station is 120 m.
The train takes 7 seconds to completely pass through the station.

Work out the length of the train.

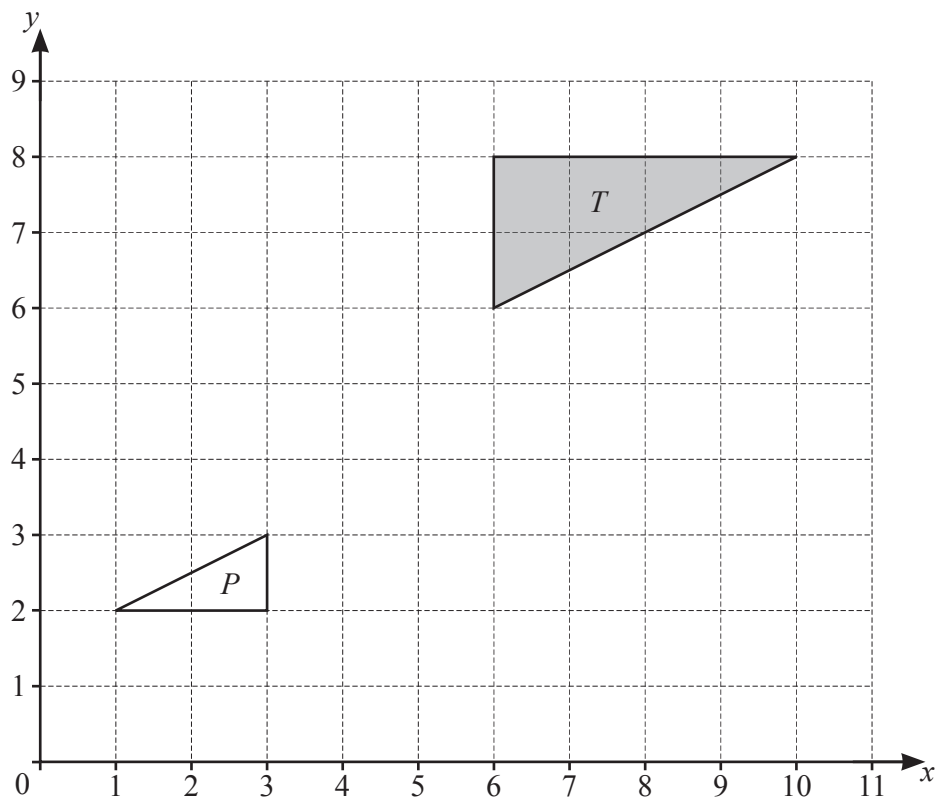
..... m [3]

15 $4^x = \frac{1}{64}$

Find the value of x .

$x = \dots\dots\dots$ [1]

16



Describe fully the **single** transformation that maps triangle T onto triangle P .

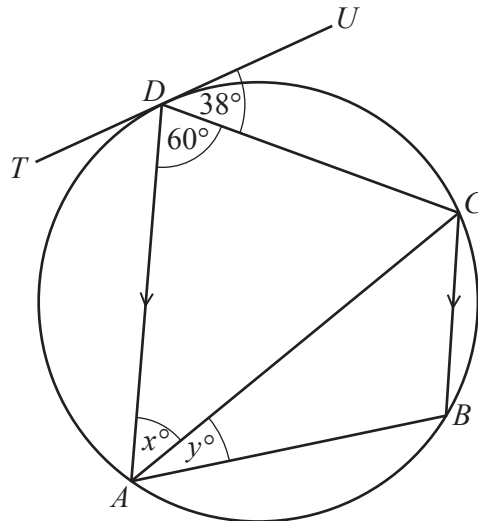
.....
 [3]

17 Find the radius of a hemisphere of volume 80 cm^3 .

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm [3]

18



NOT TO
SCALE

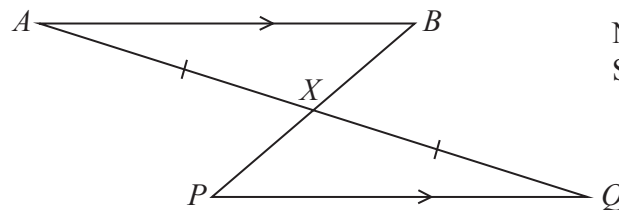
A, B, C and D are points on a circle.
 TU is a tangent to the circle at D .
 DA is parallel to CB .

Find the value of x and the value of y .

$x = \dots\dots\dots$

$y = \dots\dots\dots$ [3]

19



NOT TO
SCALE

In the diagram, AB is parallel to PQ .
 AQ and PB intersect at X with $AX = XQ$.

Complete the following statements.

In triangles ABX and QPX ,

$AX = XQ$ is given information.

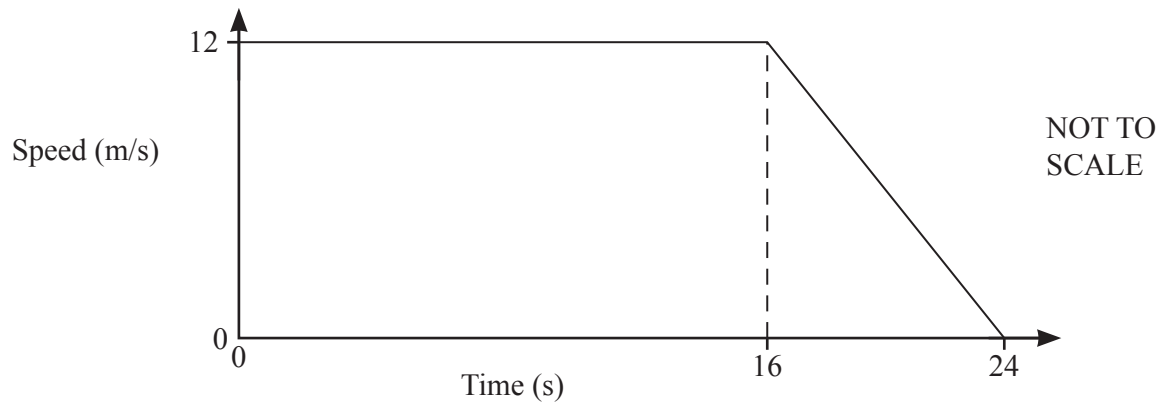
Angle $BAX =$ Angle $\dots\dots\dots$ because $\dots\dots\dots$

Angle $AXB =$ Angle $\dots\dots\dots$ because $\dots\dots\dots$

Triangle ABX is congruent to triangle QPX because of the congruency criterion $\dots\dots\dots$

$PX = \dots\dots\dots$ because the triangles are congruent. [4]

20



The diagram shows the speed–time graph for 24 seconds of a car journey.

Calculate

- (a) the deceleration of the car in the final 8 seconds,

..... m/s^2 [1]

- (b) the total distance travelled during the 24 seconds.

..... m [2]

21 Factorise completely.

$$1 - q - a + aq$$

..... [2]

22 Simplify fully $(216y^{216})^{\frac{2}{3}}$.

..... [2]

23 $x^2 + 8x + 10 = (x + p)^2 + q$

(a) Find the value of p and the value of q .

$p =$

$q =$ [2]

(b) Solve.

$x^2 + 8x + 10 = 30$

$x =$ or $x =$ [2]

24 A cuboid measures 24 cm by 12 cm by 8 cm.

Calculate the length of a diagonal of the cuboid.

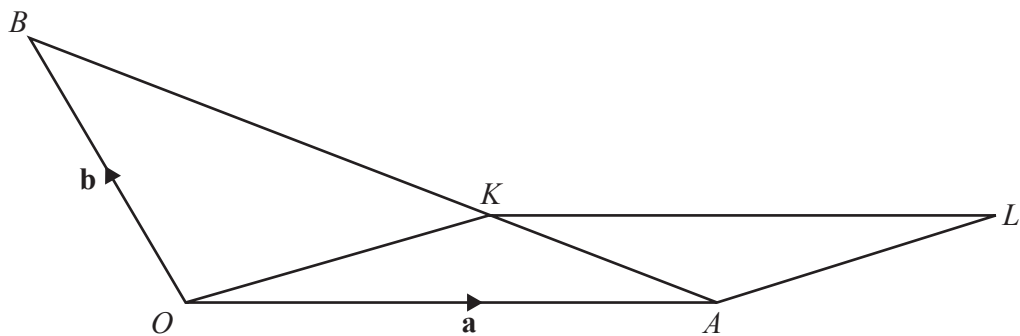
..... cm [3]

- 25 w is proportional to the square root of y .
 y is inversely proportional to x .
 When $x = 4$, $y = 16$ and $w = 8$.

Find w in terms of x .

$w = \dots\dots\dots$ [3]

26



The diagram shows a triangle OAB and a parallelogram $OALK$.
 The position vector of A is $\mathbf{a}$ and the position vector of B is $\mathbf{b}$.
 K is a point on AB so that $AK : KB = 1 : 2$.

Find the position vector of L , in terms of $\mathbf{a}$ and $\mathbf{b}$.
 Give your answer in its simplest form.

$\dots\dots\dots$ [4]

- 27 The line $y = x + 1$ intersects the graph of $y = x^2 - 3x - 11$ at the points A and B .

Find the coordinates of A and the coordinates of B .
You must show all your working.

A (..... , ...)

B (..... , ...) [4]

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Cambridge IGCSE™

SUBJECT

0580/21

Paper 2 (Extended)

May/June 2022

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **6** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

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- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

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Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks
1	31 or 37	1	
2	399	1	
3	2h 57 min	1	
4	4.286 cao	2	B1 for 4.285[7...] or 4.29 or $\frac{30}{7}$ or $4\frac{2}{7}$ or for correctly rounding their more accurate decimal to 4sf
5	320	2	M1 for $380.8 \div 1.19$ oe
6	$2 \times 2 \times 3 \times 3 \times 5$ oe	2	B1 for 2, 2, 3, 3, 5 or M1 for correct factor tree/diagram/table.
7	$\frac{9}{21}$ and $\frac{2}{21}$ oe	M1	Allow any correct denominator 21k
	$\frac{1}{3}$ cao and correct working	A1	
8(a)	7.2 oe	1	
8(b)	$[\pm] \sqrt{\frac{2s}{a}}$ final answer	2	M1 for $\frac{s}{a} = \frac{1}{2}t^2$ or $2s = at^2$ or better
9	$7y(2x - y)$ final answer	2	B1 for $7(2xy - y^2)$ or $y(14x - 7y)$ or $7y(2x - y)$ seen then spoilt
10(a)	-3	1	
10(b)	$27 - 5n$ oe final answer	2	B1 for $j - 5n$ or $27 - kn, k \neq 0$ or for $27 - 5n$ seen then spoilt
11(a)	4.5 oe	2	M1 for $\frac{8}{6} = \frac{6}{QR}$ oe or better
11(b)	135	2	M1 for $\left(\frac{6}{8}\right)^3$ or $\left(\frac{8}{6}\right)^3$ or $\left(\frac{their 4.5}{6}\right)^3$ oe
12	162	3	M2 for $\left(\frac{(5-2) \times 180}{4+5+5+7+9}\right) \times k$ where $k = 1, 4, 5, 7, 9$ or M1 for $180n \div (4 + 5 + 5 + 7 + 9)$ where $n \geq 2$ or for $(5 - 2) \times 180$ oe

Question	Answer	Marks	Partial Marks
13	1.98×10^{100}	2	B1 for 200×10^{98} or 0.02×10^{100} or answer with figs 198
14	90	3	B2 for 210 or 0.09 km OR M1 for speed $\times$ time seen M1 for correct conversion of both km to m and between h and s
15	–3	1	
16	Enlargement [sf] $-\frac{1}{2}$ [centre] (4, 4)	3	B1 for each
17	3.37 or 3.367 to 3.368	3	M2 for isolating r^3 , e.g. $r^3 = \frac{120}{\pi}$ or M1 for $\frac{1}{2} \times \frac{4}{3} \times \pi r^3 = 80$ oe If 0 scored SC1 for answer 2.67 or 2.672 to 2.673...
18	$[x =] 38$ $[y =] 22$	3	B1 for $[x =] 38$ and B2 for $[y =] 22$ or M1 for angle $ACB = \text{their } x$ or angle $BAD = 60$ or angle $CBA = 120$
19	PQX and alternate PXQ and [vertically] opposite oe ASA XB	4	B2 for lines 1 and 2 correct or B1 for line 1 or 2 correct, or both angles correct B1 for line 3 correct B1 for line 4 correct
20(a)	1.5 or $1\frac{1}{2}$	1	
20(b)	240	2	M1 for one correct area
21	$(1 - q)(1 - a)$ or $(a - 1)(q - 1)$ final answer	2	B1 for $1 - q - a(1 - q)$ or $1 - a - q(1 - a)$ or better or correct answer seen and spoilt
22	$36y^{144}$ final answer	2	B1 for ky^{144} or $36y^k$ final answer $k \neq 0$ or correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
23(a)	$[p =] 4$ $[q =] -6$	2	B1 for one correct or $(x+4)^2 - 6$ or $x^2 + px + px + p^2 [+q]$
23(b)	-10 and 2	2	M1 for $(x+4)^2 = 36$ or $(x+their4)^2 = 30 - their(-6)$ or for correct method to solve quadratic e.g. $(x+10)(x-2)$
24	28	3	M2 for $24^2 + 12^2 + 8^2$ or M1 for $24^2 + 12^2$ or $24^2 + 8^2$ or $12^2 + 8^2$
25	$\frac{16}{\sqrt{x}}$ oe final answer	3	M2 for $w = \frac{k}{\sqrt{x}}$ oe OR M1 for $w = j\sqrt{y}$ M1 for $y = \frac{c}{x}$
26	$\frac{5}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$ final answer	4	M1 for $\overrightarrow{AK} = -\frac{1}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$ or $\overrightarrow{BK} = \frac{2}{3}\mathbf{a} - \frac{2}{3}\mathbf{b}$ M1 for $\overrightarrow{AL}$ (or $\overrightarrow{OK}$) = $\mathbf{a} + their \overrightarrow{AK}$ oe soi or $\overrightarrow{OK}$ (or $\overrightarrow{AL}$) = $\mathbf{b} + their \overrightarrow{AK}$ oe soi or $\overrightarrow{BL} = \mathbf{a} + their \overrightarrow{AK}$ oe soi M1 for a correct route e.g. $\overrightarrow{OL}$, $\mathbf{a} + \overrightarrow{AL}$, $\mathbf{b} + \overrightarrow{BL}$
27	$(-2, -1)$ and $(6, 7)$	4	B3 for $x = -2$ and 6 OR M1 for $x^2 - 3x - 11 = x + 1$ or better M1 for correct method to solve <i>their</i> quadratic e.g. $(x+2)(x-6)$ If 0 scored, SC1 for one correct pair of coordinates



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MATHEMATICS**0580/22**

Paper 2 (Extended)

May/June 2022**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

- 1 At noon, the temperature is 4°C .
At midnight, the temperature is -9°C .

Work out the difference in temperature between noon and midnight.

..... $^{\circ}\text{C}$ [1]

- 2 Thibault records the number of cars of each colour in a car park.

Colour	Black	White	Silver	Red
Number of cars	8	5	4	3

He draws a pie chart to show this information.

Calculate the sector angle for the red cars.

..... [2]

- 3 Figs cost 43 cents each.
Lyra has \$5 to buy some figs.

Calculate the largest number of figs Lyra can buy and the amount of change, in cents, she receives.

..... figs and cents change [3]

- 4 Find the value of $\sqrt{68} \times \sqrt{153}$.

..... [1]

- 5 Find the total surface area of a cuboid with length 8 cm, width 6 cm and height 3 cm.

..... cm^2 [3]

- 6 Some cards have either a square, a circle or a triangle drawn on them.
Piet chooses one of the cards at random.

Complete the table to show the probability of choosing a card with each shape.

Shape	Square	Circle	Triangle
Probability	0.2	0.32	

[2]

- 7 The price of a coat is \$126.
In a sale, this price is reduced by 18%.

Find the sale price of the coat.

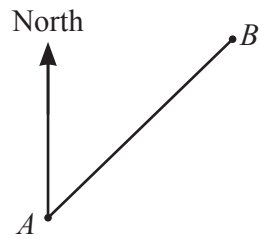
\$ [2]

- 8 The n th term of a sequence is $n^2 + 12$.

Find the first three terms of this sequence.

....., ..., ... [2]

9



NOT TO
SCALE

The bearing of B from A is 059° .

Work out the bearing of A from B .

..... [2]

10 $\mathbf{p} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

(a) Find

(i) $\mathbf{p} - \mathbf{q}$,

$\begin{pmatrix} \\ \end{pmatrix}$ [1]

(ii) $6\mathbf{p}$.

$\begin{pmatrix} \\ \end{pmatrix}$ [1]

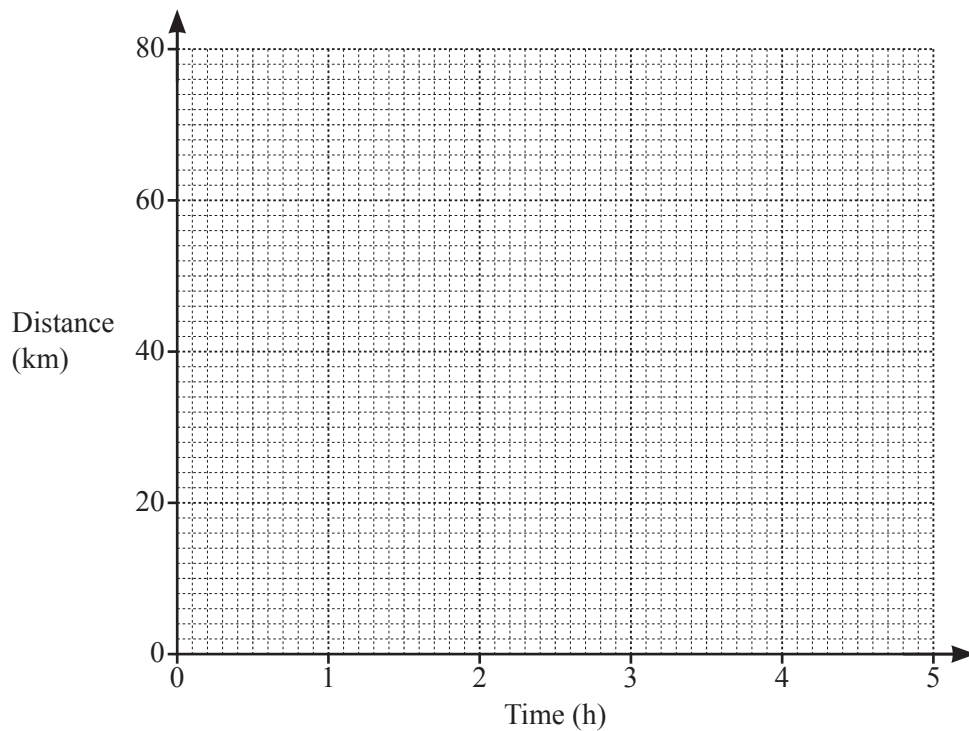
(b) Find $|\mathbf{p} - \mathbf{q}|$.

..... [2]

- 11 Find the value of p when $6^p \times 6^4 = 6^{28}$.

$p = \dots\dots\dots$ [1]

- 12 Annette cycles a distance of 70 km from Midville to Newtown.
Leaving Midville, she cycles for 1 hour 30 minutes at a constant speed of 20 km/h and then stops for 30 minutes.
She then continues the journey to Newtown at a constant speed of 16 km/h.



- (a) On the grid, draw the distance–time graph for the journey. [3]
- (b) Calculate the average speed for the whole journey.

$\dots\dots\dots$ km/h [3]

- 13 Without using a calculator, work out $4\frac{1}{8} - 2\frac{5}{6}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

- 14 Carlos invests \$4540 at a rate of $r\%$ per year compound interest.
At the end of 10 years he has earned \$1328.54 in interest.

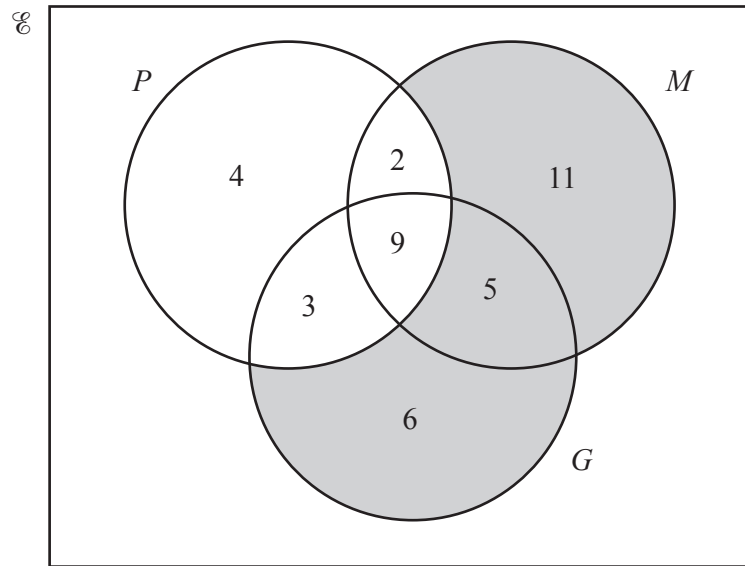
Calculate the value of r .

$r =$ [3]

- 15 Find the highest common factor (HCF) of $12a^3b$ and $20a^2b^2$.

..... [2]

- 16 The Venn diagram shows the number of students in a class of 40 who study physics (P), mathematics (M) and geography (G).



- (a) Use set notation to describe the shaded region.

..... [1]

- (b) Find $n((P \cap G) \cup M')$.

..... [1]

- (c) A student is chosen at random from those studying geography.

Find the probability that this student also studies physics or mathematics but not both.

..... [2]

- 17 (a) Sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (b) Solve the equation $3 \sin x + 1 = 0$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- 18 (a) y is directly proportional to the cube root of $(x + 1)$.
When $x = 7$, $y = 1$.

Find the value of y when $x = 124$.

$y = \dots\dots\dots$ [3]

- (b) F is inversely proportional to the square of d .

Explain what happens to F when d is halved.

$\dots\dots\dots$ [1]

9

19

$$f(x) = 7x - 8$$

$$g(x) = \frac{4}{x} + 5$$

$$h(x) = 2^x + 1$$

(a) Find $f^{-1}(x)$.

$$f^{-1}(x) = \dots\dots\dots [2]$$

(b) Find the value of x when $h(x) = g\left(\frac{1}{3}\right)$.

$$x = \dots\dots\dots [2]$$

20 Factorise completely.

(a) $2m + 3p - 8km - 12kp$

$$\dots\dots\dots [2]$$

(b) $5x^2 - 20y^2$

$$\dots\dots\dots [3]$$

- 21 The n th term of a sequence is $an^2 + bn - 4$.

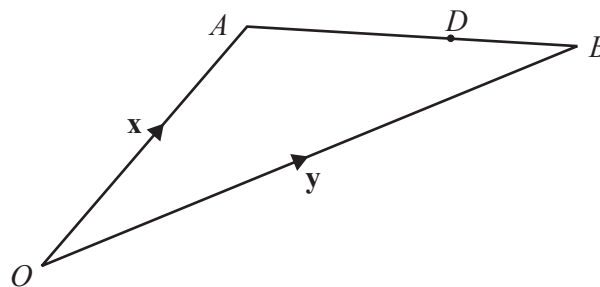
The first term is -3 and the second term is 2 .

Find the value of a and the value of b .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [5]$$

- 22



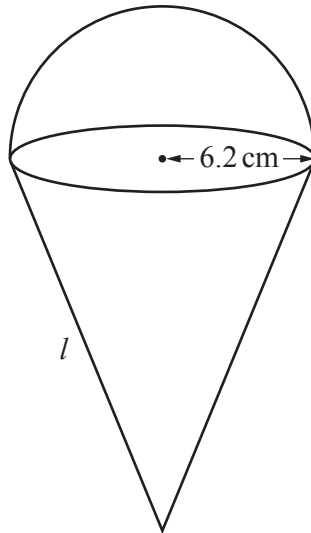
NOT TO
SCALE

$$\overrightarrow{OA} = \mathbf{x}, \overrightarrow{OB} = \mathbf{y} \text{ and } \overrightarrow{OD} = \frac{3}{7}\mathbf{x} + \frac{4}{7}\mathbf{y}.$$

Calculate the ratio $AD:DB$.

$$\dots\dots\dots : \dots\dots\dots [2]$$

23

NOT TO
SCALE

The diagram shows a solid metal shape made from a cone and a hemisphere, both with radius 6.2 cm. The total surface area of the solid shape is 600 cm^2 .

Calculate the slant height, l , of the cone.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

$l = \dots\dots\dots \text{ cm}$ [4]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

May/June 2022

MARK SCHEME

Maximum Mark: 70

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6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

PUBLISHED

Question	Answer	Marks	Partial Marks
1	13 or –13	1	
2	54	2	M1 for $\frac{360}{8+5+4+3}[\times 3]$ or $\frac{3}{8+5+4+3}[\times 360]$ oe
3	11 27	3	M1 for $500 \div 43$ oe M1 for $500 - \text{their } 11 \times 43$ oe <i>their</i> 11 must be an integer from 2 to 11
4	102	1	
5	180	3	M2 for $[2 \times](8 \times 6 + 8 \times 3 + 3 \times 6)$ oe or M1 for 8×6 or 8×3 or 3×6
6	0.48 oe	2	M1 for $1 - (0.2 + 0.32)$ oe
7	103.32 cao	2	M1 for $126 \times \left(1 - \frac{18}{100}\right)$ oe or B1 for 22.68
8	13 16 21	2	B1 for 2 correct terms in correct position or SC1 for 12, 13, 16
9	239	2	M1 for $180 + 59$ or $360 - (180 - 59)$ oe or indicates correct angle on diagram
10(a)(i)	$\begin{pmatrix} 3 \\ 4 \end{pmatrix}$	1	
10(a)(ii)	$\begin{pmatrix} 12 \\ 48 \end{pmatrix}$	1	
10(b)	5	2	M1 for $(\text{their } 3)^2 + (\text{their } 4)^2$ or better
11	24	1	
12(a)	correct graph	3	B1 for line from (0, 0) to (1.5, 30) B1 for horizontal line from (<i>their</i> 1.5, <i>their</i> 30) for 0.5 hours B1 for a line from (<i>their</i> 2, <i>their</i> 30) ending at distance 70 with a gradient of 16 Provided it fits on the grid and <i>their</i> 30 is <70

Question	Answer	Marks	Partial Marks
12(b)	15.6 or 15.55 to 15.56 nfw	3	M2 for $70 \div (\text{their final time in hours})$ (final time $\Rightarrow$) $1.5 + 0.5 + \frac{70 - \text{their } 30}{16}$ or 4.5 or <i>their</i> final time from graph or M1 for $70 \div$ any time
13	$\frac{33}{8}$ or $\frac{17}{6}$ $2\frac{1}{8} - \frac{5}{6}$	B1	Correct step for dealing with mixed numbers Allow $\frac{33k}{8k}$ or $\frac{17k}{6k}$
	$\frac{99}{24}$ and $\frac{68}{24}$ $[2]\frac{3}{24} - \frac{20}{24}$	M1	Correct method to find common denominator e.g. $4\frac{3}{24}$ and $2\frac{20}{24}$
	$1\frac{7}{24}$ cao and correct working	A1	
14	2.6[0] or 2.600...	3	M2 for $\sqrt[10]{\frac{1328.54 + 4540}{4540}}$ or M1 for $4540 \times k^{10} = 1328.54 + 4540$ for any k If 0 scored SC1 for answer -11.6 or $-11.56...$
15	$4a^2b$ final answer	2	M1 for two correct parts out of three from 4, a^2 and b in final answer
16(a)	$(M \cup G) \cap P'$	1	
16(b)	22	1	
16(c)	$\frac{8}{23}$ oe	2	M1 for $\frac{k}{23}$ or $\frac{k}{3+9+5+6}$ or $\frac{8}{c}$ or $\frac{3+5}{c}$ $c \neq 1$ or for 8 and 23 identified
17(a)	 Correct sketch to go through (0, 0), (180, 0) and (360, 0)	2	B1 for correct sine curve shape through the origin

Question	Answer	Marks	Partial Marks
17(b)	199.5 or 199.47... and 340.5 or 340.52 to 340.53...	3	B2 for one correct or M1 for $\sin x = -\frac{1}{3}$ oe If 0 scored SC1 for two reflex angles with sum of 540 or two non-reflex angles with sum of 180
18(a)	2.5	3	M1 for $y = k \times \sqrt[3]{x+1}$ M1 for $y = \text{their } k \times \sqrt[3]{124+1}$
18(b)	multiplied by 4 oe	1	
19(a)	$\frac{x+8}{7}$ final answer	2	M1 for $x = 7y - 8$ or $y + 8 = 7x$ or $\frac{y}{7} = x - \frac{8}{7}$
19(b)	4	2	M1 for $4 \div \frac{1}{3} + 5$ oe or better
20(a)	$(2m+3p)(1-4k)$ final answer	2	B1 for $2m+3p-4k(2m+3p)$ or better or $2m(1-4k)+3p(1-4k)$ or correct answer seen and spoilt
20(b)	$5(x-2y)(x+2y)$ final answer	3	B2 for $(5x-10y)(x+2y)$ or $(x-2y)(5x+10y)$ or correct answer seen then spoilt or B1 for $5(x^2-4y^2)$ or for $(x-2y)(x+2y)$
21	[a =] 2 [b =] - 1	5	M2 for correct method to find two simultaneous equations e.g. two from $a \times 1^2 + b \times 1 - 4 = -3$ $a \times 2^2 + b \times 2 - 4 = 2$ $3a + b = 2 - - 3$ or M1 for 1 correct equation M1 for correctly eliminating one variable for <i>their</i> simultaneous equations A1 for a = 2 A1 for b = - 1
22	4 : 3 oe	2	M1 for $\overrightarrow{AD} = -\frac{4}{7}x + \frac{4}{7}y$ oe or $\overrightarrow{DB} = -\frac{3}{7}x + \frac{3}{7}y$ oe

PUBLISHED

Question	Answer	Marks	Partial Marks
23	18.4 or 18.40...	4	$\text{M3 for } \frac{600 - \frac{1}{2} \times 4 \times \pi \times 6.2^2}{6.2 \times \pi} \text{ oe}$ or M2 for $\frac{1}{2} \times 4 \times \pi \times 6.2^2 + \pi \times 6.2 \times l = 600 \text{ oe}$ or $\frac{600 - 4 \times \pi \times 6.2^2}{6.2 \times \pi}$ or better or M1 for $\left[\frac{1}{2} \right] \times 4 \times \pi \times 6.2^2$ or $\pi \times 6.2 \times l$



Cambridge IGCSE™

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NAME

CENTRE
NUMBER

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NUMBER

MATHEMATICS**0580/23**

Paper 2 (Extended)

May/June 2022**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

2

- 1 The probability of picking a red sweet from a bag is 0.05 .

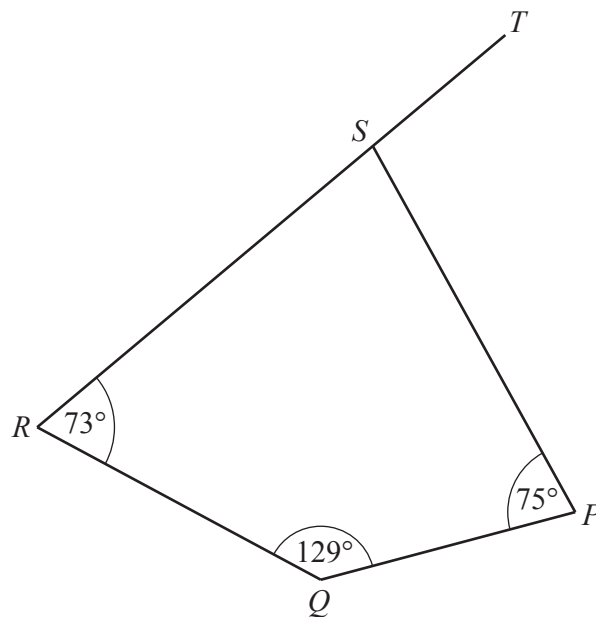
Find the probability of not picking a red sweet.

..... [1]

- 2 Work out the value of $\frac{m k^3}{\sqrt{3}}$ when $m = 4$ and $k = 7$.

..... [2]

3



NOT TO
SCALE

$PQRS$ is a quadrilateral.
 RST is a straight line.

Find angle PST .

Angle $PST =$ [2]

3

4 These are the masses, in kg, of 12 parcels.

0.3 0.4 1.2 0.8 1.1 2.1 1.7 1.8 1.2 2.3 0.7 1.1

(a) Complete the stem-and-leaf diagram for the 12 parcels.

0	3 4
1	
2	

Key: 0 | 3 represents 0.3 kg

[2]

(b) Find the median.

..... kg [1]

5 The n th term of a sequence is $n^2 - 1$.

Find the first three terms of this sequence.

....., ..., ... [2]

6 Simplify.

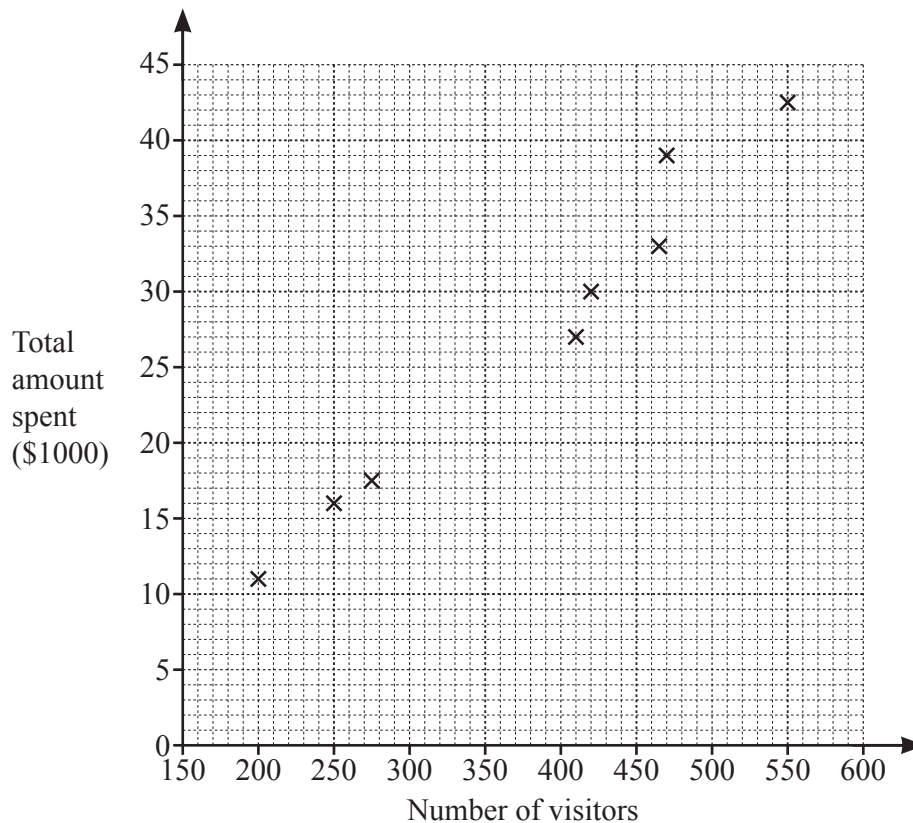
(a) $y^3 \div y^5$

..... [1]

(b) $7x^0$

..... [1]

- 7 The scatter diagram shows the number of visitors and the total amount spent, in thousands of dollars, at a zoo on each of eight days.



- (a) On one of the eight days there are 410 visitors.

Find the total amount spent by visitors during this day.

\$ [1]

- (b) Information for the ninth day is shown in the table.

Number of visitors	175
Total amount spent (\$1000)	9

Plot this information on the scatter diagram.

[1]

- (c) Draw a line of best fit on the scatter diagram.

[1]

- (d) On the tenth day the total amount spent is \$22 000.

Estimate the number of visitors on this day.

..... [1]

5

- 8 Without using a calculator, work out $\frac{2}{9} \div \frac{5}{6}$.

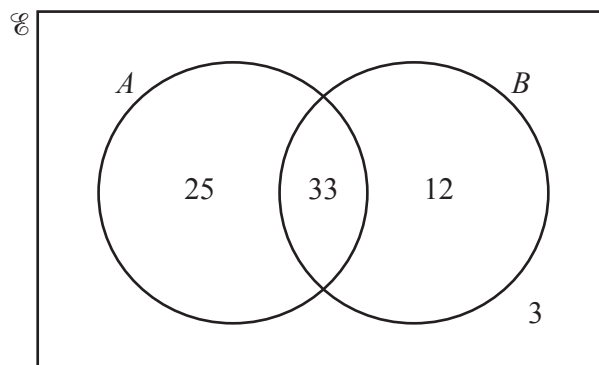
You must show all your working and give your answer as a fraction in its simplest form.

..... [2]

- 9 Change 300 m/min to km/h.

..... km/h [2]

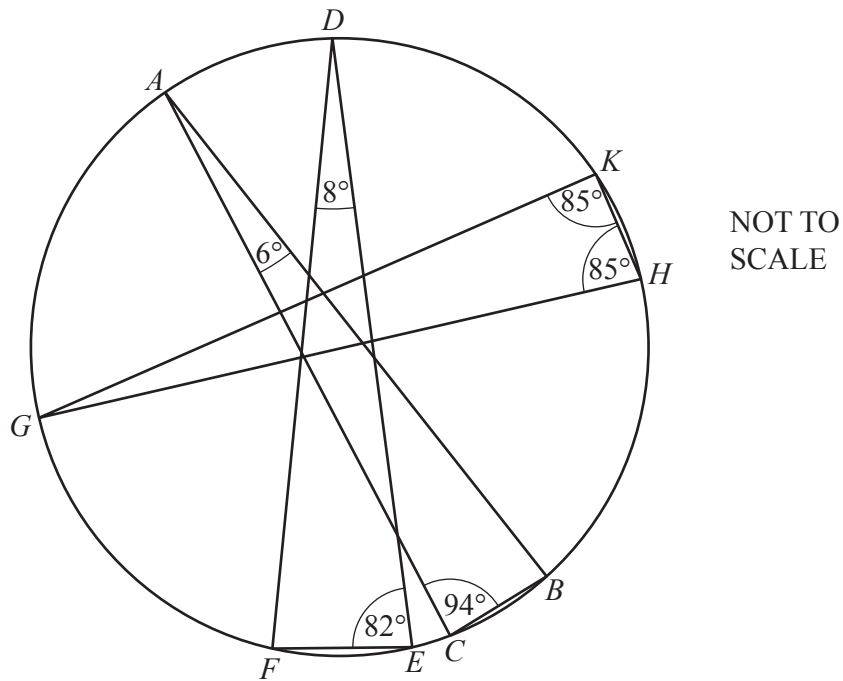
10



Find $n(A \cap B)$.

..... [1]

- 11 ABC , DEF and GHK are triangles with all vertices on the circumference of a circle.



From the list, draw a ring around the line that is a diameter of the circle.

AB AC DE DF GH GK

[1]

- 12 f is a common factor of 14 and 28.
 m is a common multiple of 10 and 25.
 p is a prime number.

Work out the largest possible value of $\frac{f}{mp}$.

..... [4]

13 Factorise completely.

(a) $18px - 27p$

..... [2]

(b) $mt - n - m + nt$

..... [2]

14 Find the n th term of this sequence.

8, 17, 32, 53, 80, ...

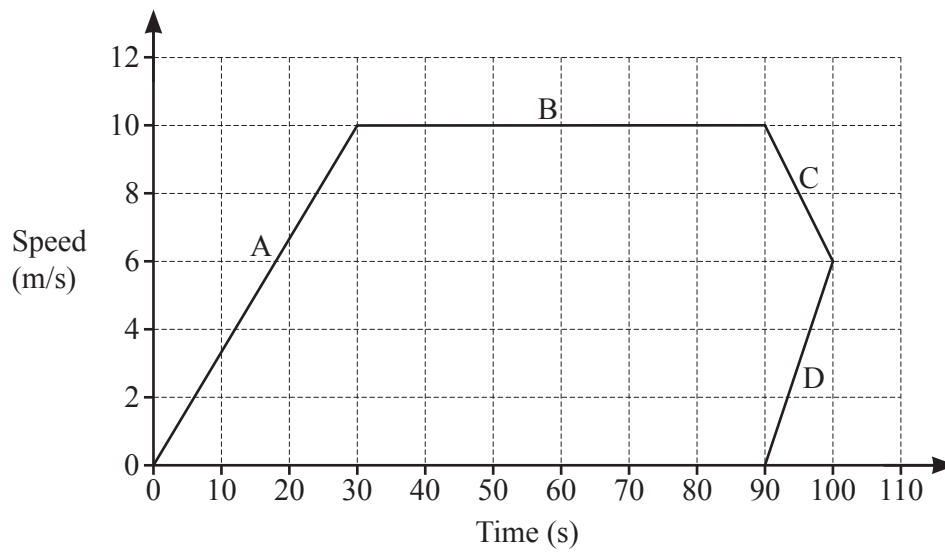
..... [2]

15 Solve.

$$12x - 3 \geq 4x + 13$$

..... [2]

- 16 Abdul draws this speed–time graph for a journey. The graph has four sections A, B, C and D.



Complete these statements about the speed–time graph.

Section cannot be correct.

Section shows constant speed.

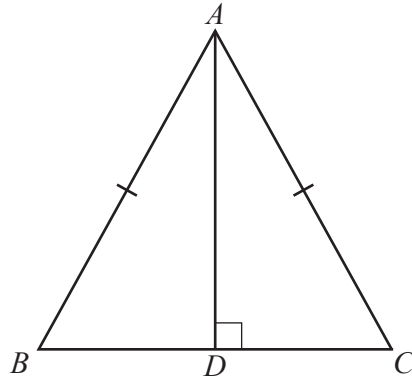
Section shows deceleration.

Section A shows acceleration of m/s^2 .

The distance travelled in the first 30 seconds of the journey is m.

[4]

17

NOT TO
SCALE

In triangle ABC , $AC = AB$.

D is the point on BC such that AD is perpendicular to BC .

Complete the following statements to show that triangle ACD and triangle ABD are congruent.

AD is perpendicular to BC so that Angle = Angle = ... $^{\circ}$

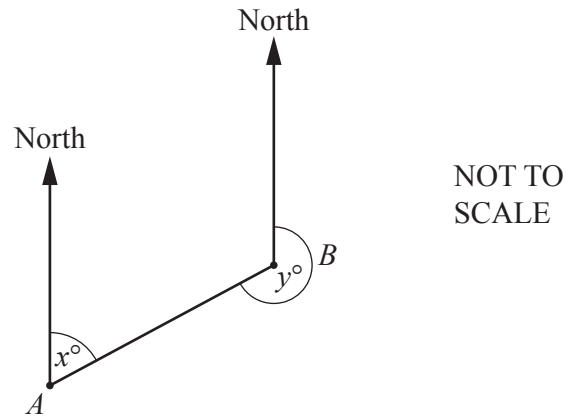
$AC = AB$ is given information.

Side is common to both triangles.

Triangle ACD is congruent to triangle ABD because of the congruency criterion [3]

- 18** The bearing of B from A is x° .
 The bearing of A from B is y° .
 $x : y = 2 : 7$

Calculate the value of y .



$y = \dots\dots\dots$ [3]

11

19 $f(x) = kx^2$ $g(x) = \frac{1}{x}$ $h(x) = \frac{7x-2}{5}$ $j(x) = \frac{3-10x}{14}$

(a) $f(-5k) = 675$

Find the value of k .

$k = \dots\dots\dots$ [2]

(b) Find $gh(x)$.

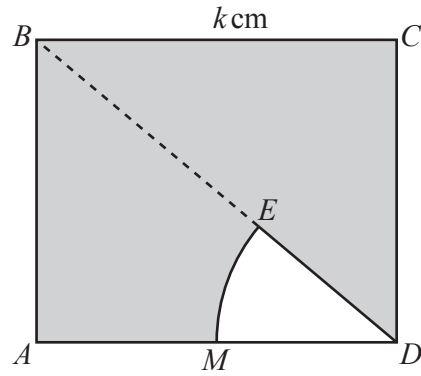
$\dots\dots\dots$ [1]

(c) Find $h^{-1}(x) + j(x)$.

Give your answer in its simplest form.

$\dots\dots\dots$ [4]

20



NOT TO
SCALE

The diagram shows a square $ABCD$ with side length k cm.
 MDE is a sector of a circle, centre D .
 E lies on the diagonal, BD , of the square.
 M is the midpoint of AD .

Find the percentage of the square that is shaded.

..... % [4]

- 21 Neha has a piece of ribbon of length 23 cm, correct to the nearest cm.
From this ribbon she cuts off a piece with length 87 mm, correct to the nearest mm.

Work out the lower bound and the upper bound for the length of the remaining ribbon.
Give your answer in centimetres.

Lower bound = ... cm

Upper bound = ...cm [3]

- 22 Simplify.

$$\frac{5x - x^2}{25 - x^2}$$

..... [3]

23 Solve the equation $3 \sin x + 3 = 1$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

24 y is inversely proportional to the cube of $(x - 1)$.
 $y = 9.45$ when $x = 3$.

Find y when $x = 4$.

$y = \dots\dots\dots$ [3]

25 $m^{-\frac{1}{4}} = 27m^{-1}$

Find the value of m .

$m = \dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 (Extended)

May/June 2022

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

ABBREVIATIONS IN MARK SCHEME

Abbreviation	Meaning
M	Method marks - for a correct method applied to appropriate numbers.
A	Accuracy marks – depend on M marks. Hence M0 A1 is not possible.
B	Independent of method marks – for a correct final answer, a partially correct answer or a correct intermediate stage.
SC	Marks given in special cases only when indicated in mark scheme.
FT	Work can be followed through after an error.
isw	Ignore subsequent working (after correct answer obtained)
cao	Correct answer only
nfw	Not from wrong working
oe	Or equivalent
soi	Seen or implied
eeo	Each error or omission
dep	Dependent on the previous mark(s)

Question	Answer	Marks	Partial Marks						
1	0.95 oe	1							
2	792 or 792.1...	2	M1 for $\frac{4 \times 7^3}{\sqrt{3}}$ oe or B1 for 1372						
3	97	2	M1 for $360 - (73 + 129 + 75)$						
4(a)	<table><tr><td>0</td><td>(3 4) 7 8</td></tr><tr><td>1</td><td>1 1 2 2 7 8</td></tr><tr><td>2</td><td>1 3</td></tr></table>	0	(3 4) 7 8	1	1 1 2 2 7 8	2	1 3	2	B1 for two rows correct or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission
0	(3 4) 7 8								
1	1 1 2 2 7 8								
2	1 3								
4(b)	1.15	1							
5	0, 3, 8	2	B1 for 2 correct terms in correct position or SC1 for −1, 0, 3						
6(a)	y^{-2} or $\frac{1}{y^2}$ final answer	1							
6(b)	7	1							
7(a)	27 000	1							
7(b)	Point plotted at (175, 9)	1							
7(c)	Correct single ruled line of best fit	1							
7(d)	300 to 350	1	FT <i>their</i> straight line of best fit provided positive gradient						
8	$\frac{2}{9} \times \frac{6}{5}$ or $\frac{4}{18} \div \frac{15}{18}$ oe	M1							
	$\frac{4}{15}$ cao	A1							
9	18	2	M1 for $\frac{300 \times 60}{1000}$ oe or B1 for figs 18 in <i>their</i> answer						
10	40	1							
11	DE	1							

Question	Answer	Marks	Partial Marks
12	0.14 oe nfww	4	M3 for $\frac{14}{50 \times 2}$ with at least 2 out of 3 values correct and for the one incorrect value: f must be 1, 2 or 7 m must be a multiple of 50 p must be prime OR B1 for $f = 14$ B1 for $m = 50$ B1 for $p = 2$ If 0 scored SC1 for a correct multiple for m, factor for f or prime for p
13(a)	$9p(2x - 3)$ final answer	2	B1 for $9(2px - 3p)$ or $p(18x - 27)$ or $3p(6x - 9)$ or $9p(2x - 3)$ seen and spoilt
13(b)	$(m + n)(t - 1)$ final answer	2	B1 for $m(t - 1) + n(t - 1)$ or $t(m + n) - [1](m + n)$ or correct answer seen and spoilt
14	$3n^2 + 5$ oe final answer	2	M1 for correctly finding second differences or an answer that is a quadratic sequence
15	$x \geq 2$ final answer	2	M1 for $12x - 4x \geq 13 + 3$ oe
16	D B C	B1	
	$\frac{1}{3}$ or 0.333...	B1	
	150	B2	or M1 for $\frac{1}{2} \times 30 \times 10$
17	ADC and ADB and 90 AD RHS	3	B1 for each correct line

Question	Answer	Marks	Partial Marks
18	252	3	M2 for $180 \div (7 - 2)$ oe OR M1 for $180 - x + y = 360$ oe M1 for correct use of ratio
19(a)	3	2	M1 for $k(-5k)^2 = 675$ or better
19(b)	$\frac{5}{7x-2}$ final answer	1	
19(c)	$\frac{1}{2}$ or 0.5	4	B3 for answer $\frac{7}{14}$ OR B2 for $\frac{5x+2}{7}$ or M1 for correct first step for $h^{-1}(x)$ e.g. $x = \frac{7y-2}{5}$ $5y = 7x - 2$ $y + \frac{2}{5} = \frac{7x}{5}$ M1FT for $\frac{2(5x+2)}{14} + \frac{3-10x}{14}$ oe with common denominator
20	90.2 or 90.18...	4	B3 for 9.82[%] OR M3 for $[100 \times] \left(k^2 - \frac{45}{360} \times \pi \times \left(\frac{k}{2} \right)^2 \right) \div k^2$ oe or M2 for $[100 \times] \frac{45}{360} \times \pi \times \left(\frac{k}{2} \right)^2 \div k^2$ oe or $k^2 - \frac{45}{360} \times \pi \times \left(\frac{k}{2} \right)^2$ or $100 \times (k^2 - m\pi k^2) \div k^2$ or M1 for $\frac{c}{360} \times \pi \times \left(\frac{k}{2} \right)^2$ oe or for $(k^2 - m\pi k^2) \div k^2$ or for $100 \times (k^2 - mk^2) \div k^2$

Question	Answer	Marks	Partial Marks
21	13.75 14.85	3	B2 for one correct answer or both correct answers seen in working then rounded to 3sf or both correct but reversed or M1 for 2 correct seen from $23 + 0.5$, $23 - 0.5$, $8.7 + 0.05$ or $8.7 - 0.05$ or better
22	$\frac{x}{5+x}$ final answer nfw	3	B1 for $x(5-x)$ B1 for $(5-x)(5+x)$ or
23	221.8 or 221.81... and 318.2 or 318.18 to 318.19	3	B2 for one correct or M1 for $\sin x = -\frac{2}{3}$ oe If 0 scored, SC1 for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
24	2.8	3	M1 for $y = \frac{k}{(x-1)^3}$ M1 for $y = \frac{\text{their } k}{(4-1)^3}$ OR M2 for $y(4-1)^3 = 9.45(3-1)^3$
25	81	3	M2 for $m^{\frac{3}{4}} = 27$ or better or M1 for $\frac{1}{m^{\frac{1}{4}}} = \frac{27}{m}$ or better or $m^{-\frac{1}{4}-1} = 27$ If 0 scored SC1 for answer $\frac{1}{81}$



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MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2022

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) The list shows 15 midday temperatures, in degrees Celsius, in Suntown.

17 21 21 18 23 22 25 19
21 17 19 18 21 24 23

- (i) Complete the stem-and-leaf diagram to show this information.

1	7
2	

Key: 1|7 represents 17°C

[2]

- (ii) Find the median.

..... °C [1]

- (iii) Find the upper quartile.

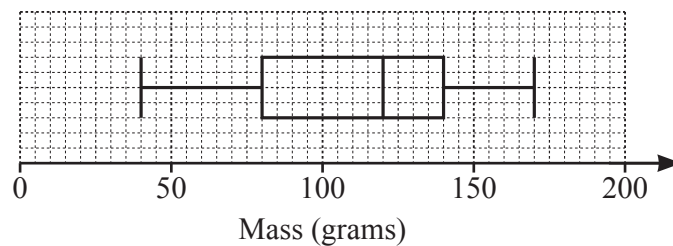
..... °C [1]

- (iv) Rahul draws a pie chart to show this information.

Calculate the sector angle for the number of days the temperature is 18°C.

..... [2]

- (b)



The box-and-whisker plot shows information about the masses, in grams, of some apples.

- (i) Find the median.

..... g [1]

- (ii) Find the range.

..... g [1]

- (iii) Find the interquartile range.

..... g [1]

- (c) (i) The time, t minutes, spent on homework in one week by each of 200 students is recorded. The table shows the results.

Time (t minutes)	$40 < t \leq 60$	$60 < t \leq 80$	$80 < t \leq 90$	$90 < t \leq 100$	$100 < t \leq 150$
Frequency	6	10	70	84	30

Calculate an estimate of the mean.

..... min [4]

- (ii) A new table with different class intervals is completed.

Time (t minutes)	$40 < t \leq 90$	$90 < t \leq 150$
Frequency	86	114

On a histogram the height of the bar for the $40 < t \leq 90$ interval is 17.2 cm.

Calculate the height of the bar for the $90 < t \leq 150$ interval.

..... cm [2]

- 2 (a) Alex, Bobbie and Chris share strawberries in the ratio Alex : Bobbie : Chris = 3 : 2 : 2.
Chris receives 12 strawberries.

Calculate the total number of strawberries shared.

..... [2]

- (b) In a sale, a shop reduces all prices by 12%.

- (i) Dina buys a book which has an original price of \$6.50 .

Calculate how much Dina pays for the book.

\$ [2]

- (ii) Elu pays \$11 for a toy.

Calculate the original price of the toy.

\$ [2]

- (c) Feri invests some money.

The rate of interest for the first year is 2.5%.

At the end of the second year the overall percentage increase of Feri's investment is 6.6%.

Find the rate of interest for the second year.

..... % [2]

- (d) A radioactive substance decays at an exponential rate of 2% per day.
The initial mass is 80 g.

(i) Find the mass at the end of 5 days.

..... g [2]

(ii) Find how many **more** whole days, after day 5, it takes for the mass to reduce to less than 67 g.

..... [3]

- 3 (a) Geeta buys x apples, $(x + 7)$ oranges and $(2x - 1)$ bananas.
The total number of pieces of fruit Geeta buys is 30.

(i) Find the number of apples Geeta buys.

..... [3]

- (ii) The cost of one apple is 15 cents.
The cost of one orange is 18 cents.
The total cost of all the fruit is \$5.55 .

Find the cost, in cents, of one banana.

..... cents [3]

- (b) (i) Solve.

$$\frac{3w}{16} - 1 = \frac{1}{2}$$

$w =$ [2]

(ii) $\frac{3(2^{-y})}{16} - 1 = \frac{1}{2}$

Find the value of y .

$y =$ [2]

(c) (i) Solve the simultaneous equations.

$$\begin{aligned} 2p + q &= 2 \\ p - q &= -\frac{1}{2} \end{aligned}$$

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [2]$$

(ii) Hence, for $0^\circ \leq u \leq 360^\circ$ and $0^\circ \leq v \leq 360^\circ$, solve the simultaneous equations.

$$\begin{aligned} 2 \sin u + \cos v &= 2 \\ \sin u - \cos v &= -\frac{1}{2} \end{aligned}$$

$$u = \dots\dots\dots \text{ or } u = \dots\dots\dots$$

$$v = \dots\dots\dots \text{ or } v = \dots\dots\dots [4]$$

4 $f(x) = 2x - 1$ $g(x) = 3x - 2$ $h(x) = \frac{1}{x}, x \neq 0$ $j(x) = 5^x$

(a) Find

(i) $f(2)$,

..... [1]

(ii) $gf(2)$.

..... [1]

(b) Find $g^{-1}(x)$.

$g^{-1}(x) =$ [2]

(c) Find x when $h(x) = j(-2)$.

$x =$ [2]

(d) Write $f(x) - h(x)$ as a single fraction.

..... [2]

(e) Find the value of $j(2)$.

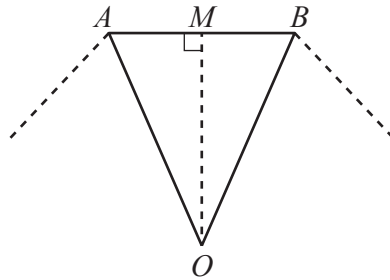
..... [1]

(f) Find x when $j^{-1}(x) = 4$.

$x =$ [2]

10

- 5 (a) $ABCDEFGH$ is a regular octagon with sides of length 6 cm.
The diagram shows part of the octagon.
 O is the centre of the octagon and M is the midpoint of AB .



NOT TO
SCALE

- (i) (a) Show that angle OAM is 67.5° .

[2]

- (b) Calculate the area of the octagon.

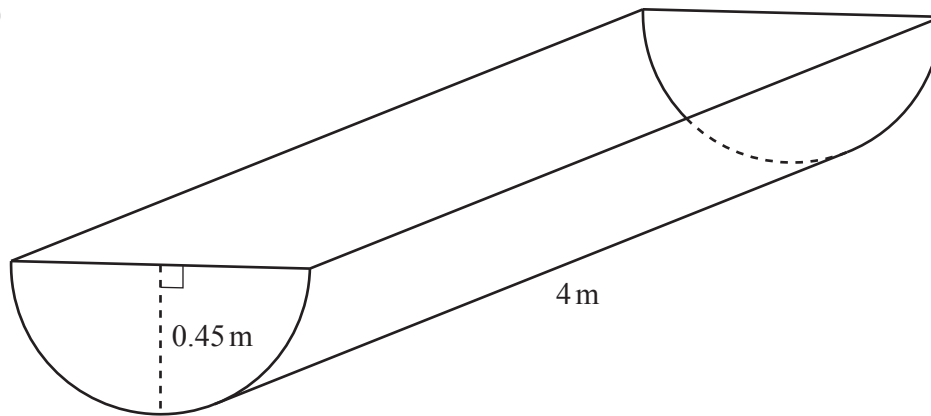
..... cm^2 [4]

- (ii) Find the area of the circle that passes through the vertices of the octagon.

..... cm^2 [3]

11

(b)



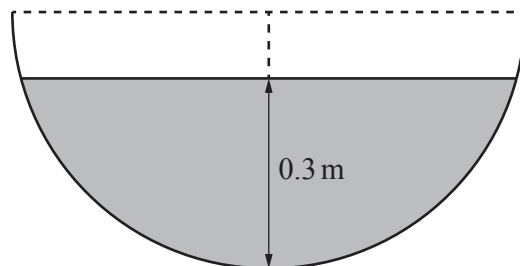
NOT TO
SCALE

The diagram shows a horizontal container for water with a uniform cross-section.
The cross-section is a semicircle.
The radius of the semicircle is 0.45 m and the length of the container is 4 m.

(i) Calculate the volume of the container.

..... m^3 [2]

(ii)



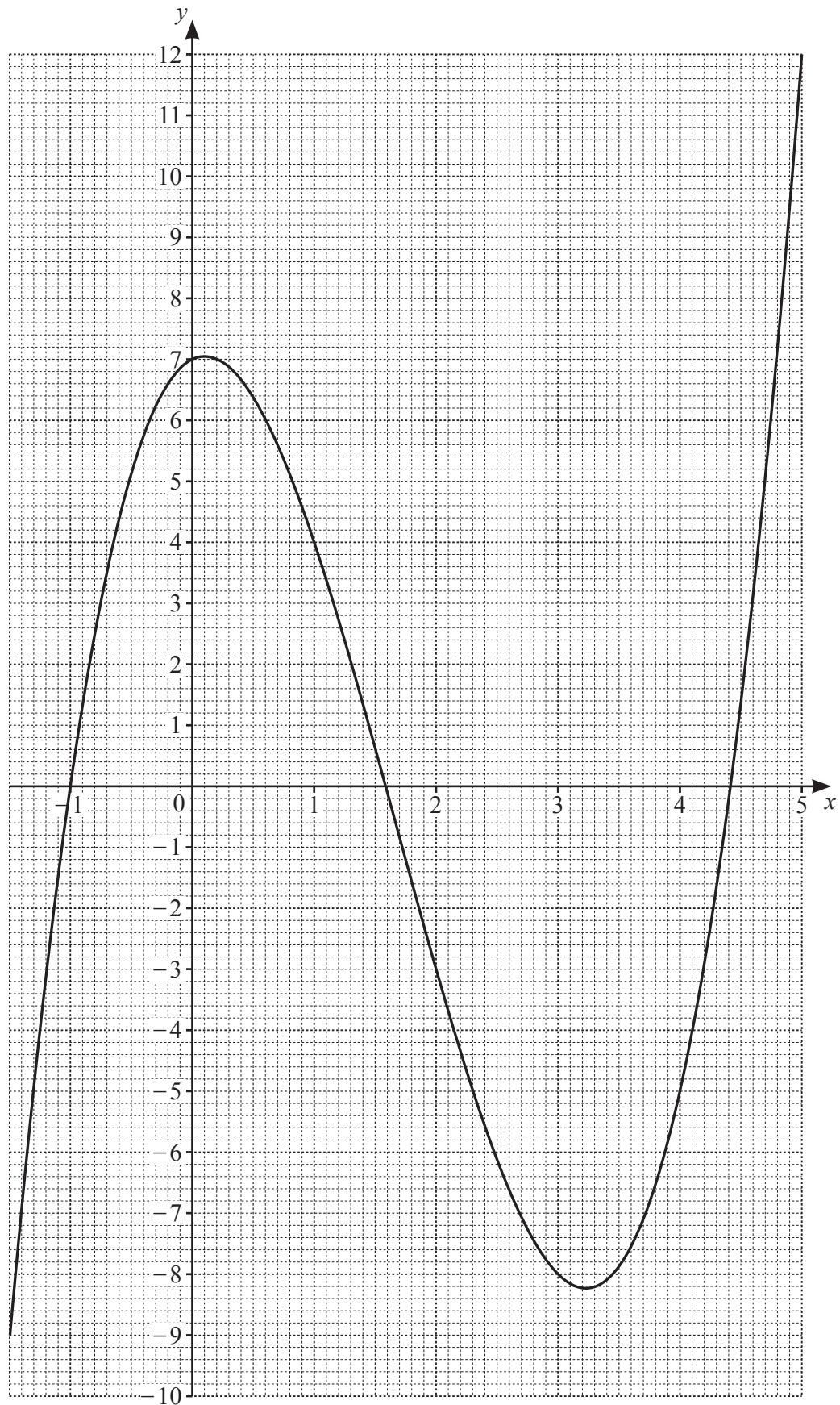
NOT TO
SCALE

The greatest depth of the water in the container is 0.3 m.
The diagram shows the cross-section.

Calculate the number of litres of water in the container.
Give your answer correct to the nearest integer.

..... litres [6]
[Turn over]

6 (a)



The diagram shows the graph of $y = f(x)$ for $-1.5 \leq x \leq 5$.

(i) Find $f(2)$.

..... [1]

(ii) Solve the equation $f(x) = 0$ for $-1.5 \leq x \leq 5$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

(iii) $f(x) = k$ has three solutions for $-1.5 \leq x \leq 5$ where k is an integer.

Find the smallest possible value of k .

$k = \dots\dots\dots$ [1]

(iv) On the grid, draw a line $y = mx$ so that $f(x) = mx$ has exactly one solution for $-1.5 \leq x \leq 5$. [2]

(b) $y = 3x^2 - 12x + 7$

(i) Find the value of $\frac{dy}{dx}$ when $x = 5$.

..... [3]

(ii) Find the coordinates of the point on the graph of $y = 3x^2 - 12x + 7$ where the gradient is 0.

(..... , ...) [2]

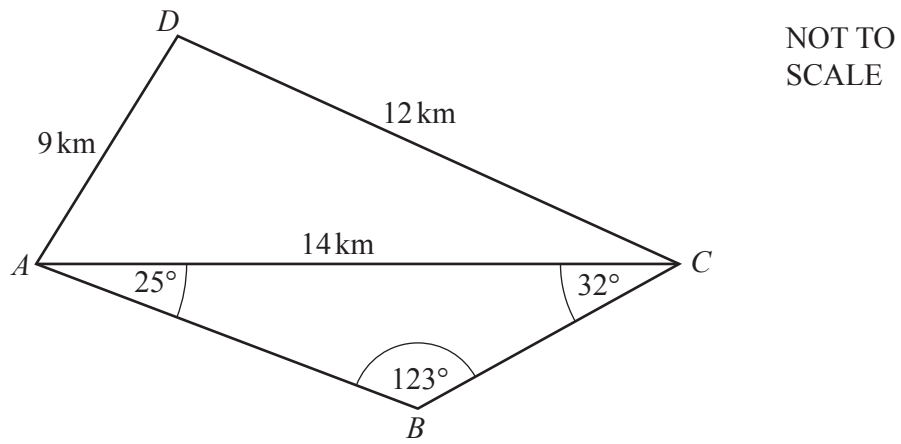
(c) When $y = 2x^p + qx^2$, $\frac{dy}{dx} = 14x^6 + 6x$.

Find the value of p and the value of q .

$p = \dots\dots\dots$

$q = \dots\dots\dots$ [2]

7



(a) Calculate angle ACD .

Angle $ACD = \dots\dots\dots$ [4]

(b) Show that $BC = 7.05$ km, correct to 2 decimal places.

[3]

15

- (c) Calculate the shortest distance from B to AC .

..... km [3]

- (d) Calculate the length of the straight line BD .

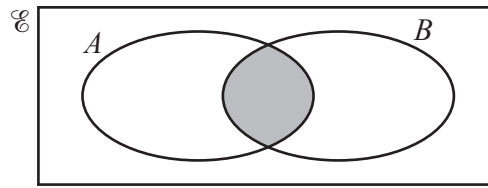
$BD =$ km [4]

- (e) C is due east of A .

Find the bearing of D from C .

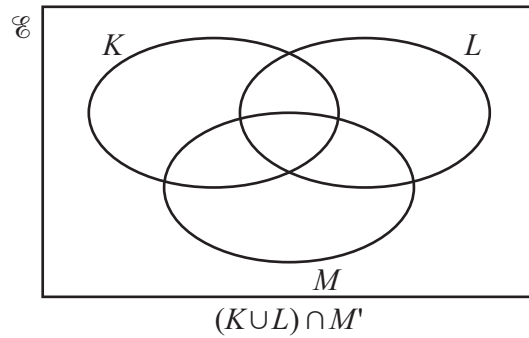
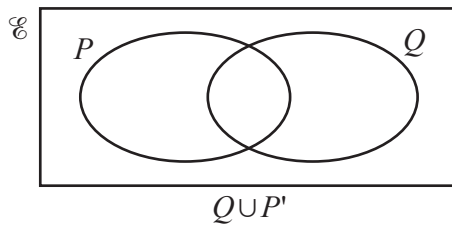
..... [2]

- 8 (a) (i) Use set notation to describe the shaded region in the Venn diagram.



..... [1]

- (ii) Shade the correct region in each Venn diagram.



[2]

- (b)



The diagram shows 11 cards.

- (i) One of these cards is chosen at random.

Write down the probability that the letter on the card is **not** A.

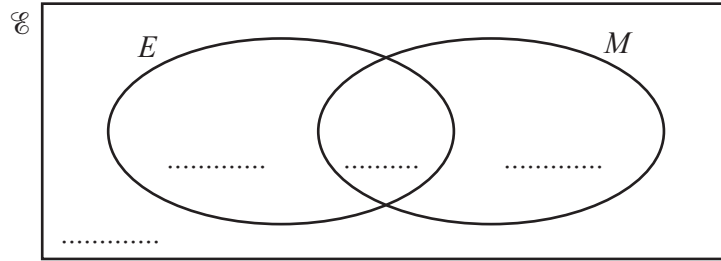
..... [1]

- (ii) A card is chosen at random from these 11 cards and then replaced.
A second card is then chosen at random.

Find the probability that exactly one card has the letter N.

..... [3]

(c)



50 students are asked if they like English (E) and if they like mathematics (M).
 3 say they do not like English and do not like mathematics.
 33 say they like English.
 42 say they like mathematics.

(i) Complete the Venn diagram. [2]

(ii) A student is chosen at random.

Find the probability that this student likes English and likes mathematics.

..... [1]

(iii) Two students are chosen at random.

Find the probability that they both like mathematics.

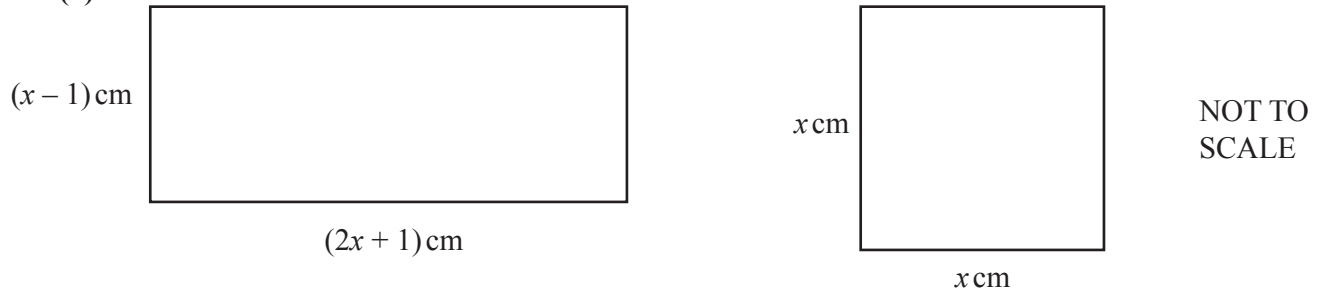
..... [2]

(iv) Two students who like English are chosen at random.

Find the probability that they both also like mathematics.

..... [2]

9 (a)

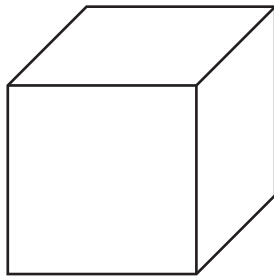


The area of the rectangle is 29 cm^2 greater than the area of the square.
The difference between the perimeters of the two shapes is $k \text{ cm}$.

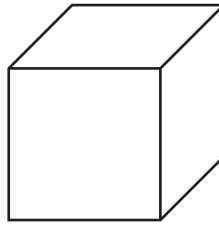
Find the value of k .
You must show all your working.

$k = \dots\dots\dots$ [6]

(b)



$(y + 1)\text{cm}$



$y\text{cm}$

NOT TO
SCALE

The volume of the larger cube is 5 cm^3 greater than the volume of the smaller cube.

(i) Show that $3y^2 + 3y - 4 = 0$.

[4]

(ii) Find the volume of the smaller cube.
Show all your working and give your answer correct to 2 decimal places.

..... cm^3 [4]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **13** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles

1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

PUBLISHED**ABBREVIATIONS IN MARK SCHEME**

Abbreviation	Meaning
M	Method marks - for a correct method applied to appropriate numbers.
A	Accuracy marks – depend on M marks. Hence M0 A1 is not possible.
B	Independent of method marks – for a correct final answer, a partially correct answer or a correct intermediate stage.
SC	Marks given in special cases only when indicated in mark scheme.
FT	Work can be followed through after an error.
isw	Ignore subsequent working (after correct answer obtained)
cao	Correct answer only
nfw	Not from wrong working
oe	Or equivalent
soi	Seen or implied
eeo	Each error or omission
dep	Dependent on the previous mark(s)

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Question	Answer											Marks	Partial Marks
1(a)(i)	1	7	7	8	8	9	9					2	B1 for one row correctly ordered or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission
	2	1	1	1	1	2	3	3	4	5			
1(a)(ii)	21											1	
1(a)(iii)	23											1	
1(a)(iv)	48											2	M1 for $\frac{2}{15}[\times 360]$ or $\frac{360}{15}[\times 2]$
1(b)(i)	120											1	
1(b)(ii)	130											1	
1(b)(iii)	60											1	
1(c)(i)	93.4											4	M1 for mid-values soi M1 for Σfx M1 dep on second M for $\Sigma fx \div 200$
1(c)(ii)	19											2	M1 for $\frac{86}{50}$ or $\frac{114}{60}$

Question	Answer	Marks	Partial Marks
2(a)	42	2	M1 for $12 \div 2$ or better
2(b)(i)	5.72	2	M1 for $\frac{100-12}{100} \times 6.50$ oe or B1 for 0.88 oe
2(b)(ii)	12.5[0]	2	M1 for $\frac{100-12}{100} \times x = 11$ or better oe

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Question	Answer	Marks	Partial Marks
2(c)	4	2	M1 for $\frac{100+2.5}{100} \times [\dots] = \frac{100+6.6}{100}$ oe
2(d)(i)	72.3 or 72.31...	2	M1 for $80 \times \left(\frac{100-2}{100}\right)^5$ oe
2(d)(ii)	4 nfww	3	B2 for answer 9 nfww or M2 for correct trials with values giving either side of 67 or M1 for $80 \times \left(\frac{100-2}{100}\right)^n = 67$ or <i>their</i> (i) $\times \left(\frac{100-2}{100}\right)^k = 67$ or an evaluated trial with $n \geq 6$ or $k \geq 1$

Question	Answer	Marks	Partial Marks
3(a)(i)	6	3	B2 for $4x + 6 = 30$ or better or M1 for $x + x + 7 + 2x - 1 [= 30]$
3(a)(ii)	21	3	M2 for $(555 - \text{their } x \times 15 - \text{their } (x + 7) \times 18) \div \text{their } (2x - 1)$ or M1 for $\text{their } x \times 15$ or $\text{their } (x + 7) \times 18$
3(b)(i)	8	2	M1 for isolating the term in w or correctly removing all fractions e.g. $\frac{3w}{16} = 1 + \frac{1}{2}$ or better or $3w - 16 = 8$
3(b)(ii)	-3	2	M1 for $2^{-y} = 8$ or $2^y = \frac{1}{8}$ or $2^{-y} = \text{their } w$ or better

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Question	Answer	Marks	Partial Marks
3(c)(i)	$[p =] \frac{1}{2}$ oe $[q =] 1$	2	B1 for each If zero scored, SC1 for 2 values satisfying one of the original equations
3(c)(ii)	$[u =] 30$ and 150 $[v =] 0$ and 360	4	B1 for each OR SC1 for $\sin u = \text{their } p$ and $\cos v = \text{their } q$ SC1 if their two different angles for u sum to 180 or if their different two angles for v sum to 360

Question	Answer	Marks	Partial Marks
4(a)(i)	3	1	
4(a)(ii)	7	1	FT <i>their</i> (i) $3 \times \text{their (i)} - 2$
4(b)	$\frac{x+2}{3}$ oe final answer	2	M1 for $y + 2 = 3x$ or $\frac{y}{3} = x - \frac{2}{3}$ or $x = 3y - 2$
4(c)	25	2	M1 for $\frac{1}{x} = 5^{-2}$ oe
4(d)	$\frac{2x^2 - x - 1}{x}$ final answer	2	M1 for $2x - 1 - \frac{1}{x}$
4(e)	2.98×10^{17} or $2.980... \times 10^{17}$	1	
4(f)	625	2	M1 for $x = j(4)$

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Question	Answer	Marks	Partial Marks
5(a)(i)(a)	$\frac{(8-2) \times 180}{8 \times 2}$ oe	M2	M1 for $\frac{(8-2) \times 180}{8}$ or $\frac{360}{8}$ or $\frac{(2 \times 8 - 4) \times 90}{8}$
5(a)(i)(b)	174 or 173.8....	4	M3 for $\frac{1}{2} \times 6 \times OM$ oe or $\frac{1}{2} \times (OA)^2 \times \sin 45$ oe or $\frac{1}{2} \times 6 \times OA \times \sin 67.5$ oe where OA and OM are as in the M2 or M2 for $OM = 3 \times \tan 67.5$ oe or for $OA = \left(\frac{3}{\cos 67.5} \right)$ or $\frac{6 \times \sin 67.5}{\sin 45}$ oe or M1 for $\frac{OM}{3} = \tan 67.5$ oe or for $\frac{3}{OA} = \cos 67.5$ oe or for $\frac{\sin 45}{6} = \frac{\sin 67.5}{OA}$ oe
5(a)(ii)	193 or 193.0 to 193.1	3	M2 for $\pi \times \left(\frac{3}{\cos 67.5} \right)^2$ oe or M1 for $\frac{3}{r} = \cos 67.5$ or $\frac{\sin 45}{6} = \frac{\sin 67.5}{r}$

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Question	Answer	Marks	Partial Marks
5(b)(i)	1.27 or 1.272 to 1.273	2	M1 for $\left[\frac{1}{2} \times \pi \times 0.45^2 \times 4\right]$ or $\frac{1}{2} \times \pi \times 0.45^2 [\times 4]$
5(b)(ii)	742 or 743	6	M5 for a method leading to the volume of water e.g. $4 \times \left\{ 2 \times \frac{\operatorname{invcos}\left(\frac{0.15}{0.45}\right)}{360} \times \pi \times 0.45^2 \right.$ $\left. - \frac{1}{2} \times 0.45^2 \times \sin\left(2 \operatorname{invcos}\left(\frac{0.15}{0.45}\right)\right) \right\}$ oe OR M2 $[2 \times] \frac{\operatorname{invcos}\left(\frac{0.15}{0.45}\right)}{360} \times \pi \times 0.45^2$ oe or $[2 \times] \frac{90 - \operatorname{invcos}\left(\frac{0.15}{0.45}\right)}{360} \times \pi \times 0.45^2$ oe or M1 for use of $\frac{\theta}{360} \times \pi \times 0.45^2$ oe M2 for $\frac{1}{2} \times 0.45^2 \times \sin\left(2 \operatorname{invcos}\left(\frac{0.15}{0.45}\right)\right)$ oe or $\frac{1}{2} \times 0.15 \times 0.45 \times \sin\left(\operatorname{invcos}\left(\frac{0.15}{0.45}\right)\right) [\times 2]$ oe

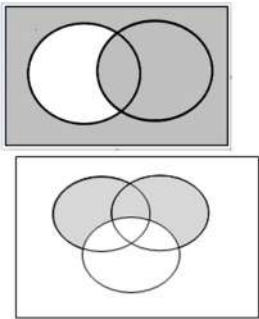
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Question	Answer	Marks	Partial Marks
5(b)(ii)			$\frac{1}{2} \times 0.45^2 \times \sin \theta$ oe or M1 for use of $\frac{1}{2} \times 0.45^2 \times \sin \theta$ oe or $[2 \times] \frac{1}{2} \times 0.15 \times 0.45 \times \sin \theta$ oe If 0 scored, SC1 for $\text{invcos} \left(\frac{0.15}{0.45} \right)$ or $\text{invsin} \left(\frac{0.15}{0.45} \right)$ or $\sqrt{0.45^2 - 0.15^2}$ soi
6(a)(i)	–3	1	
6(a)(ii)	–1 1.55 to 1.6 4.4 to 4.45	3	B1 for each
6(a)(iii)	–8	1	
6(a)(iv)	Ruled line through origin intersecting curve once	2	B1 for ruled line through origin
6(b)(i)	18	3	B2 for $6x - 12$ or B1 for $6x$ or -12
6(b)(ii)	(2, –5)	2	B1 for each. If 0 scored, M1 for <i>their</i> $6x - 12 = 0$ or states $\frac{dy}{dx} = 0$
6(c)	$[p =] 7$ $[q =] 3$	2	B1 for each

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Question	Answer	Marks	Partial Marks
7(a)	39.6 or 39.57....	4	M2 for $[\cos =] \frac{14^2 + 12^2 - 9^2}{2 \times 14 \times 12}$ or M1 for $9^2 = 14^2 + 12^2 - 2 \times 14 \times 12 \times \cos ACD$ A1 for 0.7708... or 0.771 or $\frac{37}{48}$ oe
7(b)	$\frac{14 \sin 25}{\sin 123}$	M2	M1 for $\frac{\sin 123}{14} = \frac{\sin 25}{BC}$ oe
	7.054...	A1	
7(c)	3.74 or 3.735 to 3.739	3	M2 for $7.05 \times \sin 32$ or M1 for recognition that the line from B is perpendicular to AC
7(d)	11.8 or 11.83 to 11.85	4	M1 for $32 + \text{their}(a)$ soi M2 for $12^2 + 7.05^2 - 2 \times 12 \times 7.05 \times \cos(\text{their}(a) + 32)$ or M1 for $\cos(\text{their}(a) + 32) = \frac{12^2 + 7.05^2 - BD^2}{2 \times 12 \times 7.05}$
7(e)	309.6 or 309.57...	2	FT 270 + $\text{their}(a)$ M1 for $270 + \text{their}(a)$ oe

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Question	Answer	Marks	Partial Marks
8(a)(i)	$A \cap B$	1	
8(a)(ii)		2	B1 for each
8(b)(i)	$\frac{9}{11}$	1	
8(b)(ii)	$\frac{36}{121}$ oe	3	M2 for $2 \times \frac{2}{11} \times \frac{9}{11}$ oe or M1 for $\frac{2}{11} \times \frac{9}{11}$ oe If 0 scored SC1 for $\frac{36}{110}$
8(c)(i)	3, 5, 28, 14 correctly placed	2	B1 for 28 in the intersection
8(c)(ii)	$\frac{28}{50}$ oe	1	FT <i>their</i> 28 where <i>their</i> 28 < 50
8(c)(iii)	$\frac{123}{175}$ oe	2	M1 for $\frac{42}{50} \times \frac{41}{49}$
8(c)(iv)	$\frac{63}{88}$ oe	2	FT <i>their</i> 28 M1 for $\frac{\text{their}28}{33} \times \frac{\text{their}28-1}{32}$

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Question	Answer	Marks	Partial Marks
9(a)	$x^2 - x - 30 [= 0]$	B3	M1 for $(2x+1)(x-1) - x^2 = 29$ oe B1 for $(2x+1)(x-1) = 2x^2 - 2x + x - 1$ oe soi
	$(x-6)(x+5)$ oe	M1	or correct factors for <i>their</i> 3 term quadratic equation or for correct substitution into quadratic formula or correctly completing the square for <i>their</i> 3 term quadratic equation
	$x = 6$ cao	B1	
	12 or $2 \times$ <i>their</i> x evaluated or $k = 2x$ stated	B1 FT	
9(b)(i)	$(y+1)^3 - y^3 = 5$ oe	M1	
	$(y+1)^3 = y^3 + 3y^2 + 3y + 1$ soi	B2	B1 for $(y+1)^2 = y^2 + y + y + 1$ oe soi
	Completion to $3y^2 + 3y - 4 = 0$	A1	With no errors or omissions
9(b)(ii)	$\frac{-3 \pm \sqrt{3^2 - 4(3)(-4)}}{2 \times 3}$	B2	or B1 for $\sqrt{3^2 - 4(3)(-4)}$ or for $\frac{-3 + \sqrt{\dots}}{2 \times 3}$ or $\frac{-3 - \sqrt{\dots}}{2 \times 3}$
	0.44	B2	B1 for 0.758 or 0.7583...



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MATHEMATICS**0580/42**

Paper 4 (Extended)

May/June 2022**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) Find the lowest common multiple (LCM) of 30 and 75.

..... [2]

- (b) Share \$608 in the ratio 4 : 5 : 7.

\$

\$

\$ [3]

- (c) Work out $\frac{6.39 \times 10^4}{2.45 \times 10^6}$.

Give your answer in standard form.

..... [2]

- (d) Write $0.\dot{2}\dot{7}$ as a fraction.

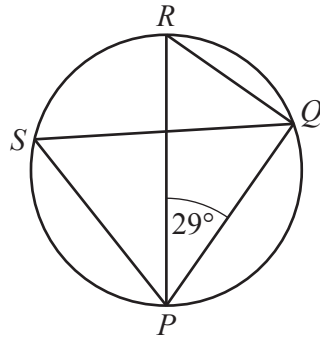
..... [1]

- (e) A stone has volume 45 cm^3 and mass 126 g.
Find the density of the stone, giving the units of your answer.

[Density = mass $\div$ volume]

..... [2]

2 (a)



NOT TO
SCALE

The points P , Q , R and S lie on a circle with diameter PR .

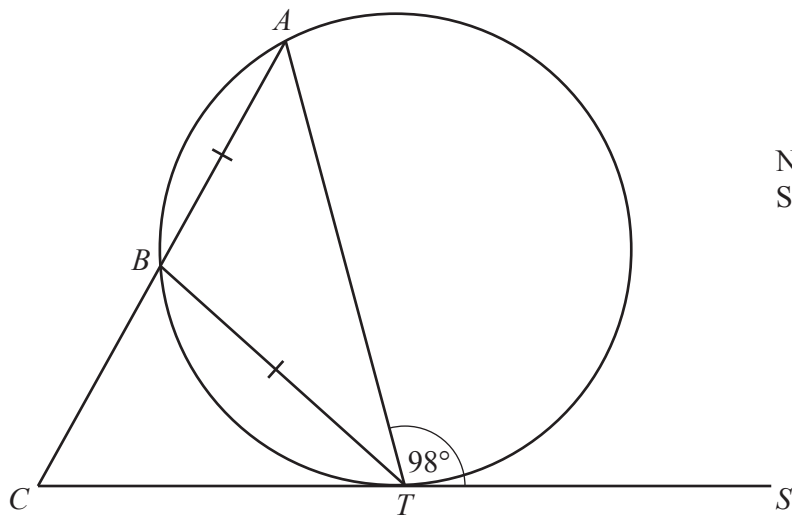
Work out the size of angle PSQ , giving a geometrical reason for each step of your working.

.....

.....

..... [3]

(b)



NOT TO
SCALE

The points A , B and T lie on a circle and CTS is a tangent to the circle at T .
 ABC is a straight line and $AB = BT$.
 Angle $ATS = 98^\circ$.

Work out the size of angle ACT .

Angle $ACT =$ [4]

3 A line, l , joins point $F(3, 2)$ and point $G(-5, 4)$.

(a) Calculate the length of line l .

..... [3]

(b) Find the equation of the perpendicular bisector of line l in the form $y = mx + c$.

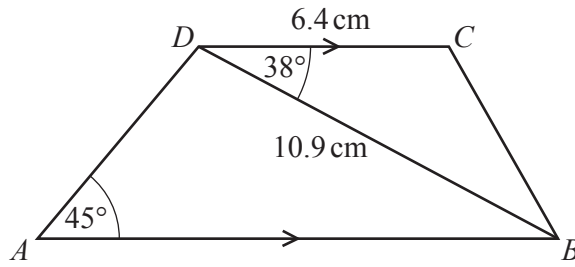
$y =$ [5]

(c) A point H lies on the y -axis such that the distance $GH = 13$ units.

Find the coordinates of the two possible positions of H .

(....., ...) and (....., ...) [4]

4



NOT TO
SCALE

$ABCD$ is a trapezium with DC parallel to AB .
 $DC = 6.4 \text{ cm}$, $DB = 10.9 \text{ cm}$, angle $CDB = 38^\circ$ and angle $DAB = 45^\circ$.

(a) Find CB .

$CB = \dots\dots\dots \text{ cm}$ [3]

(b) (i) Find angle ADB .

Angle $ADB = \dots\dots\dots$ [1]

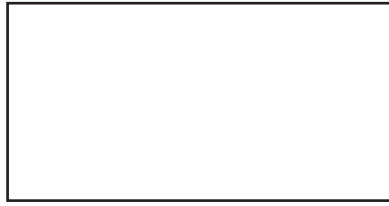
(ii) Find AB .

$AB = \dots\dots\dots \text{ cm}$ [3]

(c) Calculate the area of the trapezium.

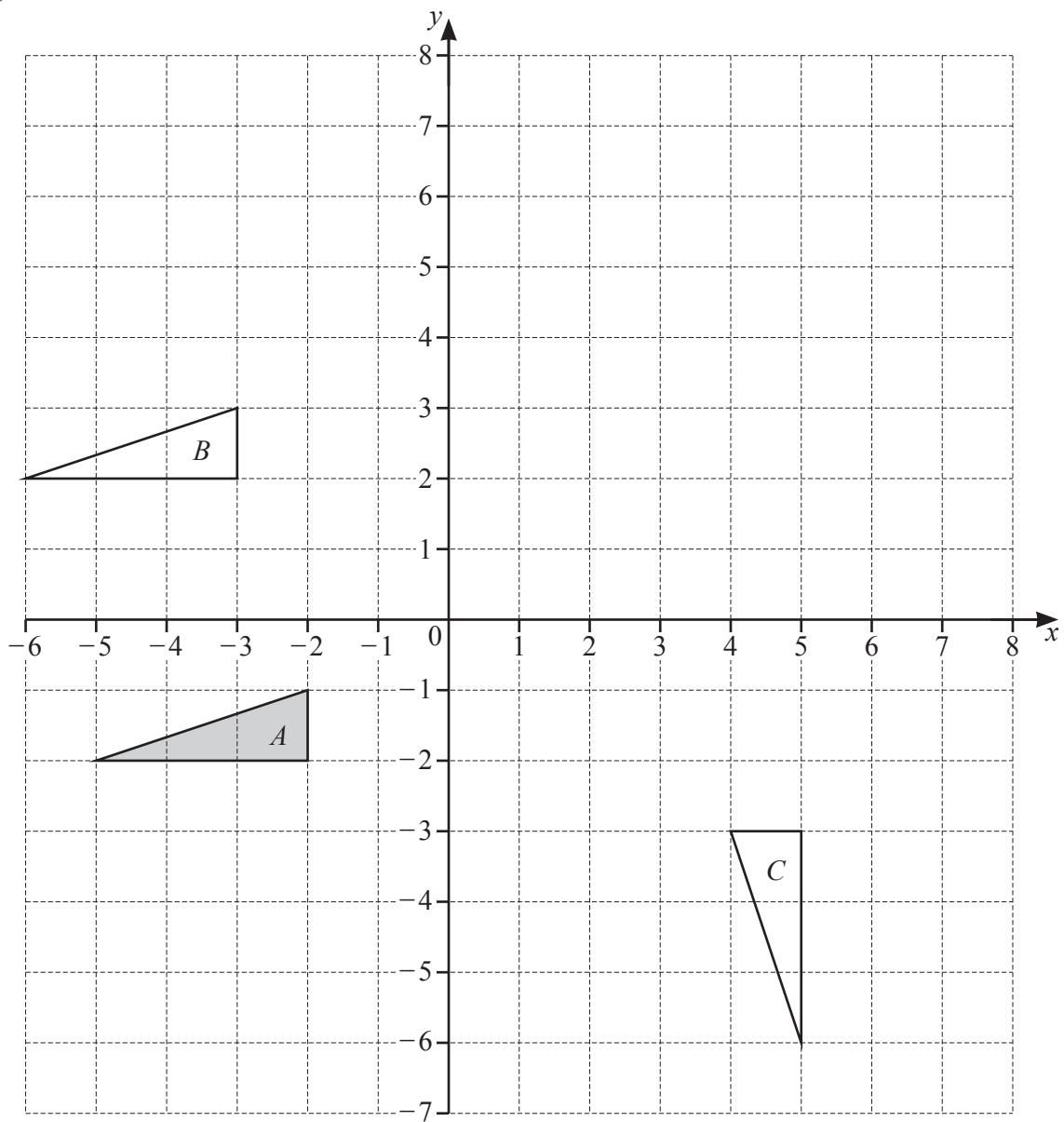
$\dots\dots\dots \text{ cm}^2$ [3]

- 5 (a) Draw the lines of symmetry of the rectangle.



[2]

- (b)



(i) Describe fully the **single** transformation that maps

(a) triangle A onto triangle B ,

.....

..... [2]

(b) triangle A onto triangle C .

.....

..... [3]

(ii) (a) Draw the image of triangle A after reflection in $y = 2$. [2]

(b) Draw the image of triangle A after enlargement by scale factor -2 , centre $(-1, 1)$. [2]

- 6 (a) At a festival, 380 people out of 500 people questioned say that they are camping.
There are 55 300 people at the festival.

Calculate an estimate of the total number of people camping at the festival.

..... [2]

- (b) 12 friends travel to the festival.
5 travel by car, 4 travel by bus and 3 travel by train.
Two people are chosen at random from the 12 friends.

Calculate the probability that they travel by different types of transport.

..... [4]

- (c) Arno buys a student ticket for \$43.68 .
This is a saving of 16% on the full price of a ticket.

Calculate the full price of a ticket.

\$ [2]

(d) At a football match, there are 29 800 people, correct to the nearest 100.

- (i) At the end of the football match, the people leave at a rate of 400 people per minute, correct to the nearest 50 people.

Calculate the lower bound for the number of minutes it takes for all the people to leave.

..... min [3]

- (ii) At a cricket match there are 27 500 people, correct to the nearest 100.

Calculate the upper bound for the difference between the number of people at the football match and at the cricket match.

..... [2]

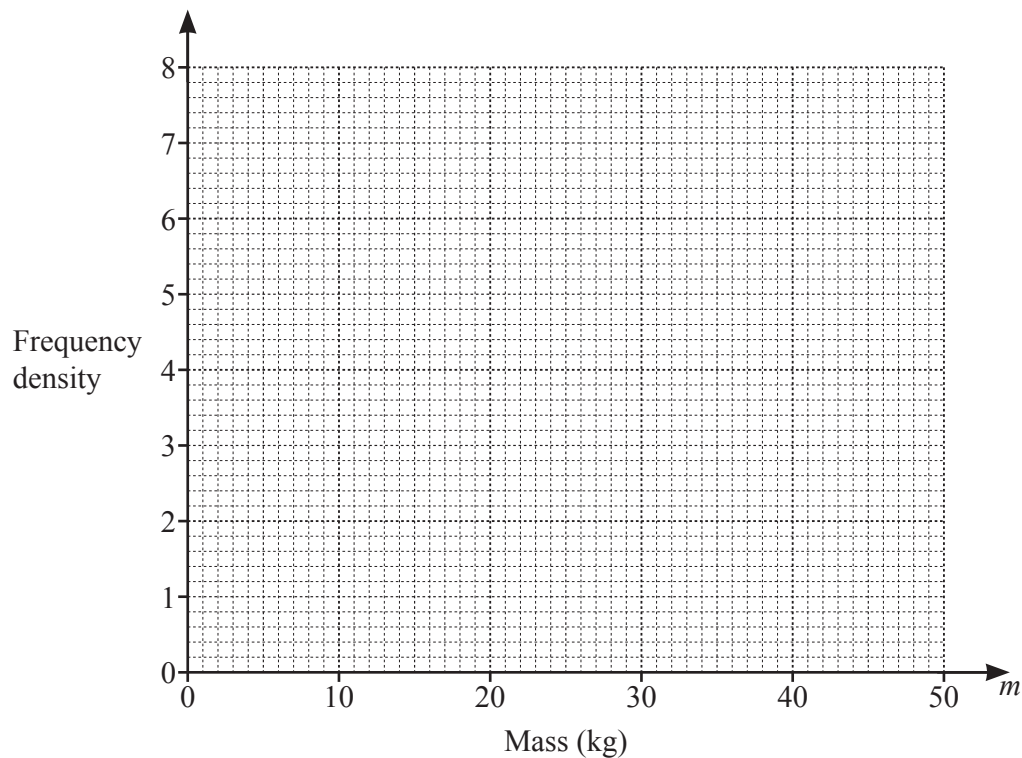
- 7 Information about the mass, m kg, of each of 150 children is recorded in the frequency table.

Mass (m kg)	$0 < m \leq 10$	$10 < m \leq 20$	$20 < m \leq 25$	$25 < m \leq 40$	$40 < m \leq 50$
Frequency	12	38	32	50	18

- (a) Calculate an estimate of the mean mass.

..... kg [4]

- (b) Draw a histogram to show the information in the table.



[4]

(c) (i) Use the frequency table to complete this cumulative frequency table.

Mass (m kg)	$m \leq 10$	$m \leq 20$	$m \leq 25$	$m \leq 40$	$m \leq 50$
Cumulative frequency					

[2]

(ii) Calculate the percentage of children with a mass greater than 10 kg.

..... % [2]

8 (a) Solve.

$$10 - 3p = 3 + 11p$$

$$p = \dots\dots\dots [2]$$

(b) Make m the subject of the formula.

$$mc^2 - 2k = mg$$

$$m = \dots\dots\dots [3]$$

(c) Solve.

$$\frac{1}{x-3} + \frac{4}{2x+3} = 1$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [5]$$

13

- (d) Solve the simultaneous equations.
You must show all your working.

$$x + 2y = 12$$

$$5x + y^2 = 39$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

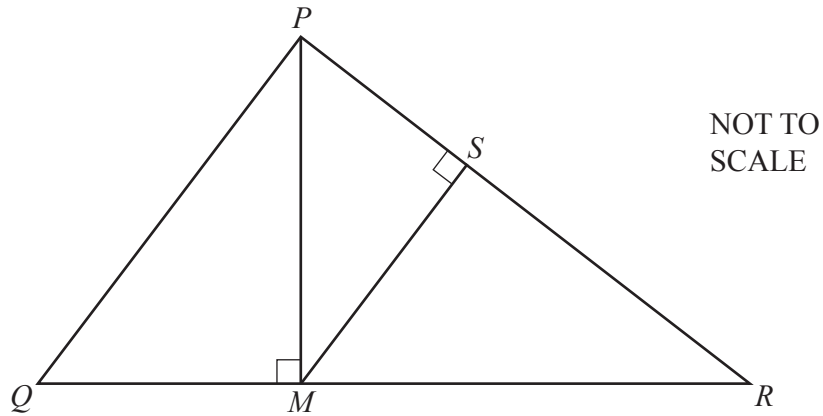
$$x = \dots\dots\dots y = \dots\dots\dots [5]$$

- (e) Expand and simplify.

$$(2x - 3)(x + 6)(x - 4)$$

$$\dots\dots\dots [3]$$

9 (a)



In triangle PQR , M lies on QR and S lies on PR .

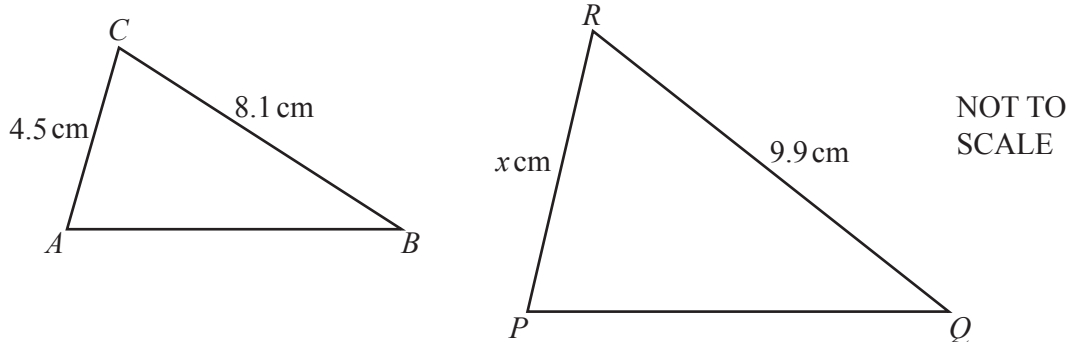
Explain, giving reasons, why triangle PMR is similar to triangle MSR .

.....

.....

..... [3]

(b)



Triangle ABC is similar to triangle PQR .

(i) Find the value of x .

$x =$ [2]

(ii) The area of triangle PQR is 25 cm^2 .

Calculate the area of triangle ABC .

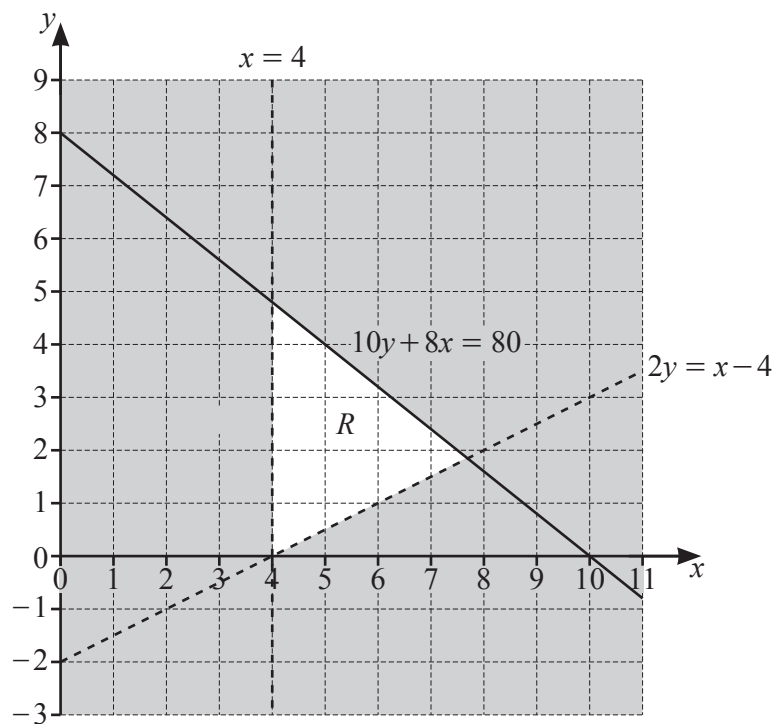
..... cm^2 [2]

- 10 (a) Find all the positive integers which satisfy the inequality.

$$3n - 8 > 5n - 15$$

..... [2]

(b)



The region marked R is defined by three inequalities.

- (i) Find these three inequalities.

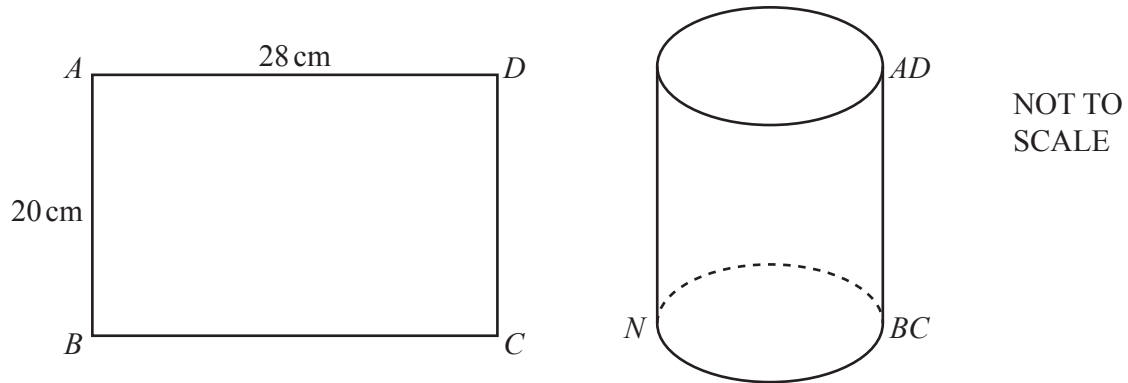
.....

 [3]

- (ii) Write down the largest value of $3x + y$ in the region R for integers x and y .

..... [2]

11 (a)



A rectangular sheet of paper $ABCD$ is made into an open cylinder with the edge AB meeting the edge DC .

$AD = 28\text{ cm}$ and $AB = 20\text{ cm}$.

(i) Show that the radius of the cylinder is 4.46 cm , correct to 3 significant figures.

[2]

(ii) Calculate the volume of the cylinder.

..... cm^3 [2]

(iii) N is a point on the base of the cylinder, such that BN is a diameter.

Calculate the angle between AN and the base of the cylinder.

..... [3]

- (b) The volume of a solid cone is 310 cm^3 .
The height of the cone is twice the radius of its base.

Calculate the slant height of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm [5]

- 12 A curve has equation $y = x^3 - kx^2 + 1$.
When $x = 2$, the gradient of the curve is 6.

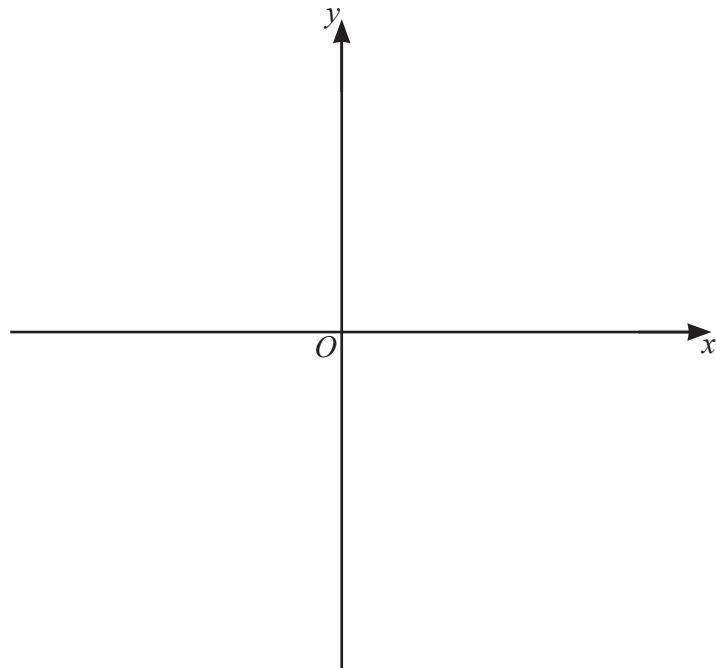
(a) Show that $k = 1.5$.

[5]

- (b) Find the coordinates of the two stationary points of $y = x^3 - 1.5x^2 + 1$.
You must show all your working.

(....., ...) and (....., ...) [4]

(c) Sketch the curve $y = x^3 - 1.5x^2 + 1$.



[2]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

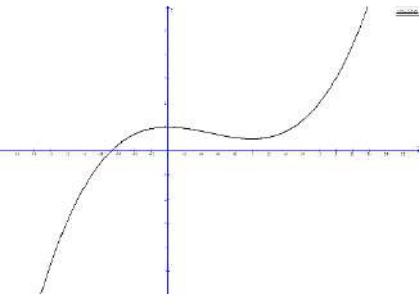
Question	Answer	Marks	Partial Marks
1(a)	150	2	B1 for answer $150k$ or M1 for prime factors of 30 or 75 seen or a list of multiples of both 30 and 75 with at least 3 of each or for $\frac{30 \times 75}{15}$ oe or for answer $2 \times 3 \times 5^2$
1(b)	152 190 266	3	Accept in any order B2 for two correct answers or M1 for $\frac{608}{4+5+7} \times k$ oe where $k=1, 4, 5, 7$
1(c)	2.61×10^{-2} 2.61×10^{-2} or $2.608... \times 10^{-2}$	2	B1 for figs 2608 or 261 seen If 0 scored, SC1 for answer $2.6[0] \times 10^{-2}$ without more accurate value in standard form seen
1(d)	$\frac{27}{99}$ oe fraction	1	
1(e)	2.8	1	
	g/cm^3 or g cm^{-3}	1	
2(a)	$PQR = 90$ angle in semi-circle	B1	
	$PRQ = 61$ angle sum of triangle [= 180]	B1	
	$PSQ = 61$ angle in same segment	B1	If 0 scored SC1 for $PSQ = PRQ$ [= 61] soi
2(b)	57	4	B1 for $ABT = 98$ B1 for TAB or $ATB = 41$ B1 for $BTC = 41$ or $TBC = 82$ or $ATC = 82$ soi
3(a)	8.25 or 8.246...	3	M2 for $(3 - -5)^2 + (2 - 4)^2$ oe or better or M1 for $(3 - -5)$ and $(2 - 4)$ oe seen
3(b)	$[y =] 4x + 7$	5	B1 for [midpoint] $(-1, 3)$ soi M1 for [gradient of $l =$] $\frac{4-2}{-5-3}$ oe M1 for gradient -1 / their $\left(-\frac{1}{4}\right)$ M1dep on at least M1 for their $(-1, 3)$ substituted into $y = \text{their } m \times x + c$ oe

Question	Answer	Marks	Partial Marks
3(c)	(0, – 8) and (0, 16)	4	B3 for (0, –8) or (0, 16) or for –8 and 16 OR B2 for distance = $[\pm]12$ soi or M1 for $13^2 - (5[-0])^2$ oe B1 for both answers (0, k), $k \neq 0$ or 4 ALT METHOD B3 for (0, –8) or (0, 16) or for –8 and 16 OR M2 for $y^2 - 8y - 128 [= 0]$ or for $(y - 4)^2 = 144$ or better or M1 for $13^2 = (-5 - 0)^2 + (4 - y)^2$ oe B1 for both answers (0, k), $k \neq 0$ or 4
4(a)	7.06 or 7.058... or 7.059	3	M2 for $\sqrt{6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38}$ oe OR M1 for $6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38$ oe A1 = 49.8...
4(b)(i)	97	1	
4(b)(ii)	15.3[0...]	3	M2 for $[AB =] \frac{10.9 \times \sin \text{their } 97}{\sin 45}$ or M1 for $\frac{\sin \text{their } 97}{AB} = \frac{\sin 45}{10.9}$ oe
4(c)	72.8 to 72.81...	3	M2 for $\frac{1}{2}(6.4) \times 10.9 \times \sin 38 + \frac{1}{2} \text{their } 15.3 \times 10.9 \times \sin 38$ oe or M1 for $\frac{1}{2} \times 6.4 \times 10.9 \times \sin 38$ oe or $\frac{1}{2} \times \text{their } 15.3 \times 10.9 \times \sin 38$ oe or M1 for height = $10.9 \times \sin 38$ oe
5(a)	Correct lines drawn	2	B1 for one correct with no incorrect lines
5(b)(i)(a)	Translation or translate $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ oe	2	B1 for each
5(b)(i)(b)	Rotation or rotate 90 [anticlockwise] oe [centre] (2, 1)	3	B1 for each
5(b)(ii)(a)	Triangle at (– 5, 6) (– 2, 6) (– 2, 5)	2	B1 for reflection in $y = k$

Question	Answer	Marks	Partial Marks
5(b)(ii)(b)	Triangle at (1, 5) (1, 7) (7, 7)	2	B1 for correct size and orientation, wrong position
6(a)	42 028	2	M1 for $\frac{380}{500}$ oe soi isw
6(b)	$\frac{47}{66}$ oe	4	0.712[1...] M3 for $2\left(\frac{5}{12} \times \frac{4}{11}\right) + 2\left(\frac{4}{12} \times \frac{3}{11}\right) + 2\left(\frac{5}{12} \times \frac{3}{11}\right)$ oe or $1 - \left(\frac{5}{12} \times \frac{4}{11} + \frac{4}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11}\right)$ oe or M2 for sum of 3 or more correct product pairs and no incorrect pairs or for $\frac{5}{12} \times \frac{4}{11} + \frac{4}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11}$ and no other pairs or M1 for $\frac{k}{12} \times \frac{j}{11}$ seen If 0 scored SC1 for answer $\frac{94}{144}$ oe
6(c)	52	2	M1 for $x \times \frac{100-16}{100} = 43.68$ oe or better
6(d)(i)	70 or 70.16[5...] or 70.17 or 70.2	3	M2 for $\frac{29750 \text{ to } 29800}{400+25}$ or $\frac{29750 \text{ to } 29800}{400+24}$ or $\frac{29800-50}{400 \text{ to } 425}$ or B1 for 29 750 or 29 850 or 29 849 or 375 or 425 or 424 seen
6(d)(ii)	2399 or 2400 nfw	2	B1 for 27 450 or 27 550 or 27 549 or 29 850 or 29 849 seen
7(a)	25.2 or 25.23...	4	M1 for midpoints soi M1 for use of $\sum fx$ with x in correct interval including both boundaries M1 (dep on 2 nd M1) for $\sum fx \div 150$
7(b)	5 correct blocks	4	B3 for 4 correct blocks or B2 for 3 correct blocks or B1 for 2 correct blocks or block widths 10, 10, 5, 15, 10 If 0 scored SC1 for 4 correct frequency densities from 1.2, 3.8, 6.4, 3.33[3...] and 1.8 oe soi
7(c)(i)	12, 50, 82, 132, 150	2	B1 for 3 or 4 correct

Question	Answer	Marks	Partial Marks
7(c)(ii)	92	2	M1 for $150 - 12$ oe seen If 0 scored, SC1 for answer 8[%]
8(a)	$\frac{1}{2}$ or 0.5 oe	2	M1 for $10 - 3 = 11p + 3p$ oe or better
8(b)	$[m =] \frac{2k}{c^2 - g}$ oe final answer	3	M1 for correctly isolating m terms M1 for correctly factorising M1 for dividing by a bracket with two terms to the final answer Maximum mark M2 if final answer incorrect
8(c)	0 4.5 oe	5	B4 for $2x^2 - 9x [= 0]$ or $9x - 2x^2 [= 0]$ or better OR M2 for $(2x + 3) + 4(x - 3) = (x - 3)(2x + 3)$ or better or M1 for $(2x + 3) + 4(x - 3)$ seen oe or common denominator $(x - 3)(2x + 3)$ oe B1 for $2x^2 - 6x + 3x - 9$ or better seen
8(d)	$y^2 - 10y + 21 [= 0]$ or $x^2 - 4x - 12 [= 0]$	M2	M1 for $y^2 + 5(12 - 2y) = 39$ oe or $5x + \frac{(12 - x)^2}{2^2} = 39$ seen oe
	$(y - 3)(y - 7) [= 0]$ or $(x + 2)(x - 6) [= 0]$	M1	or for correct factors for <i>their</i> 3– term quadratic equation or for correct substitution into quadratic formula or correctly completing the square for <i>their</i> 3– term quadratic equation
	$x = -2$ $y = 7$ $x = 6$ $y = 3$	B2	B1 for $x = -2, x = 6$ or for $y = 7, y = 3$ or for one correct pair of x and y values
8(e)	$2x^3 + x^2 - 54x + 72$ final answer	3	B2 correct expansion of three brackets unsimplified or for final answer of correct form with 3 out of 4 terms correct or B1 correct expansion of two brackets with at least three terms out of four correct
9(a)	$PMR = MSR = \text{right angle[s]} \text{ or } 90^\circ$	B1	
	$PRM = MRS$ same angle	B1	
	AAA oe OR $MPR = SMR$ 3rd angle of triangle	B1	Dep on B1B1 and no errors seen

Question	Answer	Marks	Partial Marks
9(b)(i)	5.5	2	M1 for $\frac{x}{4.5} = \frac{9.9}{8.1}$ oe
9(b)(ii)	16.7 or 16.73 to 16.74	2	M1 for $25 \times \left(\frac{8.1}{9.9}\right)^2$ oe or $25 \times \left(\frac{4.5}{\text{their } 5.5}\right)^2$ oe
10(a)	1, 2, 3	2	M1 for $15 - 8 > 5n - 3n$ oe If 0 scored, B1 for 2 correct answers and no others or 3 correct answers with one extra value
10(b)(i)	$10y + 8x \leq 80$ oe final answer $x > 4$ oe final answer $2y > x - 4$ oe final answer	3	B1 for each If 0 scored, SC1 for $10y + 8x < 80$ oe final answer and $x \geq 4$ oe final answer and $2y \geq x - 4$ oe final answer
10(b)(ii)	23 final answer	2	M1 for 7 and 2 selected soi
11(a)(i)	4.455 to 4.456... [= 4.46]	2	M1 for $[r =] \frac{28}{2\pi}$ oe
11(a)(ii)	1250 or 1247 to 1249.9...	2	M1 for $20 \times \pi \times 4.46^2$ oe
11(a)(iii)	66[.0] or 65.95 to 66.02	3	M2 for $[\tan] = \frac{20}{2 \times 4.46}$ oe or B1 for identifying angle ANB on cylinder not on rectangle
11(b)	11.8 or 11.82 to 11.83	5	M2 for $[r =] \sqrt[3]{\frac{310 \times 3}{2\pi}}$ oe or $[h =] \sqrt[3]{\frac{310 \times 3 \times 4}{\pi}}$ oe or M1 for $310 = \frac{1}{3} \pi \times r^2 \times 2r$ or $310 = \frac{1}{3} \pi \left(\frac{h}{2}\right)^2 h$ M2 for $\sqrt{(\text{their } r)^2 + (2 \times \text{their } r)^2}$ oe or M1 for $[l^2 =] (\text{their } r)^2 + (2 \times \text{their } r)^2$ oe

Question	Answer	Marks	Partial Marks
12(a)	$3x^2 - 2kx$	M2	M1 for $3x^2$ or $-2kx$
	<i>their</i> $\frac{dy}{dx} = 6$	M1	Dep on at least M1 for derivative
	$x = 2$ substituted in <i>their</i> $\frac{dy}{dx}$	M1	Dep on at least M1 for derivative
	Correct working leading to 1.5 oe	A1	A0 if any errors in working leading to 1.5
12(b)	(0, 1) (1, 0.5)	4	B3 for $x = 0$ and $x = 1$ or for (1, 0.5) OR M1 for <i>their</i> $\frac{dy}{dx} = 0$ B1 for $3x^2 - 3x$ oe or better
12(c)	correct sketch 	2	with max on positive y-axis and min in 1st quadrant B1 for positive cubic or for graph with one max which is on pos y-axis and one min which is in 1st quadrant



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MATHEMATICS**0580/43**

Paper 4 (Extended)

May/June 2022**2 hours 30 minutes**

You must answer on the question paper.

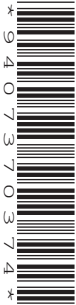
You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 Here is part of a bus timetable.

Abbots	06 50	08 25	09 20
Callet	07 12	08 47	09 42
North Moor	07 30	09 05	10 00
South Moor	07 37	09 12	10 07
Centre Point	08 00	09 35	10 30

- (a) Rashid catches the 09 20 bus at Abbots.

Find the time the bus arrives at South Moor.

..... [1]

- (b) Annisa leaves home at 8.27 am and takes 25 minutes to walk to the bus stop at Callet.
She catches the next bus to Centre Point.

Find the total time, in minutes, for her journey from leaving home to arriving at Centre Point.

..... min [2]

- (c) The distance from Abbots to Centre Point is 29.4 km.
Each bus takes the same time for the journey.

Calculate the average speed of a bus for this journey.
Give your answer in kilometres per hour.

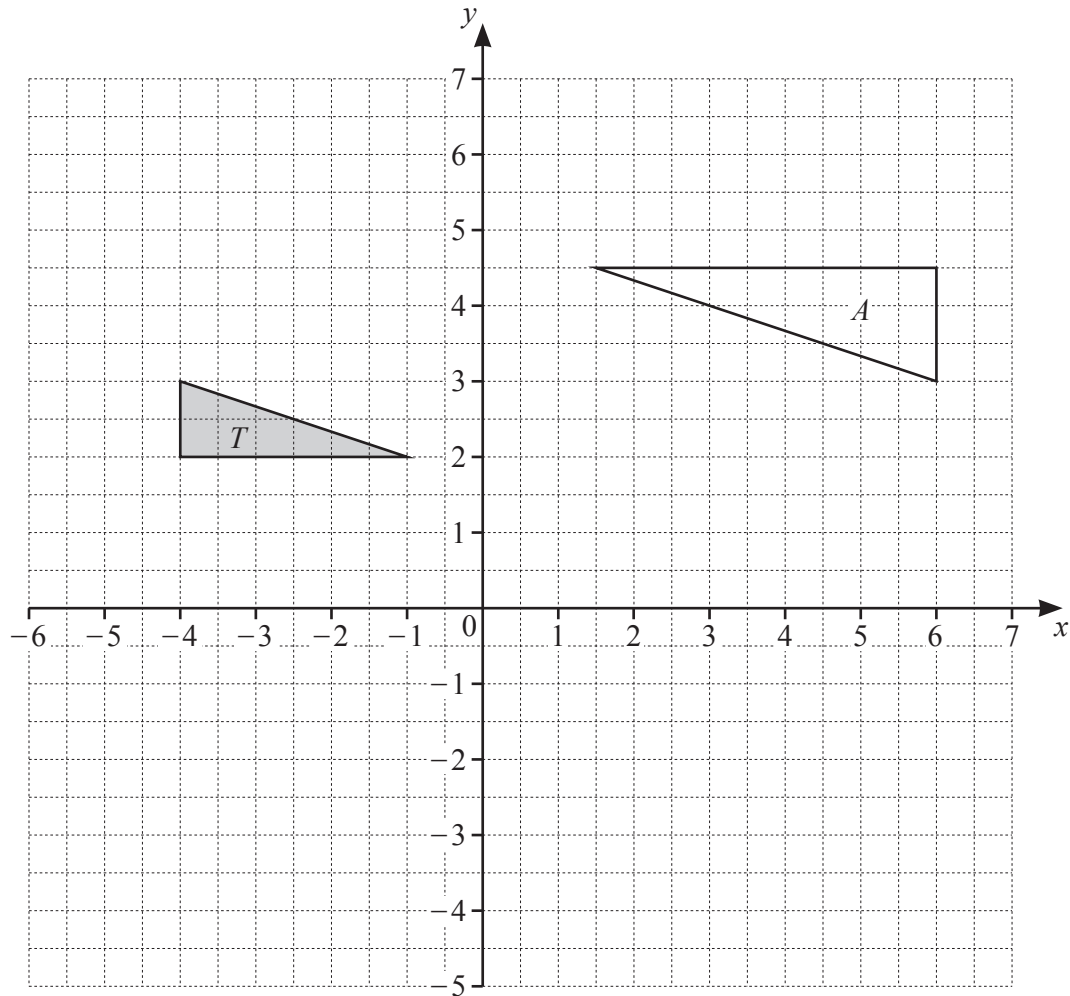
..... km/h [2]

- (d) On one journey, all 56 seats on the bus are filled.
The ratio of adults to children on this journey is adults : children = 5 : 3.
The cost for an adult ticket is \$2.80 .
The cost for a child ticket is $\frac{3}{4}$ of the adult cost.

Work out the total cost of the tickets for this journey.

\$ [4]

2 (a)



(i) Draw the image of triangle T after a reflection in the line $y = x$. [2]

(ii) Draw the image of triangle T after a translation by the vector $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$. [2]

(iii) Describe fully the **single** transformation that maps triangle T onto triangle A .

..... [3]

(b) A quadrilateral P is enlarged by a scale factor of 1.2 to give quadrilateral Q .
The area of quadrilateral P is 20 cm^2 .

Calculate the area of quadrilateral Q .

..... cm^2 [2]

- 3 (a) The table shows the numbers of tigers reported to be living in the wild in the year 2014 in some countries.

Country	Number
India	2226
Indonesia	371
Nepal	198
Bangladesh	106

- (i) Using the table,

- (a) find the number of tigers in Nepal as a percentage of the number of tigers in Bangladesh,

..... % [1]

- (b) find the ratio tigers in Bangladesh : tigers in Indonesia : tigers in India, giving your answer in its simplest form.

..... : : [2]

- (ii) Five years later, the number of tigers reported in India was 2967.

Find the percentage increase in the population of tigers in India.

..... % [2]

- (iii) The number of tigers in India in the year 2014 is approximately 30.48% greater than in the year 2010.

Find the number of tigers in India in the year 2010.

Give your answer correct to the nearest integer.

..... [3]

5

- (b) At the start of June, a hive has a population of 2000 bees.
Three months after the start of June the hive has a population of 2662 bees.

The population of this hive can be calculated using the formula

$$P = ab^x,$$

where P is the population of the hive x months after the start of June.

By finding the value of a and the value of b , calculate the population of the hive 7 months after the start of June.

Give your answer correct to the nearest integer.

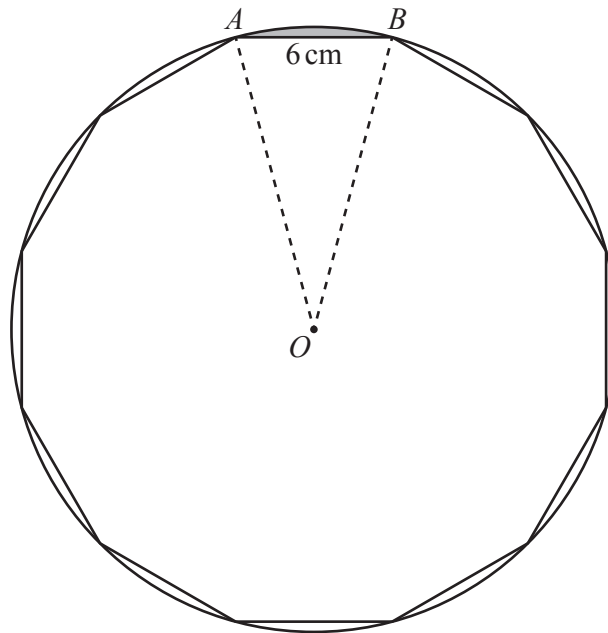
..... [5]

4 A regular 12-sided polygon has side length 6 cm.

(a) Show that one interior angle of the polygon is 150° .

[1]

(b) The polygon is enclosed by a circle, centre O , so that each vertex touches the circumference of the circle.



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(i) Show that the radius, AO , of the circle is 11.6 cm, correct to 1 decimal place.

[3]

(ii) Calculate

(a) the circumference of the circle,

..... cm [2]

(b) the perimeter of the shaded **minor** segment formed by the chord AB .

..... cm [2]

(c) The regular 12-sided polygon is the cross-section of a prism of length 2 cm.

Calculate the volume of the prism.

..... cm^3 [3]

- 5 The time, t minutes, taken by each of 80 people to travel to work is recorded. The table shows information about these times.

Time (t minutes)	$0 < t \leq 5$	$5 < t \leq 10$	$10 < t \leq 20$	$20 < t \leq 35$	$35 < t \leq 60$
Frequency	3	7	18	28	24

- (a) (i) Write down the class interval containing the median time.

..... $< t \leq$ [1]

- (ii) Calculate an estimate of the mean time.

..... min [4]

- (b) (i) One of these 80 people is chosen at random.

Find the probability that this person took longer than 10 minutes to travel to work.
Give your answer as a fraction in its simplest form.

..... [2]

- (ii) Two people are chosen at random from those taking 20 minutes or less to travel to work.

Calculate the probability that one of these people took 5 minutes or less and the other took more than 5 minutes.

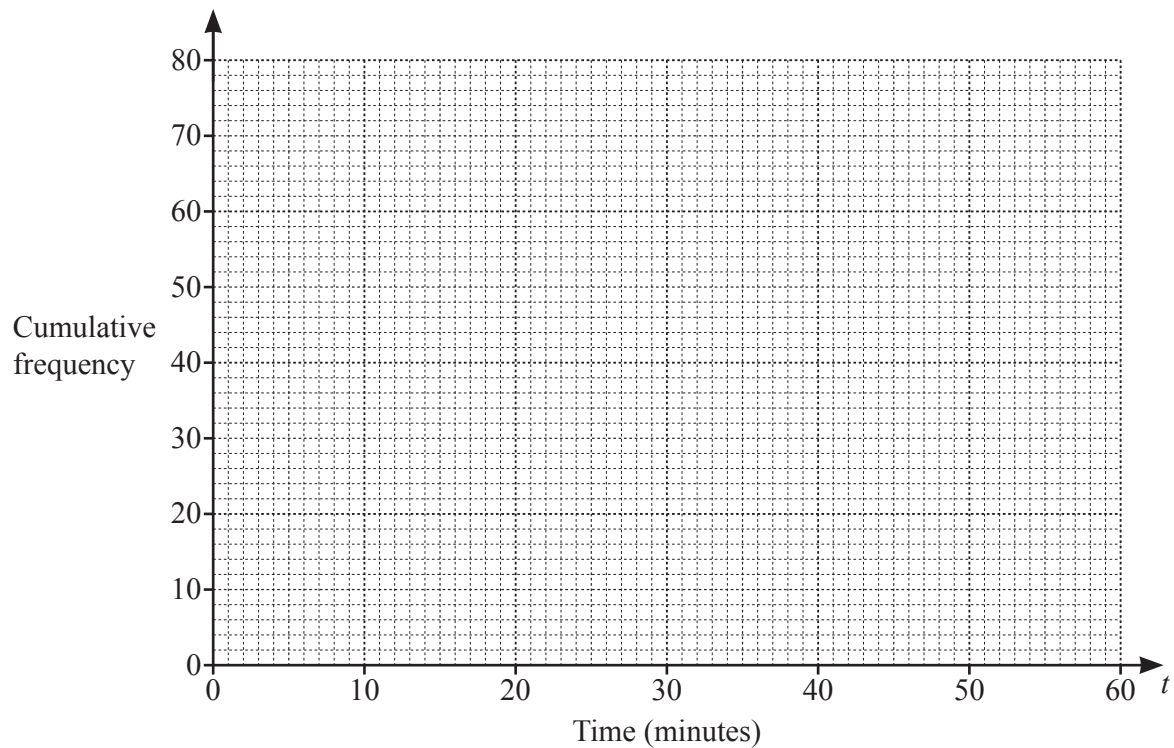
..... [3]

- (c) (i) Use the frequency table on page 8 to complete the cumulative frequency table.

Time (t minutes)	$t \leq 5$	$t \leq 10$	$t \leq 20$	$t \leq 35$	$t \leq 60$
Cumulative frequency	3	10			80

[1]

- (ii) On the grid, draw a cumulative frequency diagram to show this information.



[3]

- (iii) Find an estimate for the 80th percentile.

..... min [2]

- (iv) Find an estimate for the percentage of people who took longer than 45 minutes to travel to work.
Show all your working.

..... % [3]

6 (a) Simplify.

$$a - 2b - 3a + 7b$$

..... [2]

(b) Expand and simplify.

$$4(x - 5) - (3 - 2x)$$

..... [2]

(c) Write as a single fraction in its simplest form.

$$\frac{3}{x-5} - \frac{7}{2x}$$

..... [3]

(d) Solve.

$$\frac{13-4x}{3} = 6-x$$

$x =$ [3]

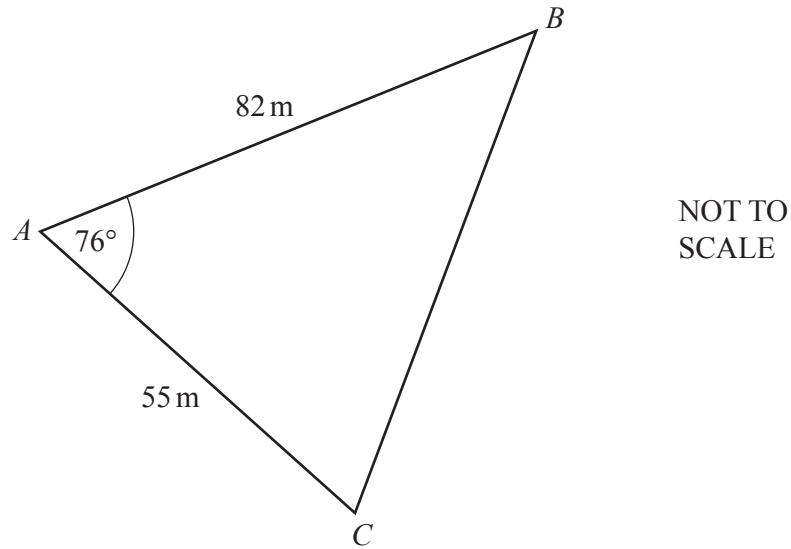
11

- (e) Make x the subject of the formula.

$$y = \frac{5(p-2x)}{x}$$

$$x = \dots\dots\dots [4]$$

7



The diagram shows a field ABC .

(a) Calculate BC .

$BC = \dots\dots\dots\text{ m}$ [3]

(b) Calculate angle ACB .

Angle $ACB = \dots\dots\dots$ [3]

- (c) A gate, G , lies on AB at the shortest distance from C .

Calculate AG .

$AG = \dots\dots\dots$ m [3]

- (d) A different triangular field PQR has the same area as ABC .
 $PQ = 90$ m and $QR = 60$ m.

Work out the two possible values of angle PQR .

Angle $PQR = \dots\dots\dots$ or $\dots\dots\dots$ [5]

- 8 (a) A has coordinates $(-2, 7)$, B has coordinates $(1, -5)$ and C has coordinates $(5, 4)$.

(i) Find the coordinates of the midpoint of the line AB .

(....., ...) [2]

(ii) Find $\overrightarrow{AC}$.

$\overrightarrow{AC} = \begin{pmatrix} \\ \end{pmatrix}$ [2]

(iii) Find $|\overrightarrow{AC}|$.

..... [2]

(iv) Find the equation of the line AB .
Give your answer in the form $y = mx + c$.

$y =$ [3]

- (v) Find the equation of the line perpendicular to AB that passes through C .
Give your answer in the form $y = mx + c$.

$$y = \dots\dots\dots [3]$$

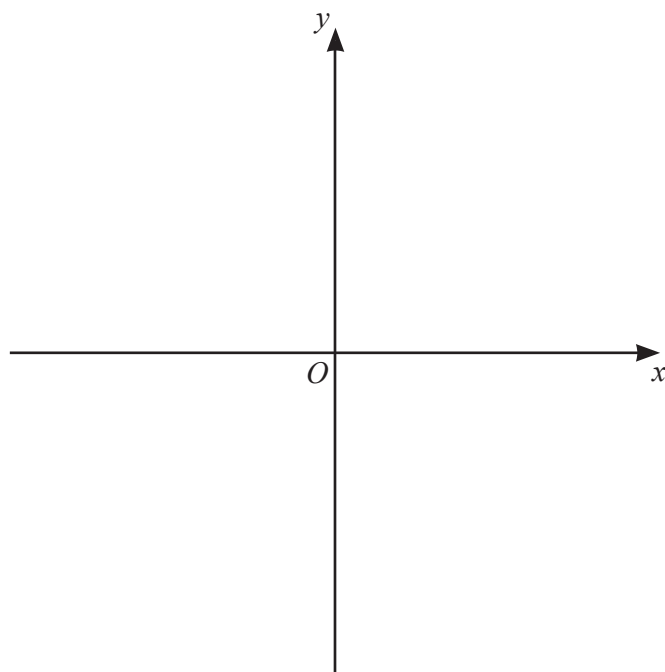
- (b) The graphs of $y + 5x = 8$ and $y = 2x^2 + 6x - 13$ intersect at the points P and Q .

Find the coordinates of P and the coordinates of Q .
Show all your working.

$$P (\dots\dots\dots , \dots\dots\dots)$$

$$Q (\dots\dots\dots , \dots\dots\dots) [6]$$

- 9 (a) Sketch the graph of $y = (x+1)(3-x)(3+x)$, indicating the coordinates of the points where the graph crosses the x -axis and the y -axis.



[4]

- (b) (i) Show that $y = (x+1)(3-x)(3+x)$ can be written as $y = 9 + 9x - x^2 - x^3$.

[2]

- (ii) Calculate the x -values of the turning points of $y = 9 + 9x - x^2 - x^3$.
Show all your working and give your answers correct to 2 decimal places.

$x = \dots\dots\dots$, $x = \dots\dots\dots$ [7]

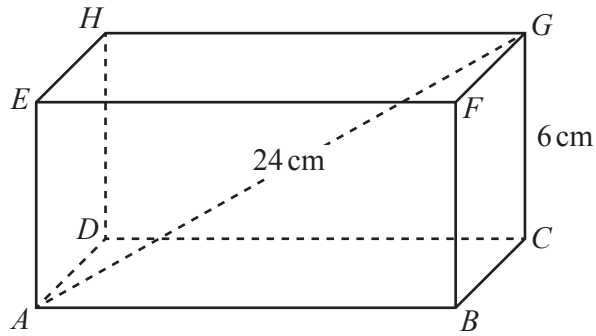
- (iii) The equation $9 + 9x - x^2 - x^3 = k$ has one solution only when $k < a$ and when $k > b$, where a and b are integers.

Find the maximum value of a and the minimum value of b .

$a = \dots\dots\dots$

$b = \dots\dots\dots$ [3]

10



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The diagram shows a cuboid $ABCDEFGH$.
 $CG = 6$ cm, $AG = 24$ cm and $AB = 2BC$.

(a) Calculate AB .

$AB = \dots\dots\dots$ cm [4]

(b) Calculate the angle between AG and the base $ABCD$.

$\dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	10 07	1	
1(b)	123	2	M1 for $10\ 30 - 8\ 27$ soi or $10\ 30 - 8\ 52 + 25$ soi or $25 + 50 + 48$
1(c)	$25.2, 25\frac{1}{5}$	2	M1 for figs $29.4 \div 70 [\times 60]$ oe
1(d)	\$142.1[0] cao	4	M2 for [adults =] $56 \div 8 \times 5$ and [child =] $56 \div 8 \times 3$ or better or M1 for $56 \div (5 + 3) \times k$ where $k = 1, 3$ or 5 M1 for <i>their</i> $35 \times 2.80 + \text{their } 21 \times 2.80 \times \frac{3}{4}$ oe
2(a)(i)	Triangle drawn at (2, – 1), (2, – 4), (3, – 4)	2	B1 for two correct points If 0 scored, SC1 for reflection of triangle <i>T</i> in $y = -x$
2(a)(ii)	Triangle drawn at (– 5, 6), (– 2, 5), (– 5, 5)	2	B1 for translation by $\begin{pmatrix} -1 \\ k \end{pmatrix}$ or by $\begin{pmatrix} k \\ 3 \end{pmatrix}$ If 0 scored SC1 for triangle drawn at (–4.5, 3.5), (–4.5, 4.5) and (–1.5, 3.5)
2(a)(iii)	Enlargement [SF] – 1.5 oe [centre] (0, 3)	3	B1 for each
2(b)	$28.8, 28\frac{8}{10}, 28\frac{4}{5}$	2	M1 for 1.2^2 oe
3(a)(i)(a)	187 or 186.7 to 186.8 or $186\frac{42}{53}$	1	
3(a)(i)(b)	2 : 7 : 42 cao	2	B1 for 106 : 371 : 2226 or any equivalent ratio If 0 scored, SC1 for 2 : 7 : 42 in the wrong order
3(a)(ii)	33.3 or 33.28 to 33.29	2	M1 for $\frac{2967 - 2226}{2226} [\times 100]$ oe or $\frac{2967}{2226} \times 100 [- 100]$ oe

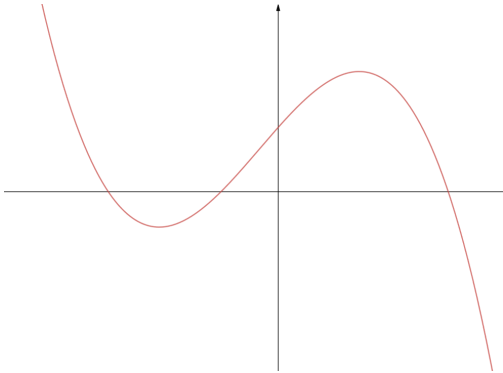
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Question	Answer	Marks	Partial Marks
3(a)(iii)	1706 cao nfw	3	B2 for 1705 to 1706.0... or 1710 or M1 for $\left(1 + \frac{30.48}{100}\right)x = 2226$ oe or better If 0 or M1 scored, SC1 for rounding <i>their</i> decimal answer seen to nearest integer
3(b)	3897	5	B1 for $a = 2000$ M2 for $[b =] \sqrt[3]{\frac{2662}{2000}}$ or M1 for $2662 = 2000b^3$ M1 for <i>their</i> $2000 \times \left(\sqrt[3]{\frac{2662}{\text{their } 2000}}\right)^7$ or for <i>their</i> $a \times (\text{their } b)^7$ provided <i>their a</i> and <i>their b</i> are clearly identified in the working If 0 or M1 scored, SC1 for rounding <i>their</i> decimal answer seen to nearest integer.
4(a)	$\frac{(12-2) \times 180}{12} [= 150]$ oe or $180 - \frac{360}{12} [= 150]$	1	Accept $\frac{(2 \times 12 - 4) \times 90}{12} [= 150]$
4(b)(i)	$\frac{3}{\cos 75}$ oe or $\frac{6 \sin 75}{\sin 30}$	M2	M1 for $\frac{3}{AO} = \cos 75$ oe or $\frac{r}{\sin 75} = \frac{6}{\sin 30}$
	11.59...	A1	
4(b)(ii)(a)	72.8 or 72.9 or 72.82 to 72.89...	2	M1 for $2 \times \pi \times 11.6$
4(b)(ii)(b)	12.1 or 12.06 to 12.08	2	M1 for $[6 +] \text{their (b)(ii)(a)} \div 12$ oe
4(c)	806 or 807 or 805.9 to 807.4	3	B2 for 402.9... to 403.7 OR M2 for $\frac{1}{2} \times 6 \times 11.6 \times \sin 75 \times 12 \times 2$ oe or M1 for $\frac{1}{2} \times 6 \times 11.6 \times \sin 75 [\times k]$ oe
5(a)(i)	$20 < t \leq 35$	1	

Question	Answer	Marks	Partial Marks
5(a)(ii)	28 nfw	4	M1 for midpoints soi M1 for use of $\sum fm$ with m in correct interval including both boundaries M1 (dep on 2 nd M1) for $\sum fm \div 80$
5(b)(i)	$\frac{7}{8}$ cao	2	M1 for $\frac{18+28+24}{80}$ oe
5(b)(ii)	$\frac{25}{126}$ oe	3	M2 for $[2 \times] \left(\frac{3}{28} \times \frac{25}{27} \right)$ or $[2 \times] \left(\frac{25}{28} \times \frac{3}{27} \right)$ oe or M1 for either $\frac{3}{28}$ or $\frac{25}{27}$ or $\frac{25}{28}$ or $\frac{3}{27}$ If 0 scored, SC1 for answer $\frac{75}{392}$ oe
5(c)(i)	28 and 56	1	
5(c)(ii)	Correct diagram	3	B1FT <i>their</i> (c)(i) for plots at 5 correct heights B1 for 5 plots at upper ends of intervals on correct vertical line B1FT (dep on at least B1) for increasing curve or polygon through 5 points After 0 scored, SC1FT for 4 correct points plotted
5(c)(iii)	Strict FT <i>their</i> reading at 80 th percentile for an increasing curve/polygon	2	B1 for 64 written or a mark at cf = 64 on graph or a mark on curve at $(t, 64)$
5(c)(iv)	Correct integer reading at $t = 45$	M1	FT <i>their</i> cf graph for all three marks
	$\frac{80 - (\text{their reading at } t = 45)}{80} [\times 100]$ or $\frac{(\text{their reading at } t = 45)}{80} \times 100$	M1	
	Percentage consistent with <i>their</i> reading	A1	If no working shown then SC1 for a correct percentage that follows from a correct reading from <i>their</i> graph.
6(a)	$5b - 2a$ final answer	2	B1 for $5b$ or $-2a$ in final answer or for $5b - 2a$ seen
6(b)	$6x - 23$ final answer nfw	2	M1 for $4x - 20$ or $-3 + 2x$

Question	Answer	Marks	Partial Marks
6(c)	$\frac{35-x}{2x(x-5)}$ or $\frac{35-x}{2x^2-10x}$ oe final answer nfw	3	B1 for $3(2x) - 7(x-5)$ or better isw B1 for $2x(x-5)$ as common denominator isw, allow expanded
6(d)	-5	3	M1 for $13 - 4x = 18 - 3x$ oe or $\frac{-4x}{3} + x = 6 - \frac{13}{3}$ oe M1FT for $-4x + 3x = 18 - 13$ oe or for $\frac{-x}{3} = \frac{5}{3}$
6(e)	$[x =] \frac{5p}{y+10}$ oe final answer	4	M1 for correctly clearing the x from the denominator M1 for correctly expanding the brackets or (dealing with the 5 correctly throughout) M1 for correctly isolating terms in x M1 for correctly factorising and dividing by the bracket Max 3 marks if answer is incorrect
7(a)	87.[0] or 86.98 to 86.99	3	M2 for $\sqrt{82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76}$ oe OR M1 for $82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76$ oe A1 for 7570 or 7566 to 7567
7(b)	66.1 or 66.2 or 66.13 to 66.17	3	M2 for $\frac{82 \times \sin 76}{\text{their (a)}}$ oe or M1 for $\frac{82}{\sin C} = \frac{\text{their (a)}}{\sin 76}$ oe
7(c)	13.3 or 13.30 to 13.31	3	M2 for $AG = 55 \cos 76$ oe or M1 for recognition that CG is perpendicular to AB

Question	Answer	Marks	Partial Marks
7(d)	54.1 or 54.13... and 125.9 or 125.86 to 125.87	5	B4 for 54.1 or 54.13... or 125.9 or 125.86 to 125.87 M3 for $[\sin Q =] \frac{0.5 \times 82 \times 55 \times \sin 76}{0.5 \times 90 \times 60}$ oe or M2 for $0.5 \times 82 \times 55 \times \sin 76 = 0.5 \times 60 \times 90 \times \sin Q$ oe or M1 for $0.5 \times 82 \times 55 \times \sin 76$ oe or for $0.5 \times 60 \times 90 \sin Q = \text{their area of } ABC$ If B4 not scored then SC1 for two angles seen that sum to 180 (from use of sine ratio) but not 0 and 180.
8(a)(i)	(-0.5, 1)	2	B1 for each
8(a)(ii)	$\begin{pmatrix} 7 \\ -3 \end{pmatrix}$	2	B1 for each
8(a)(iii)	7.62 or 7.615 to 7.616	2	FT <i>their (a)(ii)</i> M1 for $(\text{their } 7)^2 + (\text{their } -3)^2$ oe
8(a)(iv)	$[y =] -4x - 1$ final answer	3	B2 for answer $-4x + c$ [oe] or for correct equation in different form or for $-4x + -1$ or for $-4m - 1$ OR M1 for $\frac{-5-7}{1--2}$ oe M1 for correct substitution shown of $(-2, 7)$ or $(1, -5)$ or <i>their</i> $(-0.5, 1)$ into $y = (\text{their } m)x + c$ oe OR M1 for $7 = -2m + c$ and $-5 = m + c$ A1 for $m = -4$ and $c = -1$
8(a)(v)	$[y =] \frac{1}{4}x + \frac{11}{4}$ final answer	3	M1 for $\text{grad} = \frac{1}{4}$ oe nfwf soi, FT negative reciprocal of <i>their</i> gradient from (iv) M1 for correct substitution shown of $(5, 4)$ into $y = (\text{their } m)x + c$ oe or, if no substitution shown, $(5, 4)$ satisfies <i>their</i> final linear equation.

Question	Answer	Marks	Partial Marks
8(b)	$2x^2 + 11x - 21 [= 0]$	M2	or M1 for $8 - 5x = 2x^2 + 6x - 13$ oe or better
	$(2x - 3)(x + 7) [= 0]$ oe or $\frac{-11 \pm \sqrt{11^2 - 4 \times 2 \times (-21)}}{2 \times 2}$ or $-\frac{11}{4} \pm \sqrt{\frac{21}{2} + \left(\frac{11}{4}\right)^2}$ oe	M2	Allow correct method to solve <i>their</i> quadratic equation e.g. formula, complete the square but not for $2x^2 + 6x - 13$ M1 FT <i>their</i> equation for $2x(x + 7) - 3(x + 7) [= 0]$ or $x(2x - 3) + 7(2x - 3) [= 0]$ or $(2x + a)(x + b) [= 0]$ where $ab = -21$ or $2b + a = 11$ OR M1 for $\sqrt{11^2 - 4 \times 2 \times -21}$ or for $\frac{-11 + \sqrt{k}}{2 \times 2}$ or $\frac{-11 - \sqrt{k}}{2 \times 2}$ OR M1 for $\left(x + \frac{11}{4}\right)^2$
	$\left(\frac{3}{2}, \frac{1}{2}\right)$ and $(-7, 43)$	B2	B1 for one correct pair or for 2 correct x-values or 2 correct y-values
9(a)	Correct sketch of negative cubic crossing the x-axis at $-3, -1$ and 3 and crossing the y-axis at 9 	4	B1 for any negative cubic shape with two turning points B2 for three intercepts only with x-axis labelled at $-3, -1$ and 3 or B1 for one or two correctly labelled x-intercepts B1 for intercept with y-axis labelled at 9 If no graph drawn, SC1 for all four intercepts labelled on axes.
9(b)(i)	$3 - x + 3x - x^2$ or better or $3 + x + 3x + x^2$ or better or $9 [-3x + 3x] - x^2$	M1	At least 3 of the four terms correct or for the correct expansion of all three brackets with all 8 terms correct
	Correct completion to $[y =] 9 + 9x - x^2 - x^3$	A1	with no errors or omissions seen

Question	Answer	Marks	Partial Marks
9(b)(ii)	$9 - 2x - 3x^2 = 0$ oe	B3	B2 for $9 - 2x - 3x^2$ or B1 for two correct terms M1 for <i>their</i> derivative = 0 or stating $\frac{dy}{dx} = 0$
	$\frac{- -2 \pm \sqrt{(-2)^2 - 4 \times -3 \times 9}}{2 \times -3}$ oe OR $-\frac{1}{3} \pm \sqrt{\frac{9}{3} + \left(\frac{1}{3}\right)^2}$ oe	B2	FT <i>their</i> derivative B1FT for $\sqrt{(-2)^2 - 4(-3)(9)}$ or better or for $\frac{-(-2) + \sqrt{q}}{2 \times -3}$ or $\frac{-(-2) - \sqrt{q}}{2 \times -3}$ OR B1 for $\left(x + \frac{1}{3}\right)^2$
	-2.10 and 1.43 final answer	B2	B1 for each or for answers -2.1 or -2.097 ... and 1.4 or 1.430 to 1.431 or SC1 for -2.097... and 1.43[0] to 1.431 seen in working or for -1.43 and 2.10 as final answer
9(b)(iii)	$[a =] -6$ $[b =] 17$	3	B2 for either a correct or b correct or for $[a =] -5.04$ or -5.049 to -5.05 and $[b =] 16.9...$ seen or M1 for substitution of one of <i>their</i> solutions into $9 + 9x - x^2 - x^3$ oe or SC1 for reversed answers, $a = 17$, $b = -6$
10(a)	20.8 or 20.76 to 20.79	4	B3 for $[BC =] 10.4$ or 10.38 to $10.39...$ or $6\sqrt{3}$ oe or M2 for $(2x)^2 + x^2 + 6^2 = 24^2$ oe or M1 for $24^2 - 6^2$ oe or $x^2 + 6^2$ oe or $(2x)^2 + 6^2$ oe, or $x^2 + (2x)^2$ oe or SC2 for final answer of $12\sqrt{5}$ or 26.8 or 26.83... OR M3 for $x^2 + \left(\frac{x}{2}\right)^2 + 6^2 = 24^2$ oe or M2 for $x^2 + \left(\frac{x}{2}\right)^2$ or M1 for $x^2 + 6^2$ oe or $\left(\frac{x}{2}\right)^2 + 6^2$ oe or $24^2 - 6^2$ oe

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Question	Answer	Marks	Partial Marks
10(b)	14.5 or 14.47 to 14.48	3	M2 for $\sin [\dots] = \frac{6}{24}$ oe or M1 for recognising the correct angle <i>GAC</i>



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NUMBER

MATHEMATICS**0580/22**

Paper 2 (Extended)

February/March 2022**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

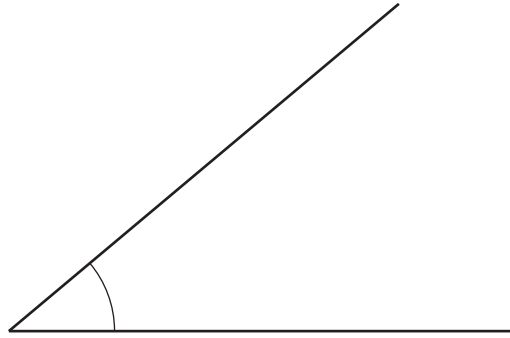
INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

2

1



Measure the marked angle.

..... [1]

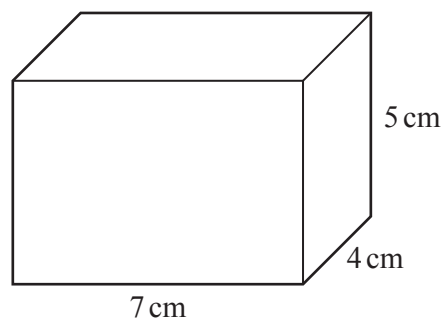
- 2 Work out $\sqrt{5} \times 6^2$.
Give your answer correct to 2 decimal places.

..... [2]

- 3 A journey starts at 21 15 one day and ends at 04 33 the next day.
Calculate the time taken, in hours and minutes.

..... h min [1]

4



NOT TO
SCALE

Calculate the **total** surface area of this cuboid.

..... cm^2 [3]

3

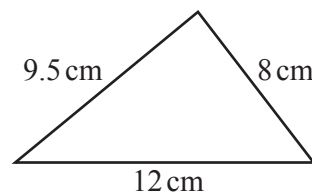
- 5 (a) Write down the gradient of the line $y = 5x + 7$.

..... [1]

- (b) Find the coordinates of the point where the line $y = 5x + 7$ crosses the y -axis.

(....., ...) [1]

6



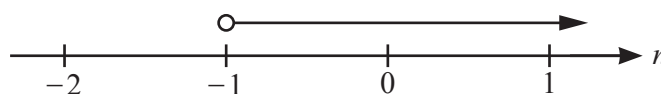
NOT TO
SCALE

Using a ruler and compasses only, construct this triangle.
Leave in your construction arcs.
The side of length 12 cm has been drawn for you.

.....

[2]

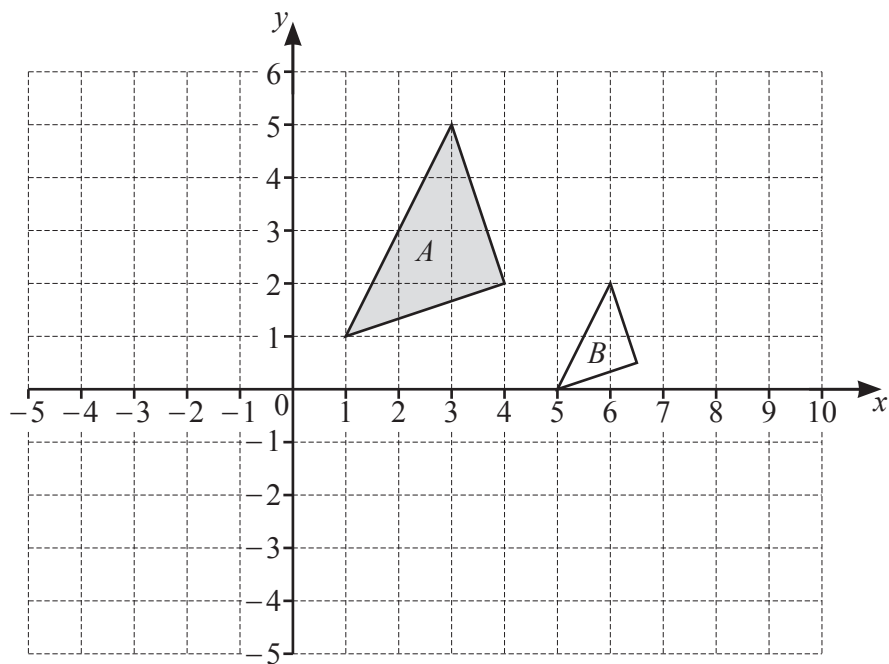
7



Write down the inequality, in terms of n , shown by the number line.

..... [1]

8



(a) On the grid, draw the image of

(i) triangle A after a reflection in the y -axis, [1]

(ii) triangle A after a translation by the vector $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$. [2]

(b) Describe fully the **single** transformation that maps triangle A onto triangle B .

..... [3]

9 Factorise completely.

$$12a^3 - 21a$$

..... [2]

- 10 (a) The n th term of a sequence is $n^2 + 7$.

Find the first three terms of this sequence.

....., ..., ... [2]

- (b) These are the first four terms of a different sequence.

15 7 - 1 -9

Find the n th term of this sequence.

..... [2]

- 11 As the temperature increases, people eat more ice cream.

What type of correlation does this statement describe?

..... [1]

- 12 (a) Sanjay invests \$700 in an account paying simple interest at a rate of 2.5% per year.

Calculate the value of his investment at the end of 6 years.

\$ [3]

- (b) Meera invests \$700 in an account paying compound interest at a rate of $r\%$ per year.
At the end of 17 years the value of her investment is \$1030.35 .

Find the value of r .

$r =$ [3]

13 (a) Simplify $h^2 \times h^5$.

..... [1]

(b) Simplify $\left(\frac{7}{x}\right)^{-3}$.

..... [1]

(c) $a^8 \div a^p = a^2$

Find the value of p .

$p =$ [1]

14 Calculate the circumference of a circle with radius 4.7 cm.

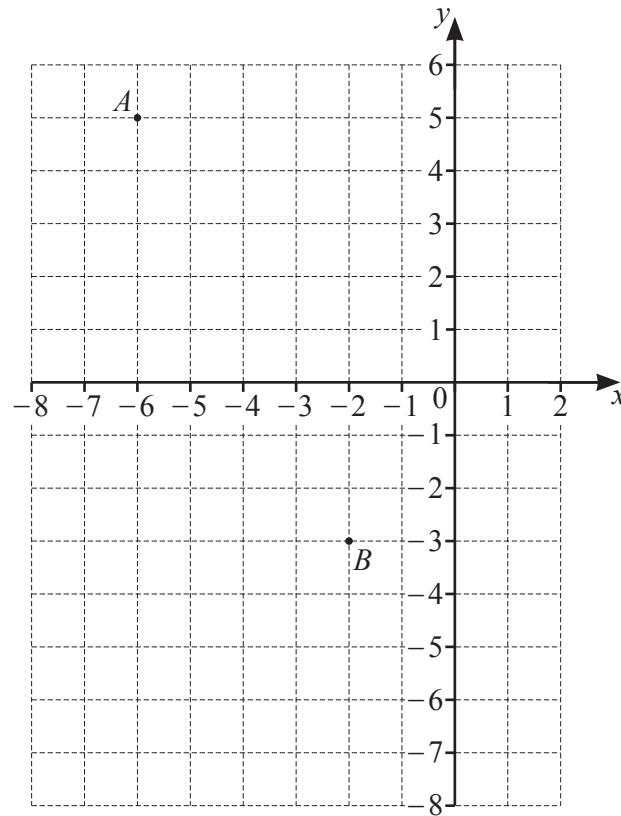
..... cm [2]

15 **Without using a calculator**, work out $2\frac{1}{3} \times \frac{11}{14}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

16



A is the point $(-6, 5)$ and B is the point $(-2, -3)$.

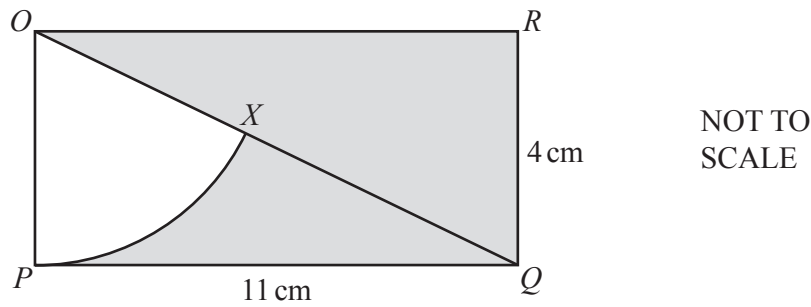
- (a) Find the equation of the straight line, l , that passes through point A and point B .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [2]

- (b) Find the equation of the line that is perpendicular to l and passes through the origin.

$\dots\dots\dots$ [2]

17



The diagram shows a rectangle $OPQR$ with length 11 cm and width 4 cm.
 OQ is a diagonal and OPX is a sector of a circle, centre O .

Calculate the percentage of the rectangle that is shaded.

..... % [5]

- 18** Mrs Kohli buys a jacket, 2 shirts and a hat.

The jacket costs \$ x .

The shirts each cost \$24 less than the jacket and the hat costs \$16 less than the jacket.

Mrs Kohli spends exactly \$100.

Write down an equation in terms of x .

Solve this equation to find the cost of the jacket.

\$ [3]

- 19 y is inversely proportional to the square root of $(x+4)$.
When $x = 5$, $y = 2$.

Find y when $x = 77$.

$$y = \dots\dots\dots [3]$$

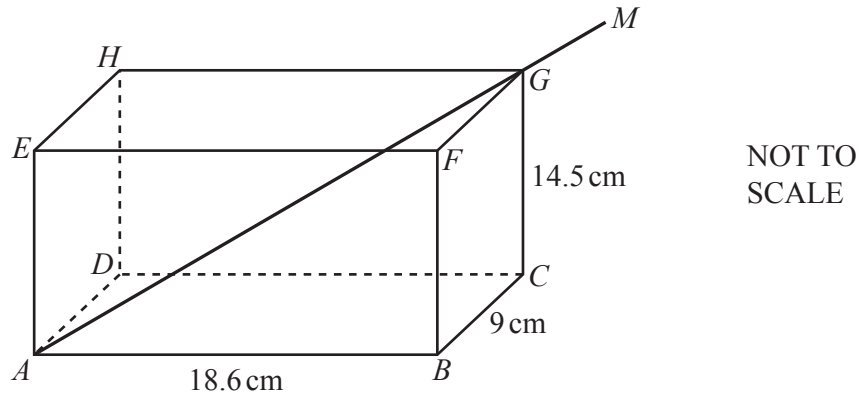
- 20 Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned} 3x + y &= 11 \\ x^2 - 2y &= 18 \end{aligned}$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [5]$$

21



The diagram shows an open rectangular box $ABCDEFGH$.

$AB = 18.6$ cm, $BC = 9$ cm and $CG = 14.5$ cm.

A straight stick AGM rests against A and G and extends outside the box to M .

(a) Calculate the angle between the stick and the base of the box.

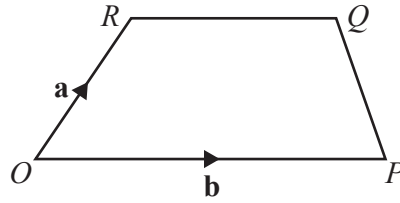
..... [4]

(b) $AM = 30$ cm.

Show that $GM = 4.8$ cm, correct to 1 decimal place.

[3]

22

NOT TO
SCALE

The diagram shows a trapezium $OPQR$.

O is the origin, $\overrightarrow{OR} = \mathbf{a}$ and $\overrightarrow{OP} = \mathbf{b}$.

$$|\overrightarrow{RQ}| = \frac{3}{5} |\overrightarrow{OP}|$$

(a) Find $\overrightarrow{PQ}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ in its simplest form.

$$\overrightarrow{PQ} = \dots\dots\dots [2]$$

(b) When PQ and OR are extended, they intersect at W .

Find the position vector of W .

$$\dots\dots\dots [2]$$

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

February/March 2022

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the February/March 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	40°	1	
2	80.50 cao	2	B1 for 80.498... or 80.5 or correctly rounding their more accurate decimal to 2 dp
3	7 [h] 18 [min]	1	
4	166	3	M2 for $[2 \times] (7 \times 4 + 4 \times 5 + 5 \times 7)$ or M1 for 7×4 or 4×5 or 5×7
5(a)	5	1	
5(b)	(0, 7)	1	
6	correct triangle with arcs	2	B1 for correct triangle with incorrect or no arcs or for two correct arcs. or a triangle with arcs but one side not in range
7	$n > -1$ oe	1	
8(a)(i)	triangle at $(-1, 1)$ $(-4, 2)$ $(-3, 5)$	1	
8(a)(ii)	triangle at $(-2, -3)$ $(1, -2)$ $(0, 1)$	2	B1 for translation by $\begin{pmatrix} -3 \\ k \end{pmatrix}$ or by $\begin{pmatrix} k \\ -4 \end{pmatrix}$
8(b)	enlargement [sf] $\frac{1}{2}$ [centre] $(9, -1)$	3	B1 for each
9	$3a(4a^2 - 7)$ final answer	2	B1 for $3(4a^3 - 7a)$ or $a(12a^2 - 21)$ or for $3a(4a^2 - 7)$ seen then spoilt
10(a)	8 11 16	2	B1 for two correct
10(b)	$23 - 8n$ oe final answer	2	B1 for $j - 8n$ or $23 - kn$ $k \neq 0$ or $23 - 8n$ seen then spoilt
11	Positive	1	

Question	Answer	Marks	Partial Marks
12(a)	805	3	B2 for 105 or M2 for $\frac{700 \times 2.5 \times 6}{100} + 700$ oe or M1 for $\frac{700 \times 2.5 [\times 6]}{100}$ oe
12(b)	2.3[0...]	3	M2 for $\sqrt[17]{\frac{1030.35}{700}}$ oe or M1 for $1030.35 = 700(k)^{17}$ oe for any k
13(a)	h^7 final answer	1	
13(b)	$\frac{x^3}{343}$ final answer	1	
13(c)	6	1	
14	29.5 or 29.53...	2	M1 for $2 \times \pi \times 4.7$ oe
15	$\frac{7}{3}$ oe improper fraction	M1	or $\frac{k}{3} \times \frac{11}{14}$ where $k > 3$
	$1\frac{5}{6}$ cao	A2	A1 for $\frac{77}{42}$ or $\frac{11}{6}$ or $1\frac{35}{42}$
16(a)	$[y =] -2x - 7$ final answer	2	B1 for $-2x + c$ or $kx - 7$, $k \neq 0$ final answer
16(b)	$y = \frac{1}{2}x[\pm 0]$ final answer	2	FT $-\frac{1}{\text{their gradient in (a)}}$ B1 for $y = kx[\pm 0]$ oe, $k \neq 0$ or $y = \text{their} \frac{1}{2}x + c$ oe for any c or $\text{their} \frac{1}{2}x [\pm 0]$ oe

Question	Answer	Marks	Partial Marks
17	77.8 or 77.77 to 77.80	5	B4 for answer 22.2[%] or 22.20[%] to 22.23[%] OR M1 for $\tan^{-1} \frac{11}{4}$ oe or $\tan^{-1} \frac{4}{11}$ oe M2 for $4 \times 11 - \frac{\text{their acute angle}}{360} \times \pi \times 4^2$ oe or M1 for $\frac{\text{their acute angle}}{360} \pi \times 4^2$ oe M1 for $\frac{\text{their shaded area}}{4 \times 11} [\times 100]$ oe or $\frac{\text{their sector area}}{4 \times 11} \times 100$ oe
18	A correct equation leading to 41	3	M2 for $4x = 164$ or M1 for $x + 2(x - 24) + x - 16 = 100$ oe or M1 for correctly simplifying <i>their</i> equation to the form $kx = c$ provided at least one part correct from $[2](x - 24)$ oe or $x - 16$ or B1 for answer 41 without an equation in x shown
19	$\frac{2}{3}$ oe	3	M1 for $y = \frac{k}{\sqrt{x+4}}$ M1 for $y = \frac{\text{their } k}{\sqrt{77+4}}$

Question	Answer	Marks	Partial Marks
20	$x^2 + 6x - 40 [=0]$ or $y^2 - 40y - 41 [=0]$	M2	M1 for correct method to eliminate one variable e.g. $x^2 - 2(11 - 3x) = 18$ or $\frac{(11 - y)^2}{3^2} - 2y = 18$
	$(x - 4)(x + 10) [=0]$ or $(y - 41)(y + 1) [=0]$	M1	or for correct factors for <i>their</i> quadratic equation or for correct use of quadratic formula for <i>their</i> quadratic equation or for correctly completing the square for <i>their</i> quadratic equation
	$x = 4, y = -1$ $x = -10, y = 41$	B2	B1 for $x = 4, x = -10$ or for $y = -1, y = 41$ or for a correct pair of x and y values If B0 scored and at least 1 method mark scored SC1 for correct substitution shown of both of <i>their</i> x values or <i>their</i> y values into $3x + y = 11$ or $x^2 - 2y = 18$
21(a)	35.1 or 35.05 to 35.06	4	M3 for $\tan = \frac{14.5}{\sqrt{18.6^2 + 9^2}}$ oe or M2 for $[AC^2 =] 18.6^2 + 9^2$ oe or better or $[AG^2 =] 18.6^2 + 9^2 + 14.5^2$ or M1 for recognising the angle GAC

Question	Answer	Marks	Partial Marks
21(b)	$30 - \sqrt{18.6^2 + 9^2 + 14.5^2}$ $30 - \frac{14.5}{\sin(\text{their}(\mathbf{a}))}$ or $30 - \frac{\sqrt{18.6^2 + 9^2}}{\cos(\text{their}(\mathbf{a}))}$	M2	M1 for $AG^2 = 18.6^2 + 9^2 + 14.5^2$ oe or better or $\sin(\text{their}(\mathbf{a})) = \frac{14.5}{AG}$ or $\cos(\text{their}(\mathbf{a})) = \frac{\sqrt{18.6^2 + 9^2}}{AG}$
	4.75 to 4.78...	A1	
22(a)	$a - \frac{2}{5}b$ oe simplified	2	M1 for $-b + a + \frac{3}{5}b$ or a correct route
22(b)	$\frac{5}{2}a$ oe	2	B1 for ka where $k > 1$ or $\frac{5}{2}\overline{OR}$



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MATHEMATICS**0580/42**

Paper 4 (Extended)

February/March 2022**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 A company employed 300 workers when it started and now employs 852 workers.

(a) Calculate the percentage increase in the number of workers.

..... % [2]

(b) Of the 852 workers, the ratio part-time workers : full-time workers = 5 : 7.

Calculate the number of full-time workers.

..... [2]

(c) The company makes 40 600 headphones in one year.

Write this number

(i) in words,

..... [1]

(ii) in standard form.

..... [1]

(d) In one month, the company sells 3 000 headphones.

Of these, 48% are exported, $\frac{3}{8}$ are sold to shops and the rest are sold online.

Calculate the number of headphones that are sold online.

..... [3]

3

- (e) One year, sales increased by 15%.
The following year sales increased by 18%.

Calculate the overall percentage increase in sales.

..... % [3]

- 2 The table shows some values for $y = x^2 - \frac{1}{3x}$, $x \neq 0$.
The y -values are rounded to 1 decimal place.

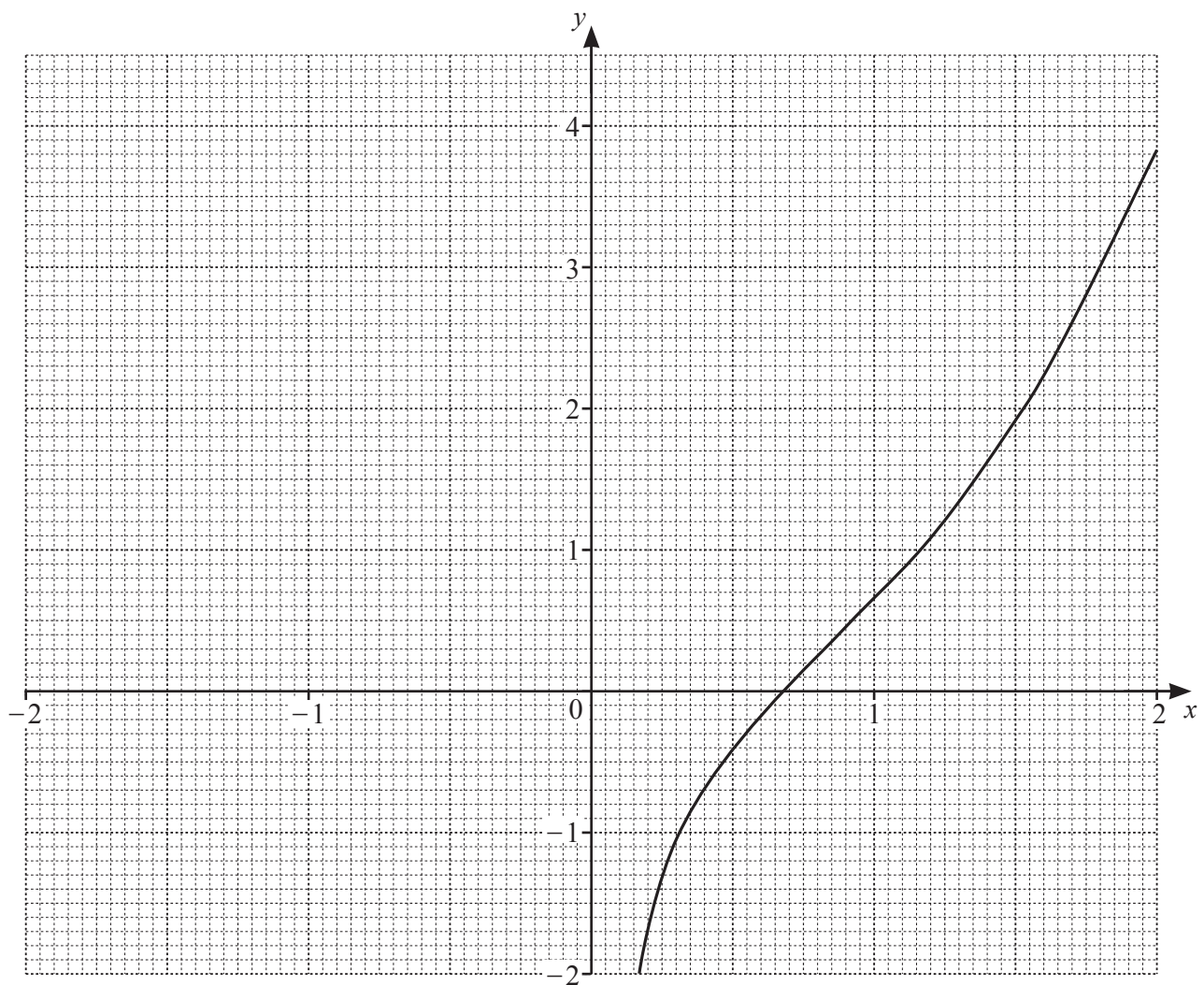
x	-2	-1.5	-1	-0.75	-0.5	-0.25	-0.1
y	4.2	2.5	1.3			1.4	3.3

(a) Complete the table.

[2]

(b) On the grid, draw the graph of $y = x^2 - \frac{1}{3x}$ for $-2 \leq x \leq -0.1$.

The graph of $y = x^2 - \frac{1}{3x}$ for $x > 0$ has been drawn for you.



[4]

(c) By drawing a suitable line on the grid, solve the equation $x^2 - \frac{1}{3x} + 1 = 0$.

$x =$ [2]

5

3

$$f(x) = 1 + 4x$$

$$g(x) = x^2$$

(a) Find

(i) $gf(3)$,

..... [2]

(ii) $fg(x)$,

..... [1]

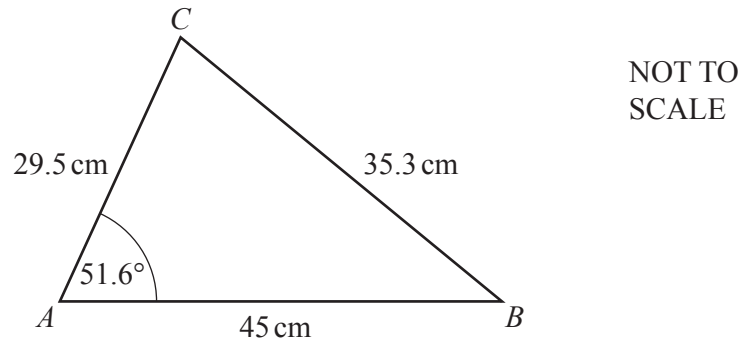
(iii) $f^{-1}f(x)$.

..... [1]

(b) Find the value of x when $f(x) = 15$.

$x =$ [2]

4 (a)



In triangle ABC , $AB = 45$ cm, $AC = 29.5$ cm, $BC = 35.3$ cm and angle $CAB = 51.6^\circ$.

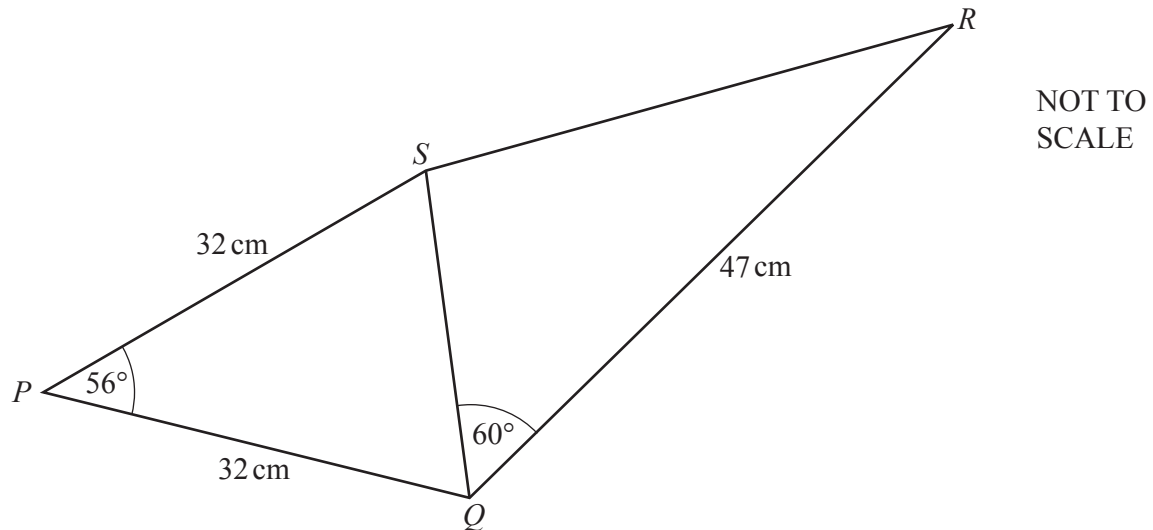
(i) Calculate angle ABC .

Angle $ABC = \dots\dots\dots$ [3]

(ii) Calculate the area of triangle ABC .

$\dots\dots\dots$ cm^2 [2]

(b)

NOT TO
SCALE

The diagram shows a quadrilateral $PQRS$ formed from two triangles, PQS and QRS . Triangle PQS is isosceles, with $PQ = PS = 32$ cm and angle $SPQ = 56^\circ$. $QR = 47$ cm and angle $SQR = 60^\circ$.

(i) Calculate SR .

$SR = \dots\dots\dots$ cm [4]

(ii) Calculate the shortest distance from P to SQ .

$\dots\dots\dots$ cm [3]

- 5 The table shows information about the mass, m grams, of each of 120 letters.

Mass (m grams)	$0 < m \leq 50$	$50 < m \leq 100$	$100 < m \leq 200$	$200 < m \leq 500$
Frequency	43	31	25	21

- (a) Calculate an estimate of the mean mass.

..... g [4]

- (b) Iraj draws a histogram to show this information.
He makes the height of the first bar 17.2 cm.

Calculate the height of each of the remaining bars.

height of bar for $50 < m \leq 100$ cm

height of bar for $100 < m \leq 200$ cm

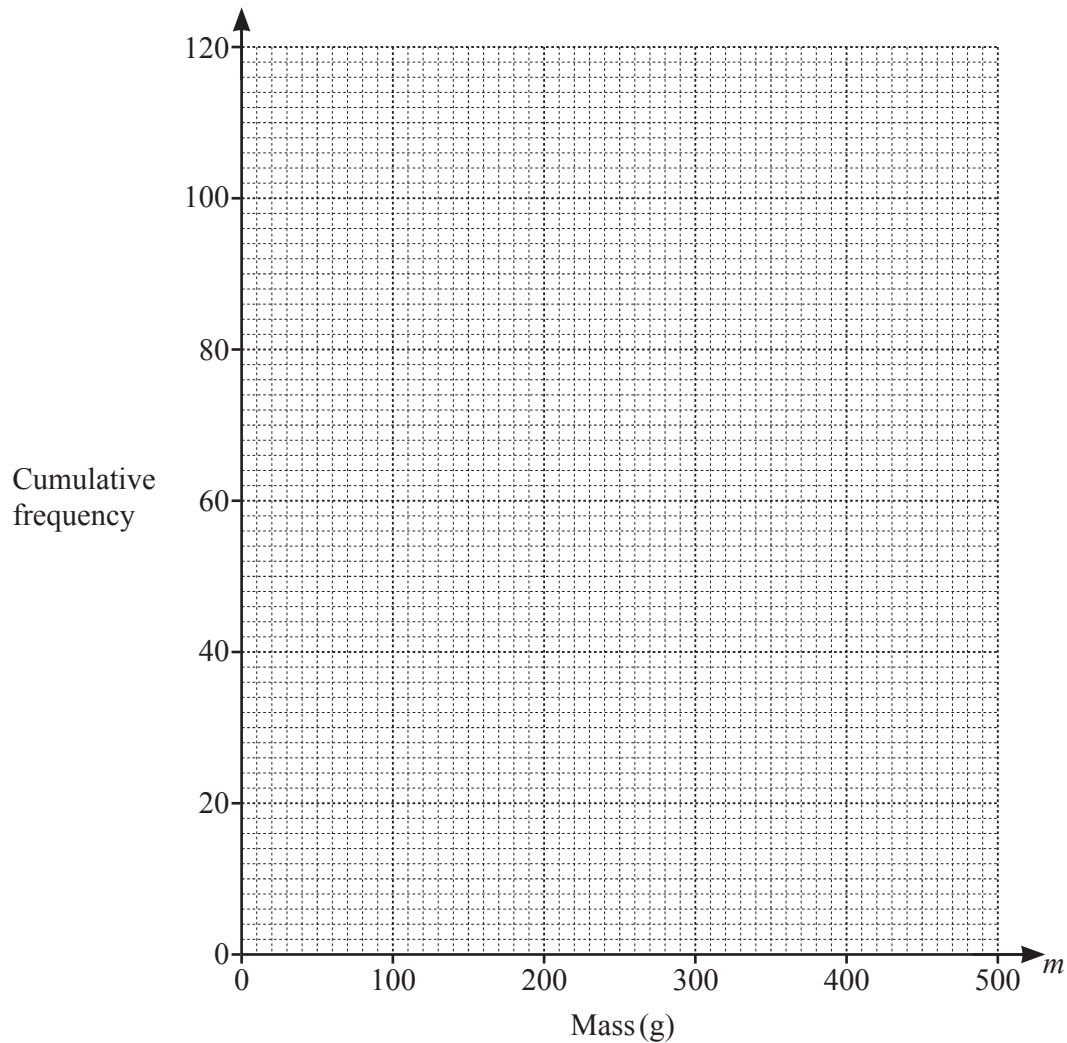
height of bar for $200 < m \leq 500$ cm [3]

- (c) Complete the cumulative frequency table.

Mass (m grams)	$m \leq 50$	$m \leq 100$	$m \leq 200$	$m \leq 500$
Cumulative frequency				

[2]

(d) Draw a cumulative frequency diagram.



[3]

(e) Use the cumulative frequency diagram to find an estimate for

(i) the median,

..... g [1]

(ii) the upper quartile,

..... g [1]

(iii) the 40th percentile,

..... g [2]

(iv) the number of letters with a mass m where $250 < m \leq 400$.

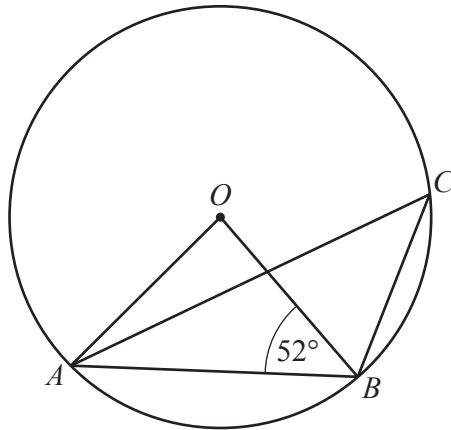
..... [2]

- 6 (a) The interior angle of a regular polygon is 156° .

Calculate the number of sides of this polygon.

..... [2]

(b)



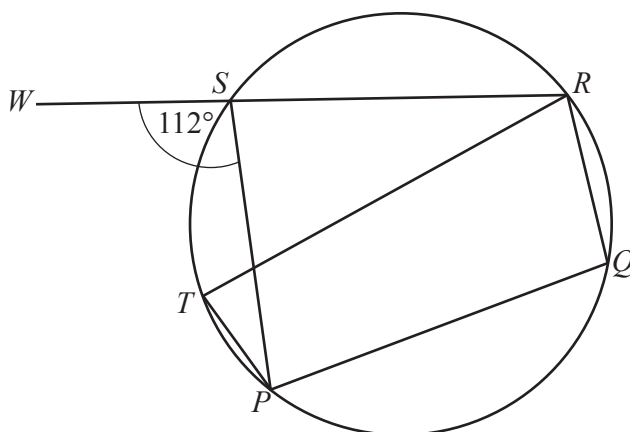
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SCALE

A , B and C lie on a circle, centre O .
Angle $OBA = 52^\circ$.

Calculate angle ACB .

Angle $ACB =$ [2]

(c)



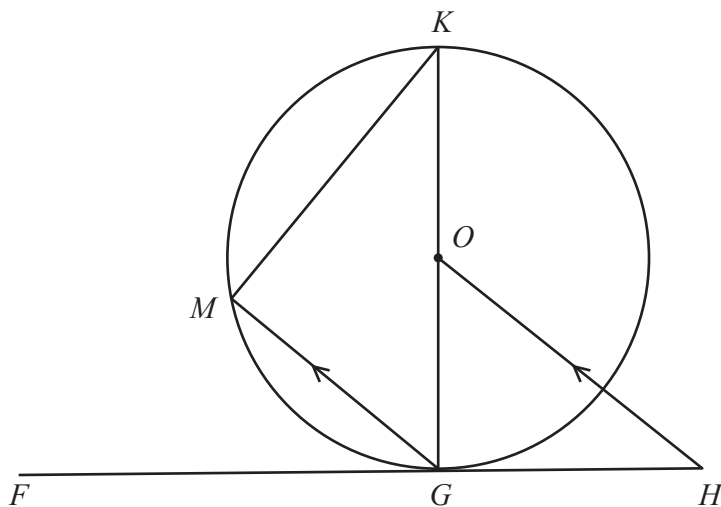
NOT TO
SCALE

P, Q, R, S and T lie on a circle.
 WSR is a straight line and angle $WSP = 112^\circ$.

Calculate angle PTR .

Angle $PTR = \dots\dots\dots [2]$

(d)



NOT TO
SCALE

G, K and M lie on a circle, centre O .
 FGH is a tangent to the circle at G and MG is parallel to OH .

Show that triangle GKM is mathematically similar to triangle OHG .
Give a geometrical reason for each statement you make.

.....

.....

.....

.....

.....

.....

[4]

7 Two rectangular picture frames are mathematically similar.

- (a) The areas of the frames are 350 cm^2 and 1134 cm^2 .
The width of the smaller frame is 17.5 cm.

Calculate the width of the larger frame.

..... cm [3]

- (b) A picture in the smaller frame has length 15 cm and width 10.5 cm, both correct to the nearest 5 mm.

Calculate the upper bound for the area of this picture.

..... cm^2 [2]

- (c) In a sale, the price of a large frame is reduced by 18%.
Parthi pays \$166.05 for 5 large frames in the sale.

Calculate the original price of one large frame.

\$ [2]

- (d) Parthi advertises a large frame for a price of \$57 or 48.20 euros.
The exchange rate is \$1 = 0.88 euros.

Calculate the difference between these prices, in dollars and cents, correct to the nearest cent.

\$ [3]

- 8 Darpan runs a distance of 12 km and then cycles a distance of 26 km. His running speed is x km/h and his cycling speed is 10 km/h faster than his running speed. He takes a total time of 2 hours 48 minutes.

- (a) An expression for the time, in hours, Darpan takes to run the 12 km is $\frac{12}{x}$.

Write an equation, in terms of x , for the total time he takes in hours.

..... [3]

- (b) Show that this equation simplifies to $7x^2 - 25x - 300 = 0$.

[4]

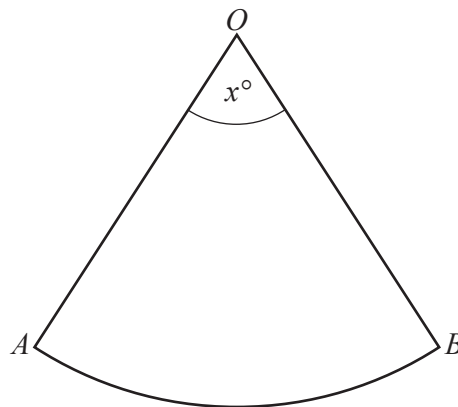
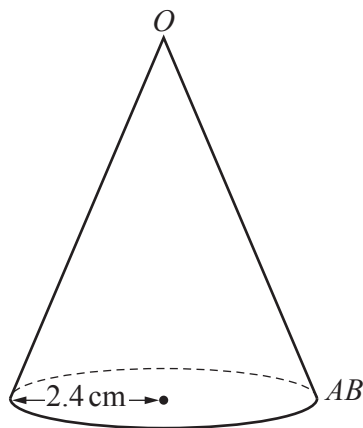
- (c) Use the quadratic formula to solve $7x^2 - 25x - 300 = 0$.
You must show all your working.

$x =$ or $x =$ [4]

- (d) Calculate the number of minutes Darpan takes to run the 12 km.

..... min [2]

9 (a)

NOT TO
SCALE

The volume of a paper cone of radius 2.4 cm is 95.4 cm^3 .

The paper is cut along the slant height from O to AB .

The cone is opened to form a sector OAB of a circle with centre O .

Calculate the sector angle x° .

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... [6]

- (b) An empty fuel tank is filled using a cylindrical pipe with diameter 8 cm.
Fuel flows along this pipe at a rate of 2 metres per second.
It takes 24 minutes to fill the tank.

Calculate the capacity of the tank.

Give your answer in litres.

..... litres [4]

10 (a) Expand and simplify.

$$(x+1)(x-2)(x+3)$$

..... [3]

(b) Make g the subject of the formula.

$$M = \frac{2fg}{g-c}$$

$g =$ [4]

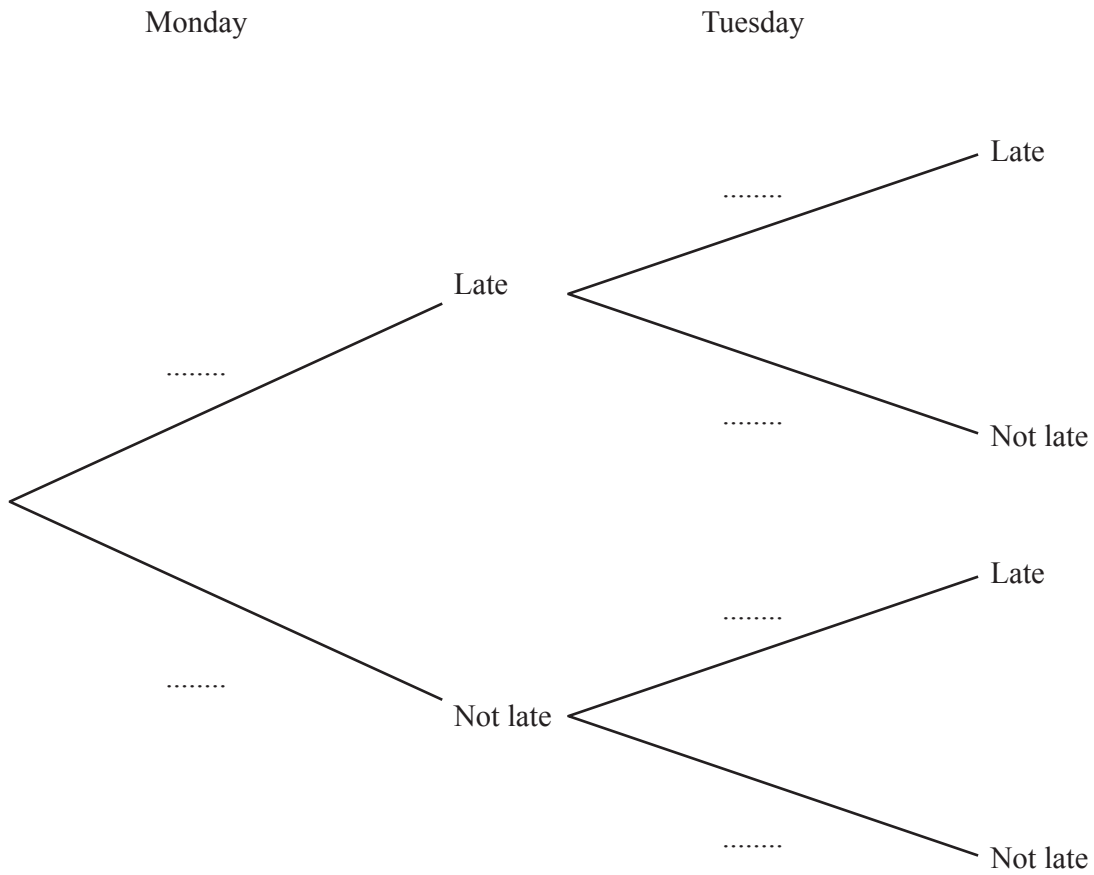
(c) Simplify.

$$\frac{4x^2 - 16x}{x^2 - 16}$$

..... [3]

11 (a) The probability that Shalini is late for school on any day is $\frac{1}{6}$.

(i) Complete the tree diagram for Monday and Tuesday.

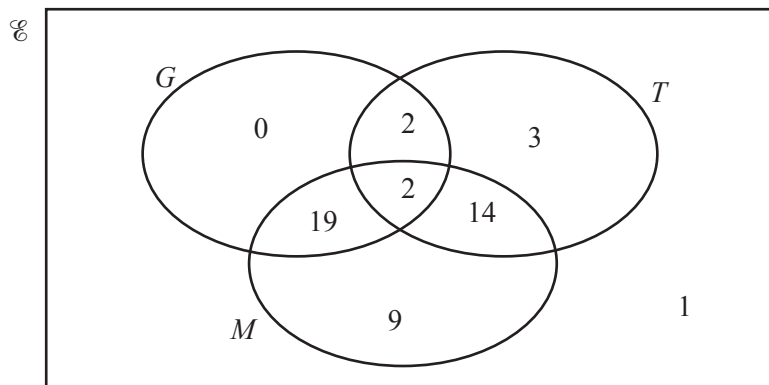


[2]

(ii) Calculate the probability that Shalini is late on Monday but is not late on Tuesday.

..... [2]

- (b) The Venn diagram shows the number of students in a group of 50 students who wear glasses (G), who wear trainers (T) and who have a mobile phone (M).



- (i) Use set notation to describe the region that contains only one student.

- (ii) Find $n(T' \cap (G \cup M))$ [1]

..... [1]

- (iii) One student is picked at random from the 50 students.

Find the probability that this student wears trainers but does not wear glasses.

..... [1]

- (iv) Two students are picked at random from those wearing trainers.

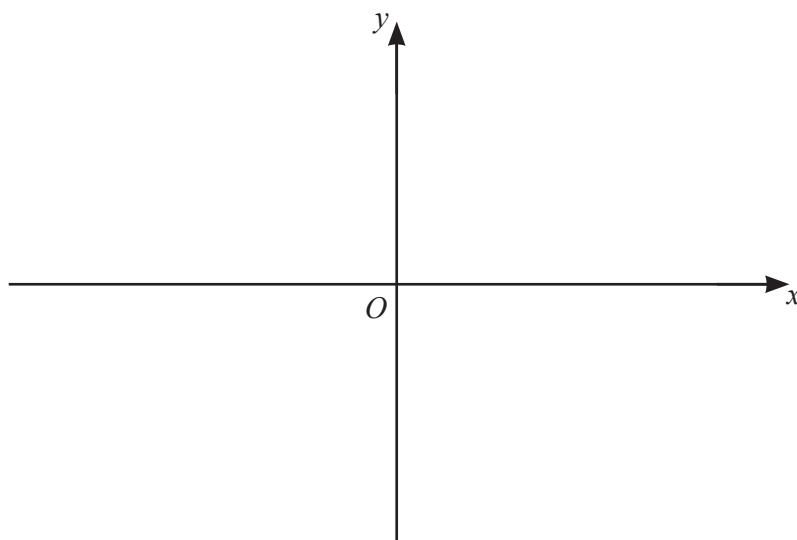
Find the probability that both students have mobile phones.

..... [3]

12 (a) Solve the equation $\tan x = 11.43$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

(b) Sketch the curve $y = x^3 - 4x$.



[3]

- (c) A curve has equation $y = x^3 + ax + b$.
The stationary points of the curve have coordinates $(2, k)$ and $(-2, 10 - k)$.

Work out the value of a , the value of b and the value of k .

$a = \dots\dots\dots$, $b = \dots\dots\dots$, $k = \dots\dots\dots$ [6]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

February/March 2022

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the February/March 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

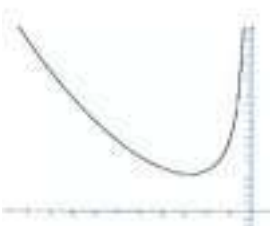
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	184	2	M1 for $\frac{852-300}{300}[\times 100]$ oe or for $\frac{852}{300}\times 100[-100]$ oe
1(b)	497	2	M1 for $\frac{852}{5+7}\times k$ oe where $k = 1, 5$ or 7
1(c)(i)	Forty thousand six hundred	1	
1(c)(ii)	4.06×10^4	1	
1(d)	435	3	M2 for $3000\times\left(1-\frac{48}{100}-\frac{3}{8}\right)$ oe or B2 for 2565, or 1440 and 1125 or 1875 and 1440 or 1560 and 1125 or M1 for $1-\frac{48}{100}-\frac{3}{8}$ or $3000\times\left(\frac{48}{100}+\frac{3}{8}\right)$ oe or B1 for 1440 or 1125 or 1560 or 1875 If 0 scored SC1 for answer 975
1(e)	35.7	3	M2 for $\frac{100+15}{100}\times\frac{100+18}{100}[-1]$ oe or better or M1 for $k\times\frac{100+15}{100}\times\frac{100+18}{100}$ oe
2(a)	1[.0] 0.9	2	B1 for each
2(b)	correct curve 	4	B3 FT for 6 or 7 points B2 FT for 4 or 5 points B1 FT for 2 or 3 points

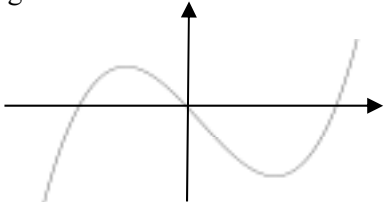
Question	Answer	Marks	Partial Marks
2(c)	ruled line at $y = -1$	B1	
	0.3 to 0.32	B1	
3(a)(i)	169	2	M1 for $g(13)$ or $(1+4x)^2$ or better
3(a)(ii)	$1+4x^2$ final answer	1	
3(a)(iii)	x	1	
3(b)	3.5 or $\frac{7}{2}$	2	M1 for $1+4x=15$
4(a)(i)	40.9 or 40.91...	3	M2 for $[\sin ABC = \frac{29.5 \sin 51.6}{35.3}]$ oe or for $[\cos ABC = \frac{35.3^2 + 45^2 - 29.5^2}{2 \times 35.3 \times 45}]$ or M1 for $\frac{29.5}{\sin ABC} = \frac{35.3}{\sin 51.6}$ oe or for correct implicit cosine rule
4(a)(ii)	520 or 520.0 to 520.2...	2	FT <i>their</i> (a)(i) if used provided working shown M1 for $0.5 \times 29.5 \times 45 \times \sin 51.6$ oe or for $0.5 \times 35.3 \times 45 \times \sin(\text{their(a)(i)})$ or for $0.5 \times 35.3 \times 29.5 \sin(180 - 51.6 - \text{their(a)(i)})$
4(b)(i)	41.2 or 41.21 to 41.23	4	M1 for $SQ = 2 \times 32 \times \sin\left(\frac{1}{2} \times 56\right)$ oe or $\sqrt{32^2 + 32^2 - 2 \times 32 \times 32 \times \cos 56}$ oe or $\frac{32 \sin 56}{\sin((180 - 56) \div 2)}$ oe M2 for $SR^2 = 47^2 + (\text{their } SQ^2) - 2 \times 47 \times \text{their } SQ \times \cos 60$ or M1 for implicit form
4(b)(ii)	28.3 or 28.25 to 28.29...	3	M2 for $32 \times \sin 62$ oe or M1 for recognition that line from P is perpendicular to SQ
5(a)	121 or 120.8... or $120 \frac{5}{6}$	4	M1 for midpoints soi M1 for use of $\sum fx$ with x in correct interval including both boundaries but not if x is 50, 50, 100 and 300 M1 (dep on 2nd M1) for $\sum fx \div 120$

Question	Answer	Marks	Partial Marks
5(b)	12.4 5 1.4	3	B1 for each If 0 scored SC1 for fd's [0.86,] 0.62, 0.25 and 0.07 oe
5(c)	43 74 99 120	2	B1 for 2 or 3 correct
5(d)	Correct diagram	3	B1 for correct horizontal placement for 4 plots B1FT for correct vertical placement for 4 plots B1FT dep on at least B1 for reasonable increasing curve or polygon through <i>their</i> 4 points If 0 scored SC1 FT for 3 out of 4 points correctly plotted
5(e)(i)	Strict FT <i>their</i> median reading	1	
5(e)(ii)	Strict FT <i>their</i> UQ reading	1	
5(e)(iii)	Strict FT <i>their</i> reading at 40th percentile	2	B1 for 48 written or mark at cf = 48 on graph
5(e)(iv)	Strict FT <i>their</i> reading at 400 – <i>their</i> reading at 250	2	B1 for either correct reading at 250 or 400
6(a)	15	2	M1 for $\frac{360}{180-156}$ or for $\frac{180(n-2)}{n} = 156$ oe
6(b)	38	2	B1 for $AOB = 76$
6(c)	68	2	B1 for $RSP = 68$ or $RQP = 112$

Question	Answer	Marks	Partial Marks
6(d)	Two pairs of equal angles identified with fully correct reasons	M3	M2 for one pair of equal angles identified with fully correct reasons $KMG = 90$ angle in semicircle and $OGH = 90$ angle between tangent and radius OR $KMG = OGH$ alternate segment OR $GOH = MGK$ alternate angles OR Angle $FGM =$ angle GHO corresponding and angle $FGM = GKM$ alternate segment and angle $H =$ angle K or M1 for $KMG = 90$, angle in semicircle or $OGH = 90$, angle between tangent and radius
	Two or three pairs of angles equal [so similar] oe	A1	Dep on M3 with no incorrect work seen
7(a)	31.5	3	M2 for $17.5 \times \sqrt{\frac{1134}{350}}$ oe or M1 for $\sqrt{\frac{1134}{350}}$ oe isw or $\sqrt{\frac{350}{1134}}$ oe isw or for $\frac{1134}{350} = \left(\frac{x}{17.5}\right)^2$ oe
7(b)	163.9375 or $163\frac{15}{16}$ final answer	2	B1 for $15 + 0.25$ or $10.5 + 0.25$ or better seen
7(c)	40.5[0]	2	M1 for $x \times \left(1 - \frac{18}{100}\right) = \frac{166.05}{[5]}$ oe
7(d)	\$2.23 final answer	3	B2 for 2.227... or 2.23 seen OR M2 for $57 - \frac{48.2}{0.88}$ oe or M1 for $\frac{48.2}{0.88}$ oe If 0 scored SC1 for 57×0.88 oe seen

Question	Answer	Marks	Partial Marks
8(a)	$\frac{12}{x} + \frac{26}{x+10} = 2.8$ oe isw	3	B2 for $\frac{12}{x} + \frac{26}{x+10}$ oe isw OR B1 for $\frac{26}{x+10}$ seen B1 for time = 2.8 or $\frac{168}{60}$ or $2\frac{48}{60}$ oe
8(b)	$12(x+10) + 26x = 2.8x(x+10)$ or better	M2	FT <i>their</i> time, provided 2 algebraic fractions one in x and other in $\pm x \pm 10$ M1 for $12(x+10) + 26x$ seen or better
	$12x + 120 + 26x = 2.8x^2 + 28x$	M1	FT <i>their</i> equation dep on M2
	$2.8x^2 - 10x - 120 = 0$ oe or $30x + 300 + 65x = 7x^2 + 70x$ or better leading to $7x^2 - 25x - 300 = 0$	A1	with no errors or omissions
8(c)	$\frac{[-]25 \pm \sqrt{([-]25)^2 - 4 \times 7 \times -300}}{2 \times 7}$ oe	B2	B1 for $\sqrt{([-]25)^2 - 4(7)(-300)}$ or better or for $\frac{[-]25 + \sqrt{q}}{2 \times 7}$ or $\frac{[-]25 - \sqrt{q}}{2 \times 7}$
	- 5 and 8.57 or 8.571...	B2	B1 for each or SC1 for final answers 5 and -8.57
8(d)	84 to 84.01...	2	FT $\frac{720}{\text{their positive answer}}$ to 3 sf or better M1 for $\frac{12}{\text{their positive answer}} [\times 60]$ oe
9(a)	54[.0] or 53.99 to 54.03...	6	M2 for $[h =] 95.4 \times 3 \div (\pi \times 2.4^2)$ oe or M1 for $95.4 = \frac{1}{3} \times \pi \times 2.4^2 \times h$ M2 for [slant ht, $l =] \sqrt{(\text{their } h)^2 + 2.4^2}$ or M1 for $(\text{their } h)^2 + 2.4^2$ M1 for $\frac{x}{360} \times 2 \times \pi \times \text{their } l = 2 \times \pi \times 2.4$ oe or $\frac{x}{360} \times \pi \times (\text{their } l)^2 = \pi \times 2.4 \times \text{their } l$

Question	Answer	Marks	Partial Marks
9(b)	14500 or 14470 to 14480	4	M3 for $200 \times 60 \times 24 \times \pi \times 4^2 [\div 1000]$ or $2 \times 60 \times 24 \times \pi \times 0.04^2 [\times 1000]$ or M2 for $200 \times \pi \times 4^2$ or for $2 \times \pi \times 0.04^2$ or M1 for $\pi \times 4^2$ oe or $\pi \times 0.04^2$ seen oe isw or $1000 \text{ cm}^3 = 1 \text{ litre}$ soi or $1 \text{ m}^3 = 1000 \text{ litres}$ soi or for 24×60 seen oe
10(a)	$x^3 + 2x^2 - 5x - 6$ final answer	3	B2 for correct expansion of three brackets unsimplified or for simplified expression of correct form with 3 out of 4 terms correct or B1 for correct expansion of 2 of the 3 given brackets with at least 3 terms out of four correct
10(b)	$\frac{Mc}{M-2f}$ or $\frac{-Mc}{2f-M}$ final answer	4	M1 for clearing $g - c$ from denominator e.g. $M(g - c) = 2fg$ M1 for correctly isolating terms in g in numerator on one side M1 for correctly factorising or simplifying, to single term in g in an equation M1 for correctly dividing by bracket to final answer
10(c)	$\frac{4x}{x+4}$ final answer	3	B1 for $4x(x - 4)$ B1 for $(x + 4)(x - 4)$
11(a)(i)	$\frac{1}{6}$ oe on all late branches $\frac{5}{6}$ oe on all not late branches	2	B1 for one correct vertical pair $\frac{1}{6}$ oe and $\frac{5}{6}$ oe
11(a)(ii)	$\frac{5}{36}$ oe	2	FT <i>their</i> tree M1 for <i>their</i> $\frac{1}{6} \times \text{their } \frac{5}{6}$
11(b)(i)	$(G \cup T \cup M)'$ oe	1	
11(b)(ii)	28	1	
11(b)(iii)	$\frac{17}{50}$ oe	1	

Question	Answer	Marks	Partial Marks
11(b)(iv)	$\frac{4}{7}$ oe	3	M2 for $\frac{16}{21} \times \frac{15}{20}$ or M1 for $\frac{n}{21} \times \frac{n-1}{20}$ or for $\frac{16}{21}$ and $\frac{15}{20}$ seen If 0 scored SC1 for answer $\frac{256}{441}$ oe
12(a)	85[.0], 265[.0] and no others	2	B1 for each If 0 scored SC1 for two values in the range with a difference of 180 but not multiples of 90
12(b)	correct shape and passes through origin 	3	B1 for any positive cubic shape B1 for sketch with one max and one min and with 3 roots including zero If 0 scored, SC1 for $x(x+2)(x-2)$ soi
12(c)	$a = -12$ $b = 5$ $k = -11$	6	B5 for 2 correct OR B2 for $3x^2 + a$ or B1 for $3x^2$ isw M1dep on at least B1 for <i>their</i> $\frac{dy}{dx} = 0$ M1dep on at least B1M1 for $x = 2$ or $x = -2$ substituted in <i>their</i> $\frac{dy}{dx} = 0$ equation M1 for $k = 2^3 + 2 \times \text{their } a + b$ and $10 - k = (-2)^3 + (-2) \times \text{their } a + b$



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MATHEMATICS**0580/21**

Paper 2 (Extended)

October/November 2021**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 P is a prime number where $60 < P < 80$.
 P is 2 less than a square number.

Find the value of P .

$P = \dots\dots\dots$ [2]

- 2 Hank flies from Los Angeles to Shanghai.

- (a) The flight departs on Friday 22 July at 21 40.
 The flight takes 13 hours 35 minutes.
 The local time in Shanghai is 15 hours ahead of the local time in Los Angeles.

Find the day, date and time in Shanghai when Hank's flight arrives.

Day $\dots\dots\dots$, Date $\dots\dots\dots$, Time $\dots\dots\dots$ [3]

- (b) The cost of the flight is \$920.
 The exchange rate is \$1 = 6.87 Chinese yuan.

Find the cost of the flight in yuan.

$\dots\dots\dots$ yuan [1]

- 3 Calculate.

$$\frac{4.87 - 2.7}{-0.2 + \sqrt[3]{0.729}}$$

$\dots\dots\dots$ [1]

3

- 4 The number of items that each of 22 people buy in a supermarket is shown in the stem-and-leaf diagram.

1	1	3	6	6			
2	0	2	2	2	4	8	9
3	1	1	5	8	9	9	
4	2	4	6	7	8		

Key: 1 | 1 represents 11 items

- (a) Find the mode.

..... [1]

- (b) Find the median.

..... [1]

- 5 The table shows the relative frequency of the games won by a football team.

Result of game	won	lost	drawn
Relative frequency	0.1		

The number of games lost is twice the number of games drawn.

Complete the table.

[3]

- 6 The scale drawing shows the positions of two towns, P and Q .
The scale is 1 cm represents 4 km.



Scale: 1 cm to 4 km

- (a) Find the actual distance between town P and town Q .

..... km [2]

- (b) Measure the bearing of town Q from town P .

..... [1]

- (c) Town X is 28 km from town P on a bearing of 140° .

On the scale drawing, mark the position of town X . [2]

- 7 **Without using a calculator**, work out $1\frac{5}{6} + \frac{2}{5}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

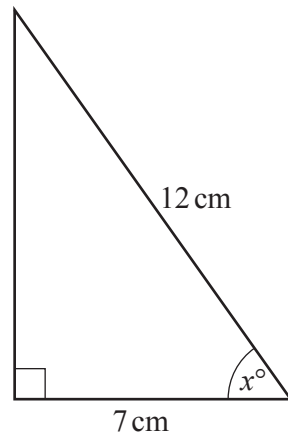
- 8 Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned} 4x - 2y &= -13 \\ -3x + 4y &= 11 \end{aligned}$$

$x =$

$y =$ [3]

9



NOT TO
SCALE

Calculate the value of x .

$x =$ [2]

10 A regular polygon has an interior angle of 174° .

Find the number of sides of this polygon.

..... [2]

11 Line L has equation $y = 4 - 5x$.

Find the equation of a line that is perpendicular to line L and passes through the point $(0, 6)$.

..... [3]

- 12 Chai invests some money.

By the end of the first year, the value of the investment has decreased by 35%.

By the end of the second year, the value of the investment has increased by 40% of its value at the end of the first year.

Find the overall percentage change in the value of the investment.

..... % [3]

- 13 Solve.

$$4 - 3x \geq \frac{6 - x}{5}$$

..... [3]

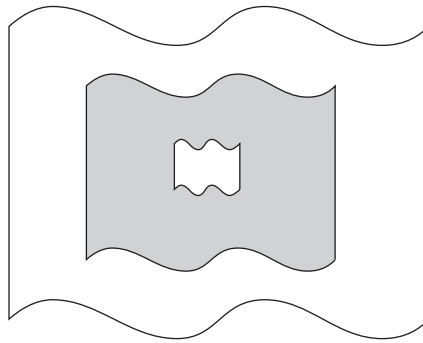
- 14 y is inversely proportional to the square root of $(x - 2)$.

When $x = 4.25$, $y = 12$.

Find x when $y = 3$.

$x =$ [3]

15



NOT TO
SCALE

The diagram shows three shapes that are mathematically similar.
The heights of the shapes are in the ratio small : medium : large = 1 : 5 : 8.

Find the ratio shaded area : total unshaded area.
Give your answer in its simplest form.

..... : [4]

16 Find the n th term of each sequence.

(a) 8, 15, 34, 71, 132, ...

..... [2]

(b) $\frac{2}{1}$, $\frac{3}{4}$, $\frac{4}{16}$, $\frac{5}{64}$, $\frac{6}{256}$, ...

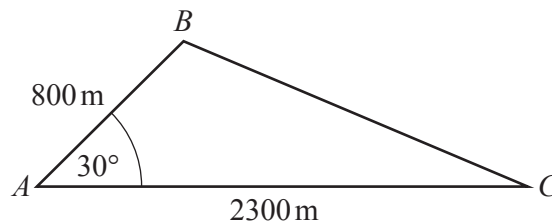
..... [3]

17 $y = \frac{3x-2}{1-x}$

Make x the subject of the formula.

$x = \dots\dots\dots$ [4]

18



NOT TO
SCALE

The diagram shows some land in the shape of a triangle ABC .
Houses are built on this land.
Each house requires 400 m^2 of land.

Find the greatest number of houses that can be built on this land.

$\dots\dots\dots$ [3]

10

19 Write as a single fraction in its simplest form.

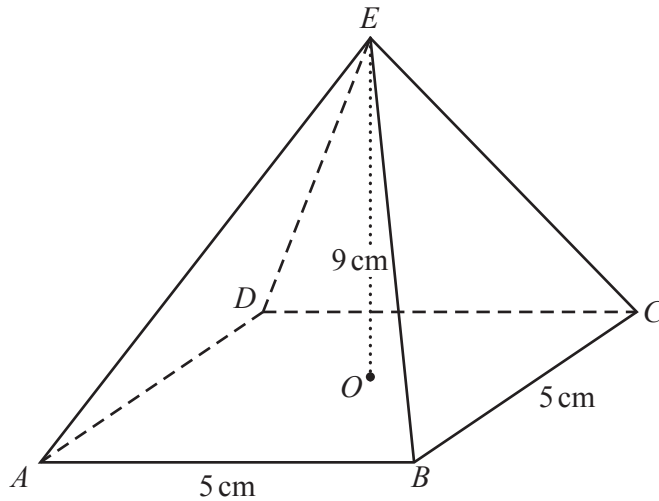
$$\frac{2}{x+3} - \frac{x+2}{7}$$

..... [3]

20 Solve $3(2 + \cos x) = 5$ for $0^\circ \leq x \leq 360^\circ$.

..... [3]

21

NOT TO
SCALE

The diagram shows a pyramid $ABCDE$.
 The pyramid has a square horizontal base $ABCD$ with side 5 cm.
 The vertex E is vertically above the centre O of the base.
 The height OE of the pyramid is 9 cm.

Calculate the angle that EC makes with the base $ABCD$.

..... [4]

Question 22 is printed on the next page.

22 (a) Simplify.

$$\frac{x^{\frac{2}{3}}}{x^{\frac{8}{3}}}$$

..... [1]

(b) $16 = 64^k$

Find the value of k .

$k =$ [1]

(c) Solve.

$$3^{3x} \times \left(\frac{1}{9}\right)^{4-3x} = 3$$

$x =$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of 7 printed pages.

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Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks				
1	79	2	B1 for 64 or 81 seen or for answer 61, 62, 67, 71 or 73				
2(a)	Sunday 24 [July] 02 15	3	B1 for Sunday 24th [July] as final answer B2 for 02 15 oe as final answer or B1 for sight of any of these 12 40 oe, 11 15 oe, 28h 35min, 50 15, 35 15 or 0215 oe spoilt or M1 for departure time + 13h35min + 15h evaluated as a time with one interval correctly added				
2(b)	6320.4[0]	1					
3	3.1	1					
4(a)	22	1					
4(b)	30	1					
5	<table border="1"><tr><td>lost</td><td>drawn</td></tr><tr><td>0.6 oe</td><td>0.3 oe</td></tr></table>	lost	drawn	0.6 oe	0.3 oe	3	B2 for 0.6 oe or 0.3 oe or M1 for 1 – 0.1 or 0.9 seen
lost	drawn						
0.6 oe	0.3 oe						
6(a)	32.8	2	M1 for 8[cm] to 8.4[cm] seen or for <i>their</i> measurement [in cm] multiplied by 4				
6(b)	065	1					
6(c)	X correctly placed 7 cm from P on a bearing of 140°	2	M1 for X on bearing of 140 from P or for X 7 cm from P If 0 scored SC1 for X on bearing of 140 from Q and 7 cm from Q				
7	$\frac{25 \text{ or } 55}{30}$ and $\frac{12}{30}$	M1	Accept $\frac{25k \text{ or } 55k}{30k}$ and $\frac{12k}{30k}$				
	$2\frac{7}{30}$ cao	A2	A1 for $\frac{67k}{30k}$ or $1\frac{37k}{30k}$				

Question	Answer	Marks	Partial Marks
8	Correctly eliminates one variable	M1	
	$[x =] - 3$, $[y =] 0.5$ oe	A2	A1 for either correct If M0 scored, SC1 for 2 values satisfying one of the original equations If 0 scored, SC1 for correct answers from no working
9	54.3 or 54.31...	2	M1 for $\cos [x] = \frac{7}{12}$ oe
10	60	2	M1 for $360 \div (180 - 174)$ or for $\frac{180(n-2)}{n} = 174$ oe
11	$y = \frac{1}{5}x + 6$ oe final answer	3	B2 for $y = \frac{1}{5}x + c$ oe or $\frac{1}{5}x + 6$ oe or $y = mx + 6$ oe or B1 for [gradient =] $\frac{1}{5}$ oe or $mx + 6$
12	$[-] 9$	3	M2 for $[k \times] \left(1 - \frac{35}{100}\right) \times \left(1 + \frac{40}{100}\right)$ oe or better or for $[k \times] \left(\frac{35}{100} - \left(1 - \frac{35}{100}\right) \times \frac{40}{100}\right)$ or M1 for $[k \times] \left(1 - \frac{35}{100}\right)$ oe or $[k \times] \left(1 + \frac{40}{100}\right)$ or better
13	$x \leq 1$ final answer	3	M1 for $20 - 15x \geq 6 - x$ or $4 - 3x \geq \frac{6}{5} - \frac{x}{5}$ M1 for correctly isolating terms in x FT <i>their</i> first step of dealing with the 5 $20 - 6 \geq -x + 15x$ or $-3x + \frac{x}{5} \geq \frac{6}{5} - 4$

Question	Answer	Marks	Partial Marks
14	38	3	M2 for $12 \times \sqrt{4.25 - 2} = 3 \times \sqrt{x - 2}$ OR M1 for $y = \frac{k}{\sqrt{x - 2}}$ oe M1 for $3 = \frac{\text{their } k}{\sqrt{x - 2}}$ oe
15	3 : 5 nfw	4	M3 for $5^2 - 1$ oe and $8^2 - 5^2 + 1$ oe or M2 for $5^2 - 1$ oe or $8^2 - 5^2 + 1$ oe or M1 for 5^2 oe or 8^2 oe seen
16(a)	$n^3 + 7$ oe final answer	2	B1 for any cubic or for 3rd differences of 6
16(b)	$\frac{n+1}{4^{n-1}}$ oe final answer	3	B1 for $n + 1$ B2 for 4^{n-1} oe or B1 for 4^{n-k} oe k can be 0 Maximum 2 marks if not correctly combined as a fraction
17	$[x =] \frac{y+2}{y+3}$ oe final answer	4	M1 $y(1 - x) = 3x - 2$ or better M1 for correctly isolating x terms on one side FT <i>their</i> first step/bracket expansion M1dep for correctly removing factor of x FT <i>their</i> previous step M1dep for correct division to isolate x Max 3 marks for an incorrect answer
18	1150	3	M2 for $\left(\frac{1}{2} \times 800 \times 2300 \times \sin 30\right) \div 400$ oe or M1 for $\frac{1}{2} \times 800 \times 2300 \times \sin 30$ oe
19	$\frac{8-5x-x^2}{7(x+3)}$ or $\frac{8-5x-x^2}{7x+21}$ final answer	3	B1 for $7 \times 2 - (x+2)(x+3)$ or better seen B1 for common denominator $7(x+3)$ oe isw

PUBLISHED

Question	Answer	Marks	Partial Marks
20	109.4 to 109.5 and 250.5 to 250.6	3	B2 for one correct angle or M1 for $\cos x = \frac{5}{3} - 2$ or better If 0 scored SC1 for two angles that sum to 360
21	68.6 or 68.55 to 68.56	4	M3 for $\tan[.] = \frac{9}{\frac{1}{2}\sqrt{5^2+5^2}}$ oe or M2 for $\frac{1}{2}\sqrt{5^2+5^2}$ oe or M1 for $5^2 + 5^2$ oe or $2.5^2 + 2.5^2$ oe or $x^2 + x^2 = 5^2$ oe or B1 for indicating required angle
22(a)	x^{-2} or $\frac{1}{x^2}$ final answer	1	
22(b)	$\frac{2}{3}$	1	
22(c)	1 nfww	3	M1 for $3^{-2(4-3x)}$ oe or better $9^{\frac{3x}{2}} \times 9^{-(4-3x)} = 9^{\frac{1}{2}}$ oe or better M1 for $3x + (their-2) \times (4-3x) = 1$ oe or better or $their \frac{3x}{2} - (4-3x) = their \frac{1}{2}$ oe or better



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MATHEMATICS**0580/22**

Paper 2 (Extended)

October/November 2021**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 The temperature at midnight is -8.5°C .
The temperature at 11 am is -1°C .

Work out the difference between the temperature at midnight and the temperature at 11 am.

..... $^{\circ}\text{C}$ [1]

- 2 The stem-and-leaf diagram shows the age, in years, of each of 15 women.

3	1	5	8	9			
4	1	1	2	3	5	6	9
5	0	2	3	8			

Key: 3 | 1 represents 31 years

Complete these statements.

The modal age is

The median age is

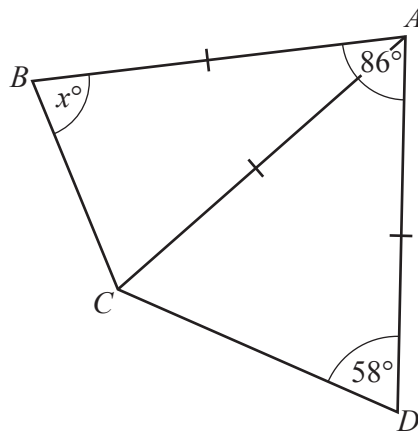
The percentage of women that are older than 51 years is%. [3]

- 3 Change 2.15 hours into minutes.

..... min [1]

3

4



NOT TO
SCALE

Triangle ABC and triangle ACD are isosceles.
Angle $DAB = 86^\circ$ and angle $ADC = 58^\circ$.

Find the value of x .

$x = \dots\dots\dots$ [3]

- 5 Angelique rents a room for a party.
The cost of renting the room is \$15.50 for the first hour and then \$7.25 for each additional hour.
She pays \$95.25 in total.

Work out the total number of hours she rents the room for.

$\dots\dots\dots$ hours [3]

4

- 6 Without using a calculator, work out $\frac{1}{3} \div \frac{7}{6} + \frac{1}{5}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [4]

- 7 Katy has 5 white flowers, x red flowers and $(2x + 1)$ yellow flowers.
She picks a flower at random.

The probability that it is white is $\frac{1}{12}$.

Find the probability that it is yellow.

..... [4]

- 8 Calculate $\sqrt[4]{39\frac{1}{16}}$.

..... [1]

- 9 2.1×10^{-1} $0.\dot{2}$ 22% $\sqrt{0.2}$ $\frac{24}{1000}$

Write these values in order of size, starting with the smallest.

..... < < < < [2]
smallest

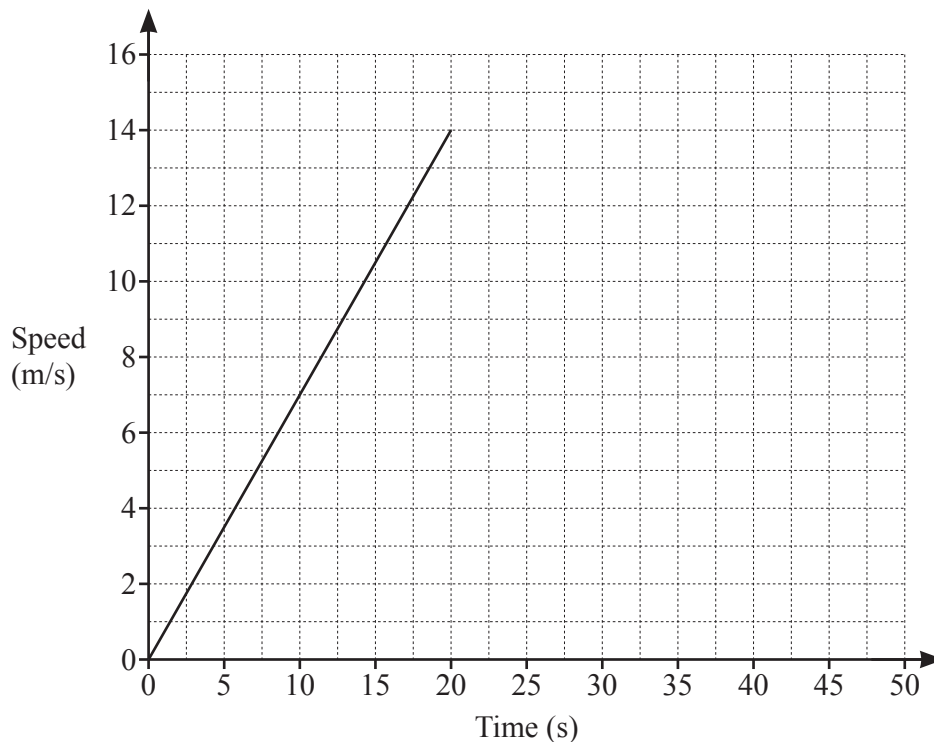
- 10 The interior angle of a regular polygon is 156° .

Work out the number of sides of this polygon.

..... [2]

- 11 A car starts its journey by accelerating from rest at a constant rate of 0.7 m/s^2 for 20 seconds, before reaching a constant speed of 14 m/s .
 It then travels at 14 m/s for a distance of 210 m.
 The car then decelerates at a constant rate of 1.4 m/s^2 , before coming to a stop.

On the grid, complete the speed–time graph for the car’s journey.



[3]

- 12 The table shows the first five terms of sequences A , B and C .

	1st term	2nd term	3rd term	4th term	5th term	n th term
Sequence A	8	3	-2	-7	-12	
Sequence B	2	$\frac{3}{2}$	$\frac{4}{3}$	$\frac{5}{4}$	$\frac{6}{5}$	
Sequence C	$\frac{1}{2}$	1	2	4	8	

Complete the table to show the n th term of each sequence.

[5]

- 13 (a) Write 243×27^{2n} as a single power of 3 in terms of n .

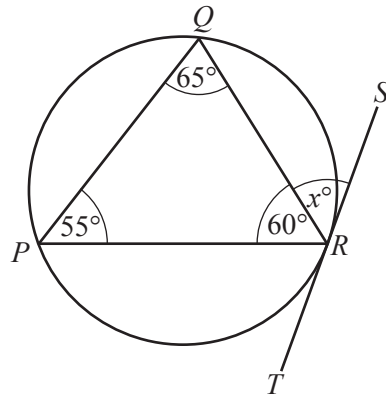
..... [2]

- (b) $k = 2 \times 3^2 \times p^3$, where p is a prime number greater than 3.

Write $6k^2$ as a product of prime factors in terms of p .

..... [2]

14



NOT TO
SCALE

P , Q and R are points on a circle.
 ST is a tangent to the circle at R .

- (a) Write down the value of x .
Give a geometrical reason for your answer.

$x = \dots\dots\dots$ because $\dots\dots\dots$
 $\dots\dots\dots$ [2]

- (b) Another tangent from the point S touches the circle at V .

Give a geometrical reason why triangle SVR is isosceles.

$\dots\dots\dots$
 $\dots\dots\dots$ [1]

- 15 (a) A is the point $(3, 16)$ and B is the point $(8, 31)$.

Find the equation of the line that passes through A and B .
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [3]

- (b) The line CD has equation $y = 0.5x - 11$.

Find the gradient of a line that is perpendicular to the line CD .

$\dots\dots\dots$ [1]

- 16** Sachin picks a number at random from the first three multiples of 3.
He then picks a number at random from the first three prime numbers.
He adds the two numbers to find a score.

(a) Complete the table.

		Multiples of 3		
		3		9
Prime numbers	2	5		11
	3	6		

[2]

- (b)** Given that the score is even, find the probability that one of the numbers he picks is 9.

..... [2]

- 17** Solve.

$$(5x - 3)(2x + 7) = 0$$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [1]

- 18 Solve the simultaneous equations.
You must show all your working.

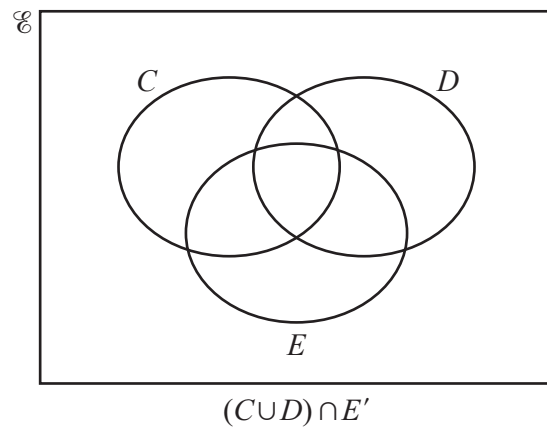
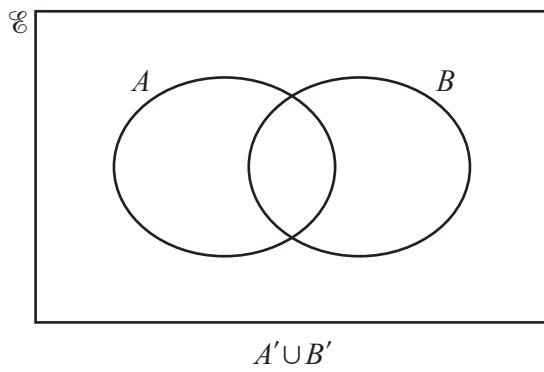
$$y = x^2 - 9x + 21$$

$$y = 2x - 3$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [5]$$

19 In these Venn diagrams, shade the given regions.



[2]

20 $f(x) = 2^{x-3}$ $g(x) = 2x - 1$ $h(x) = \frac{5}{x-4}$

(a) Find $ff(6)$.

..... [2]

(b) Find $g^{-1}g(x+21)$.

..... [1]

(c) Find x when $f(x) = h(84)$.

$x =$ [2]

21 Expand and simplify.

$$(x-3)^2(2x+5)$$

..... [3]

22 Solve the equation $7 \sin x + 2 = 0$ for $0^\circ \leq x \leq 360^\circ$.

..... [3]

Question 23 is printed on the next page.

23 Simplify.

$$\frac{3xy + 36y - 5x - 60}{2x^2 - 288}$$

..... [4]

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0580/22

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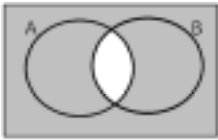
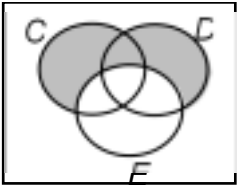
SC – Special Case

nfw – not from wrong working

soi – seen or implied

Question	Answer	Marks	Partial Marks
1	7.5	1	
2	41 43 20	3	B1 for each
3	129	1	
4	79 nfww	3	M2 for $x + x + 58 + 58 + 86 = 360$ oe or $86 - (180 - 2 \times 58)$ implied by $CAB = 22$ or B1 for $DCA = 58$ or $BCA = x$ or $DAC = 64$
5	12	3	M2 for $(95.25 - 15.5) \div 7.25$ oe or $(95.25 - (15.5 - 7.25)) \div 7.25$ oe or M1 for $95.25 - 15.5$ or B1 for 79.75
6	$\frac{1}{3} \times \frac{6}{7}$ oe or $\frac{2}{6} \div \frac{7}{6}$ oe	M1	
	$\frac{2}{7}$ oe	A1	
	their $\frac{2}{7} + \frac{1}{5}$ with a correct method to find fractions with a common denominator	M1	e.g. $\frac{10}{35} + \frac{7}{35}$ oe
	$\frac{17}{35}$ cao	A1	If order of operations not correct SC2 for answer $\frac{10}{41}$ with correct working for $\frac{1}{3} \div \left(\frac{7}{6} + \frac{1}{5} \right)$ or SC1 for $\frac{35}{30} + \frac{6}{30}$ oe
7	$\frac{37}{60}$ oe	4	B3 for $x = 18$ or 37 [yellow] or SC2 for answer $\frac{5}{12}$ or M2 for $\frac{1}{12} = \frac{5}{5+x+2x+1}$ oe or M1 for $5 + x + 2x + 1$ oe or [total number of flowers =] 60

Question	Answer	Marks	Partial Marks
8	2.5 oe	1	
9	$\frac{24}{1000} < 2.1 \times 10^{-1} < 22\% < 0.\dot{2} < \sqrt{0.2}$	2	M1 for four values in the correct order or for conversion to consistent comparable form e.g. 0.21, 0.22..., 0.22, 0.4..., 0.024
10	15	2	M1 for $360 \div (180 - 156)$ or $\frac{180(n-2)}{n} = 156$ oe
11	Straight line from (20, 14) to (35, 14) and straight line from (35, 14) to (45, 0)	3	M1 for $210 \div 14$ soi M1 for $14 \div 1.4$ or any line with gradient -1.4 ending at x axis
12	$13 - 5n$ oe final answer $\frac{n+1}{n}$ oe final answer 2^{n-2} oe final answer	5	B2 for $13 - 5n$ oe final answer or B1 for $-5n + c$ or $13 - kn$ $k \neq 0$ or $13 - 5n$ seen then spoilt B1 for $\frac{n+1}{n}$ oe final answer B2 for 2^{n-2} oe final answer or B1 for 2^{n-k} oe k can be 0
13(a)	3^{6n+5} final answer	2	B1 for 3^5 or $(3^3)^{2n}$ or better or answer $6n + 5$
13(b)	$2^3 \times 3^5 \times p^6$ final answer	2	B1 for two parts correct or $2 \times 3 \times 2 \times 3^2 \times p^3 \times 2 \times 3^2 \times p^3$ or $1944p^6$ or $k^2 = 2^2 \times 3^4 \times p^6$
14(a)	55 Alternate segment theorem	2	B1 for 55
14(b)	Tangents from an external point are equal in length	1	
15(a)	$[y =] 3x + 7$ final answer	3	M1 for $\frac{31-16}{8-3}$. oe M1 for correct substitution of (3, 16) or (8, 31) into $y = (their\ m)x + c$
15(b)	-2	1	

Question	Answer	Marks	Partial Marks																
16(a)	Multiples of 3 <table> <tr> <td>+</td><td>3</td><td>6</td><td>9</td></tr> <tr> <td>2</td><td>5</td><td>8</td><td>11</td></tr> <tr> <td>3</td><td>6</td><td>9</td><td>12</td></tr> <tr> <td>5</td><td>8</td><td>11</td><td>14</td></tr> </table> Prime numbers	+	3	6	9	2	5	8	11	3	6	9	12	5	8	11	14	2	B1 for at least 4 correct entries
+	3	6	9																
2	5	8	11																
3	6	9	12																
5	8	11	14																
16(b)	$\frac{2}{5}$ oe	2	B2FT for $\frac{\text{their } 2}{\text{their } 5}$ or B1FT for $\frac{\text{their } 2}{k}$ k is any integer in the range $1 \leq k \leq 7$ or $\frac{c}{\text{their } 5}$ c is 0, 1 or 2																
17	$\frac{3}{5}$ oe and $-\frac{7}{2}$ oe	1																	
18	$x^2 - 11x + 24 [= 0]$ or $y^2 - 16y + 39 [= 0]$	M2	M1 for $x^2 - 9x + 21 = 2x - 3$ oe or $y = \left(\frac{y+3}{2}\right)^2 - 9\left(\frac{y+3}{2}\right) + 21$ oe																
	$(x - 8)(x - 3) [= 0]$ or $(y - 13)(y - 3) [= 0]$	M1	or for correct factors for <i>their</i> quadratic equation or for correct use of quadratic formula for <i>their</i> equation																
	$[x =] 3$ $[y =] 3$ $[x =] 8$ $[y =] 13$	B2	B1 for one correct pair or two correct x values or two correct y values. If B0 scored and at least 2 method marks scored SC1 for correct substitution of both of <i>their</i> x values or <i>their</i> y values into $y = x^2 - 9x + 21$ or $y = 2x - 3$																
19	 	2	B1 for each																
20(a)	32	2	M1 for $f(6) = 8$ or $ff(x) = 2^{(2^x - 3) - 3}$ oe																

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Question	Answer	Marks	Partial Marks
20(b)	$x + 21$	1	
20(c)	-1	2	M1 for $\frac{1}{16}$ oe or 2^{-4} oe
21	$2x^3 - 7x^2 - 12x + 45$ final answer	3	B2 for unsimplified expansion of the three brackets with at most one error or for simplified four-term expression of correct form with three terms correct or B1 for correct expansion of two of the given brackets with at least three terms out of four correct
22	196.6 or 196.60... and 343.4 or 343.39...	3	B2 for one correct angle or M1 for $\sin x = -\frac{2}{7}$ or better If 0 scored SC1 for two angles that sum to 540°
23	$\frac{3y-5}{2(x-12)}$ or $\frac{3y-5}{2x-24}$ final answer	4	SC3 for answer $\frac{3y-5}{x-12}$ or B3 for $(3y-5)(x+12)$ and $2(x-12)(x+12)$ or $(2x-24)(x+12)$ or B2 for $(3y-5)(x+12)$ or $2(x-12)(x+12)$ or $(2x-24)(x+12)$ or $(2x+24)(x-12)$ or B1 for $3y(x+12) - 5(x+12)$ or $x(3y-5) + 12(3y-5)$ or $2(x^2 - 144)$ or $(x-12)(x+12)$



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MATHEMATICS**0580/23**

Paper 2 (Extended)

October/November 2021**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

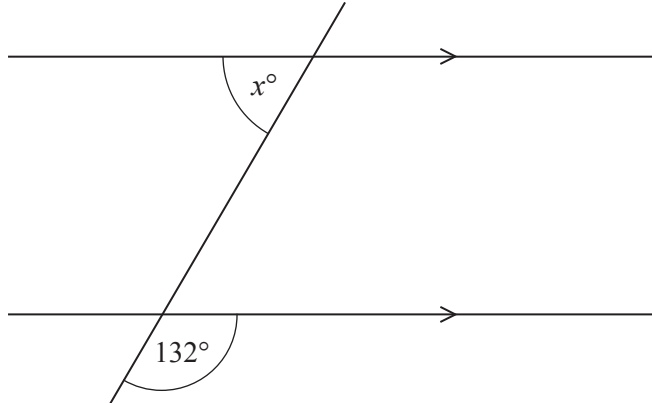
- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

- 1 Write 26 g as a percentage of 208 g.

..... % [1]

2



NOT TO
SCALE

The diagram shows two parallel lines intersecting a straight line.

Find the value of x .

$x =$ [2]

3

11 13 15 17 19

From this list, write down the number that is both a prime number and a factor of 195.

..... [1]

- 4 (a) = $\neq$ > <

Put a ring around each of the symbols that make this statement correct.

0.5 5% [1]

- (b) Insert one pair of brackets to make this statement correct.

$7 - 3 - 1 + 2 = 7$ [1]

- 5 Nina changes 153 euros into dollars when the exchange rate is \$1 = 0.9 euros.

Calculate the amount Nina receives.

\$ [1]

- 6 Marek buys a computer for \$420.
He sells it at a loss of 15%.

Calculate the selling price of this computer.

\$ [2]

- 7 Simplify.

$$32g^{32} \div 4g^4$$

..... [2]

- 8 Beatrice walks 1 km at a speed of 4 km/h and then 2 km at a speed of 4.5 km/h.

Work out Beatrice's average speed for the whole journey.

..... km/h [3]

- 9 Write the recurring decimal $0.\dot{2}\dot{7}$ as a fraction.

..... [1]

- 10 These are the first four terms of a sequence.

3 -1 -5 -9

- (a) Find the next term in this sequence.

..... [1]

- (b) Find the n th term.

..... [2]

11 $P = M(g^2 + h^2)$

- (a) Find the value of P when $M = 100$, $g = 3$ and $h = 4.5$.

$P =$ [2]

- (b) Rearrange the formula to write g in terms of P , M and h .

$g =$ [3]

- 12 Without using a calculator, work out $\frac{11}{12} + \frac{3}{4}$.

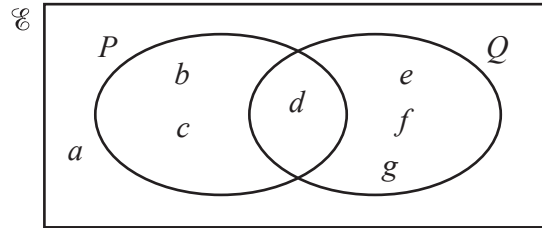
You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

- 13 Calculate $0.04^2 + 0.03 \times 0.28$.
Give your answer in standard form.

..... [2]

14



(a) Complete the statement.

$$P \cup Q = \{ \dots \dots \dots \dots \dots \dots \dots \} \quad [1]$$

(b) Find $n(Q)$.

$$\dots \dots \dots \dots \dots \dots \dots \quad [1]$$

(c) Find $n(P' \cap Q)$.

$$\dots \dots \dots \dots \dots \dots \dots \quad [1]$$

15 The cost of a train journey is increased by 6% to a new cost of \$153.70 .

Calculate the original cost of the train journey.

$$\text{\$ } \dots \dots \dots \dots \dots \dots \dots \quad [2]$$

16 Jo and Mo share \$26.
Jo receives \$5 more than Mo.

Find the ratio Jo's money : Mo's money.
Give your answer in its simplest form.

$$\dots \dots \dots \dots \dots \dots \dots : \dots \dots \dots \dots \dots \dots \dots \quad [3]$$

7

- 17 Each interior angle of a regular polygon is 178.5° .

Calculate the number of sides of this polygon.

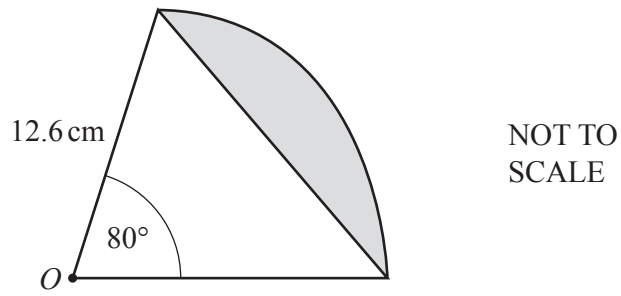
..... [2]

- 18 Find the equation of the straight line that passes through the points $(2, -2)$ and $(3, 10)$.

Give your answer in the form $y = mx + c$.

$y =$ [3]

19



The diagram shows a sector of a circle, centre O , radius 12.6 cm.

Calculate the perimeter of the shaded segment.

..... cm [4]

- 20 A lake has an area of 3 km^2 .
On a map the area of the lake is 18.75 cm^2 .

Find the scale of the map in the form $1 : n$.

1 : [3]

21 Simplify fully.

$$(243y^{10})^{\frac{3}{5}}$$

..... [2]

22 Solve the simultaneous equations.
You must show all your working.

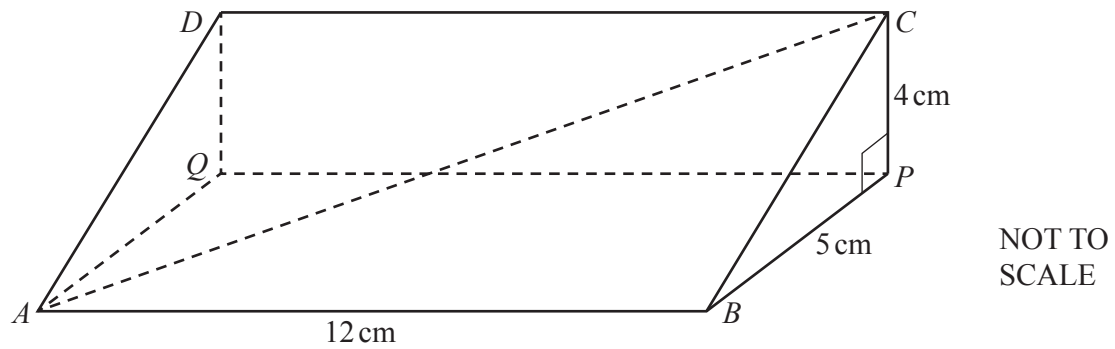
$$y = x^2 - 3x - 13$$

$$y = x - 1$$

$$x = \dots\dots\dots, y = \dots\dots\dots$$

$$x = \dots\dots\dots, y = \dots\dots\dots [5]$$

23



The diagram shows a triangular prism.
Angle $BPC = 90^\circ$.

(a) Calculate AC .

$AC = \dots\dots\dots$ cm [3]

(b) Calculate the angle between AC and the base $ABPQ$.

$\dots\dots\dots$ [3]

24 $\tan x = \sqrt{3}$ and $0^\circ \leq x \leq 360^\circ$.

Find all the possible values of x .

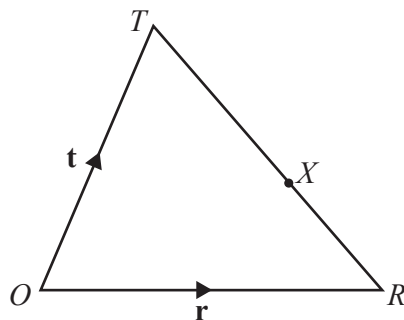
$\dots\dots\dots$ [2]

25 Simplify.

$$\frac{3x^2 - 18x}{ax - 6a + 2cx - 12c}$$

..... [4]

26



NOT TO
SCALE

ORT is a triangle.

X is a point on TR so that $TX : XR = 3 : 2$.

O is the origin, $\vec{OR} = \mathbf{r}$ and $\vec{OT} = \mathbf{t}$.

Find the position vector of X .

Give your answer in terms of $\mathbf{r}$ and $\mathbf{t}$ in its simplest form.

..... [3]

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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **6** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

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Question	Answer	Marks	Partial Marks
1	12.5	1	
2	48	2	B1 for 132 or 48 in the correct position on the diagram or M1 for $180 - 132$
3	13	1	
4(a)	$\neq$ and $>$ indicated	1	
4(b)	$7 - (3 - 1) + 2 = 7$ cao	1	
5	170	1	
6	357	2	M1 for $\left(1 - \frac{15}{100}\right) \times 420$ oe or B1 for 63
7	$8g^{28}$ final answer	2	B1 for kg^{28} or $8g^k$ as final answer or correct answer seen and spoilt
8	4.32	3	B1 for $\frac{1}{4}$ oe or $\frac{2}{4.5}$ oe seen M1 dep on B1 for $\frac{1+2}{their \frac{1}{4} + their \frac{2}{4.5}}$ oe
9	$\frac{3}{11}$ oe fraction	1	
10(a)	-13	1	
10(b)	$-4n + 7$ oe final answer	2	B1 for $-4n + k$ or $jn + 7$ ($j \neq 0$) or for a correct answer spoilt
11(a)	2925	2	M1 for $100(3^2 + 4.5^2)$ or B1 for 29.25 seen
11(b)	$[\pm] \sqrt{\frac{P}{M} - h^2}$ or $[\pm] \sqrt{\frac{P - Mh^2}{M}}$ final answer	3	M1 for correct division by M M1 for correct re-arrangement to isolate g or g^2 M1 for correct square root of two term expression Max 2 marks for an incorrect answer
12	$\frac{11}{12} + \frac{9}{12}$ oe	M1	Allow any correct common denominator $12k$
	$1\frac{2}{3}$ cao	A2	A1 for $\frac{20}{12}$ or equivalent improper fraction or mixed number

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Question	Answer	Marks	Partial Marks
13	$1[.0] \times 10^{-2}$ cao	2	B1 for 0.01 oe
14(a)	b, c, d, e, f, g	1	
14(b)	4	1	
14(c)	3	1	
15	145	2	M1 for $x\left(1 + \frac{6}{100}\right) = 153.7$ oe or better
16	31 : 21	3	B2 for equivalents e.g. 15.5 oe and 10.5 oe or for an equivalent ratio e.g. 3.1 : 2.1 or M1 for e.g. $x + 5 + x = 26$ oe or $x - 5 + x = 26$ oe
17	240	2	M1 for $360 \div (180 - 178.5)$ oe or for $\frac{180(n-2)}{n} = 178.5$ oe
18	$[y =] 12x - 26$ final answer	3	M1 for $\frac{10 - -2}{3 - 2}$ oe M1 for correct substitution of (2, -2) or (3, 10) into $y = (their\ m)x + c$ oe
19	33.8 or 33.78 to 33.80	4	M2 for $2 \times 12.6 \times \sin 40$ oe or M1 for $\sin 40 = \frac{(\dots)}{12.6}$ oe M1 for $\frac{80}{360} \times 2 \times \pi \times 12.6$ oe
20	40 000	3	B2 for 1 cm to 0.4 km or 2.5 cm to 1 km or 1 600 000 000 or M2 for $\sqrt{\frac{3 \times 10^k}{18.75}}$ oe where $k > 5$ or M1 for 1 cm ² to 0.16 km ² or 6.25 cm ² to 1 km ² or for 3×10^{10} oe or 1.875×10^{-9} oe or 3×10^6 oe and 1.875×10^{-3} oe
21	$27y^6$ final answer	2	B1 for ky^6 or $27y^k$ as final answer or correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
22	$x^2 - 4x - 12 [= 0]$ or $y^2 - 2y - 15 [= 0]$	M2	M1 for $x^2 - 3x - 13 = x - 1$ or for $y = (y + 1)^2 - 3(y + 1) - 13$
	$(x - 6)(x + 2) [= 0]$ or $(y - 5)(y + 3) [= 0]$	M1	or for correct factors for <i>their</i> quadratic equation or for correct use of quadratic formula or completing the square for <i>their</i> equation
	$[x =] 6, [y =] 5$ $[x =] -2, [y =] -3$	B2	B1 for one correct pair or two correct x values or two correct y values If B0 scored and at least 2 method marks scored SC1 for correct substitution of both of <i>their</i> x values or <i>their</i> y values into $y = x^2 - 3x - 13$ or $y = x - 1$
23(a)	13.6 or 13.60...	3	M2 for $12^2 + 5^2 + 4^2$ or M1 for $5^2 + 4^2$ or $12^2 + 4^2$ or $12^2 + 5^2$
23(b)	17.1 or 17.08 to 17.10...	3	M2 for $\sin = \frac{4}{\text{their (a)}}$ oe or $\tan = \frac{4}{\text{their AP}}$ or $\cos = \frac{\text{their AP}}{\text{their (a)}}$ or M1 for recognising angle <i>CAP</i> .
24	60 and 240	2	B1 for 60 or 240 If 0 scored SC1 for two answers with a difference of 180°
25	$\frac{3x}{a + 2c}$ final answer	4	B1 for $3x(x - 6)$ B2 for $(x - 6)(a + 2c)$ or B1 for $a(x - 6) + 2c(x - 6)$ or $x(a + 2c) - 6(a + 2c)$
26	$\frac{3}{5}\mathbf{r} + \frac{2}{5}\mathbf{t}$ or $\frac{1}{5}(3\mathbf{r} + 2\mathbf{t})$	3	M2 for $\mathbf{r} + \frac{2}{5}(-\mathbf{r} + \mathbf{t})$ oe or $\mathbf{t} + \frac{3}{5}(\mathbf{r} - \mathbf{t})$ oe or M1 for $\overrightarrow{RT} = -\mathbf{r} + \mathbf{t}$ oe or $\overrightarrow{TR} = \mathbf{r} - \mathbf{t}$ M1 for $\overrightarrow{OR} + \overrightarrow{RX}$ or $\overrightarrow{OT} + \overrightarrow{TX}$ any other correct route.



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MATHEMATICS**0580/41**

Paper 4 (Extended)

October/November 2021**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

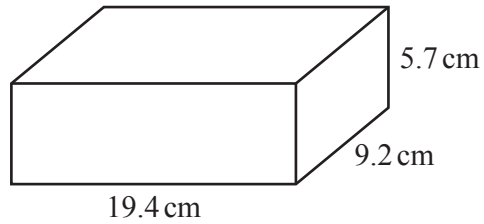
INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

2

1 (a)



NOT TO
SCALE

The diagram shows a brick in the shape of a cuboid.

(i) Calculate the total surface area of the brick.

..... cm^2 [3]

(ii) The density of the brick is 1.9 g/cm^3 .

Work out the mass of the brick.
Give your answer in kilograms.
[Density = mass $\div$ volume]

..... kg [3]

(b) 9000 bricks are needed to build a house.
200 bricks cost \$175.

Work out the cost of the bricks needed to build 5 houses.

\$ [3]

- (c) Saskia builds a wall using 1500 bricks.
She can build at the rate of 40 bricks each hour.
She works for 9 hours each day.
Saskia starts work on 6 July and works every day until the wall is completed.

Find the date when she completes the wall.

..... [3]

- (d) Rafa has a cylindrical tank.
The cylinder has a height of 105 cm and a diameter of 45 cm.

Calculate the capacity of the tank in litres.

..... litres [3]

2 Bob, Chao and Mei take part in a run for charity.

(a) Their times to complete the run are in the ratio Bob : Chao : Mei = 4 : 5 : 7.

(i) Find Chao's time as a percentage of Mei's time.

..... % [1]

(ii) Bob's time for the run is 55 minutes 40 seconds.

Find Mei's time for the run.

Give your answer in minutes and seconds.

..... min s [3]

(b) Chao collects \$47.50 for charity.

(i) Bob collects 28% more than Chao.

Find the amount Bob collects.

\$ [2]

(ii) Chao collects 60% less than Mei.

Find how much more money Mei collects than Chao.

\$ [3]

- (c) When running, Chao has a stride length of 70 cm, correct to the nearest 5 cm.
Chao runs a distance of 11.2 km, correct to the nearest 0.1 km.

Work out the minimum number of strides that Chao could take to complete this distance.

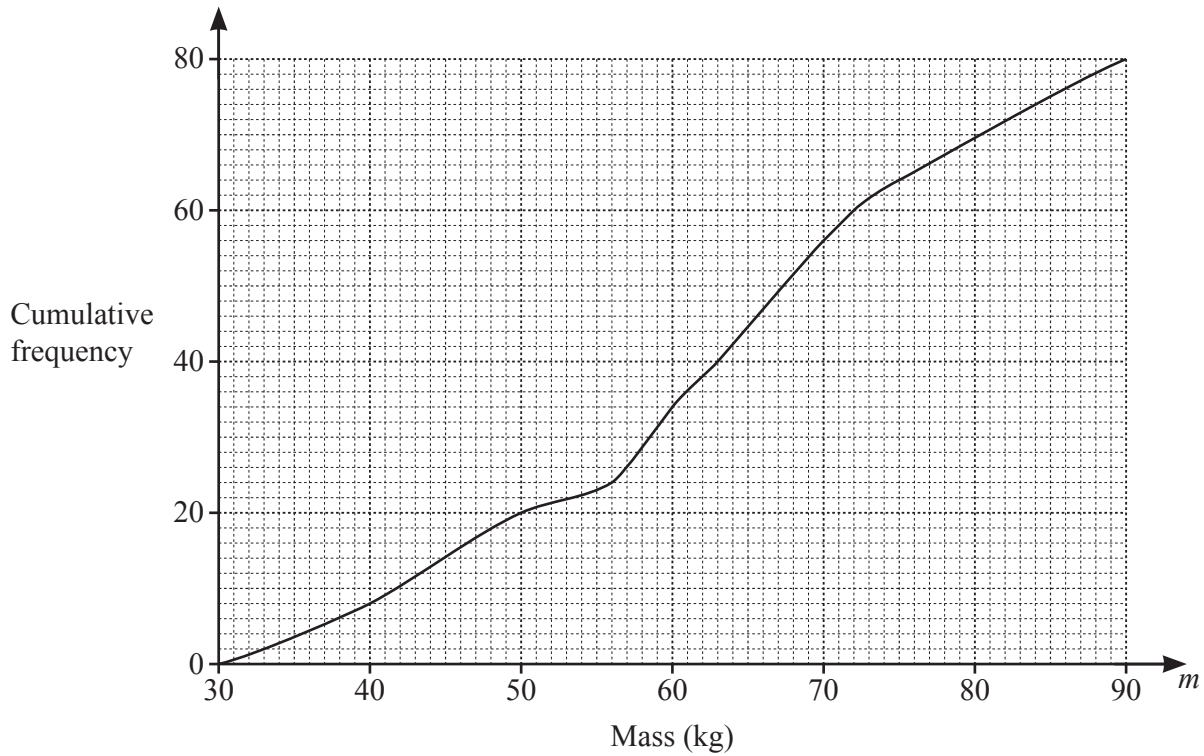
..... [4]

- (d) In 2015, a charity raised a total of \$1.6 million.
After 2015, this amount increased exponentially by 2.4% each year for the next 5 years.

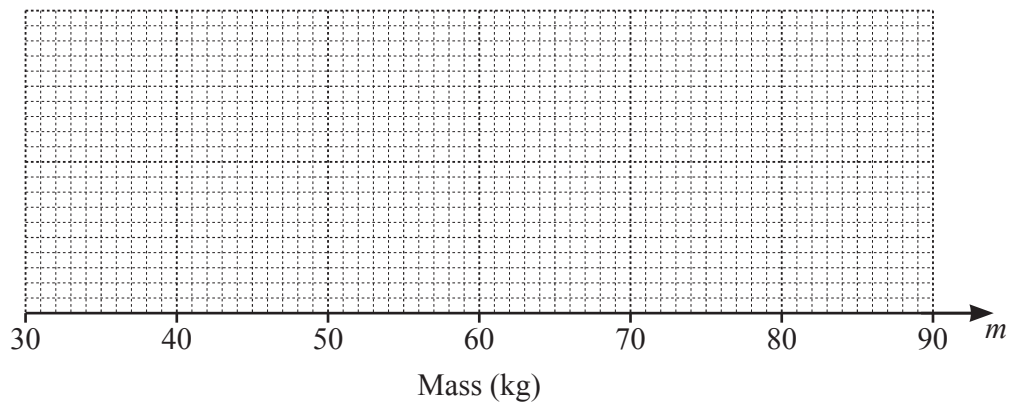
Work out the amount raised by the charity in 2020.

\$ million [2]

- 3 The cumulative frequency diagram shows information about the mass, m kg, of each of 80 boys.



(a)



On the grid, draw a box-and-whisker plot to show the information in the cumulative frequency diagram. [4]

- (b) Use the cumulative frequency diagram to find an estimate of

(i) the 30th percentile,

..... kg [2]

(ii) the number of boys with a mass greater than 75 kg.

..... [2]

- (c) (i) Use the cumulative frequency diagram to complete this frequency table.

Mass (m kg)	$30 < m \leq 40$	$40 < m \leq 50$	$50 < m \leq 60$	$60 < m \leq 70$	$70 < m \leq 80$	$80 < m \leq 90$
Frequency	8	12			14	10

[1]

- (ii) Calculate an estimate of the mean mass of the boys.

..... kg [4]

- (iii) Two boys are chosen at random from those with a mass greater than 70 kg.

Find the probability that one of them has a mass greater than 80 kg and the other has a mass of 80 kg or less.

..... [3]

4 (a) Solve.

(i) $6(7 - 2x) = 3x - 8$

$x = \dots\dots\dots$ [3]

(ii) $\frac{2x}{x-5} = \frac{2}{3}$

$x = \dots\dots\dots$ [3]

(b) Factorise completely.

(i) $2x^2 - 288y^2$

$\dots\dots\dots$ [3]

(ii) $5x^2 + 17x - 40$

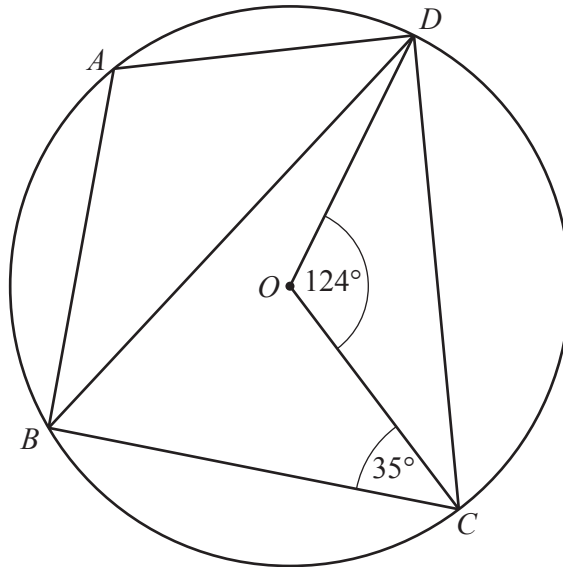
$\dots\dots\dots$ [2]

- (c) Solve $x^3 + 4x^2 - 17x = x^3 - 9$.

You must show all your working and give your answers correct to 2 decimal places.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [5]

5 (a)



NOT TO
SCALE

A, B, C and D are points on a circle, centre O .
Angle $COD = 124^\circ$ and angle $BCO = 35^\circ$.

- (i) Work out angle CBD .
Give a geometrical reason for your answer.

Angle $CBD = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$ [2]

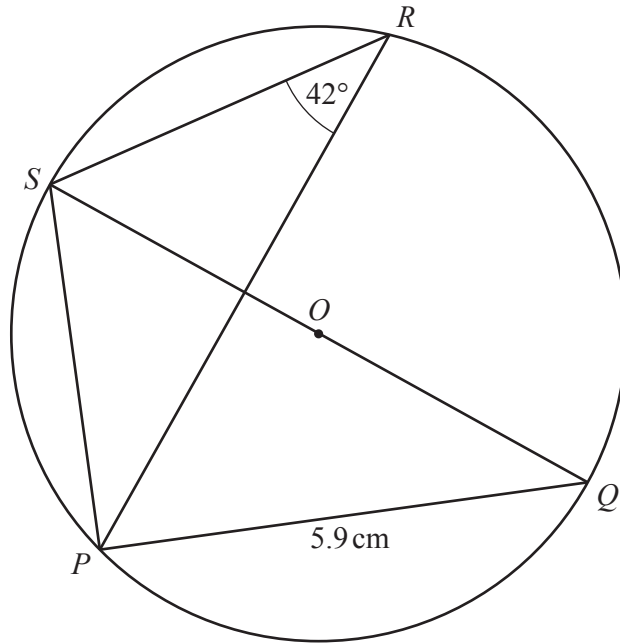
- (ii) Work out angle BAD .
Give a geometrical reason for each step of your working.

Angle $BAD = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$

$\dots\dots\dots$ [4]

(b)



NOT TO
SCALE

P , Q , R and S are points on a circle, centre O .
 QS is a diameter.
 Angle $PRS = 42^\circ$ and $PQ = 5.9\text{ cm}$.

Calculate the circumference of the circle.

..... cm [5]

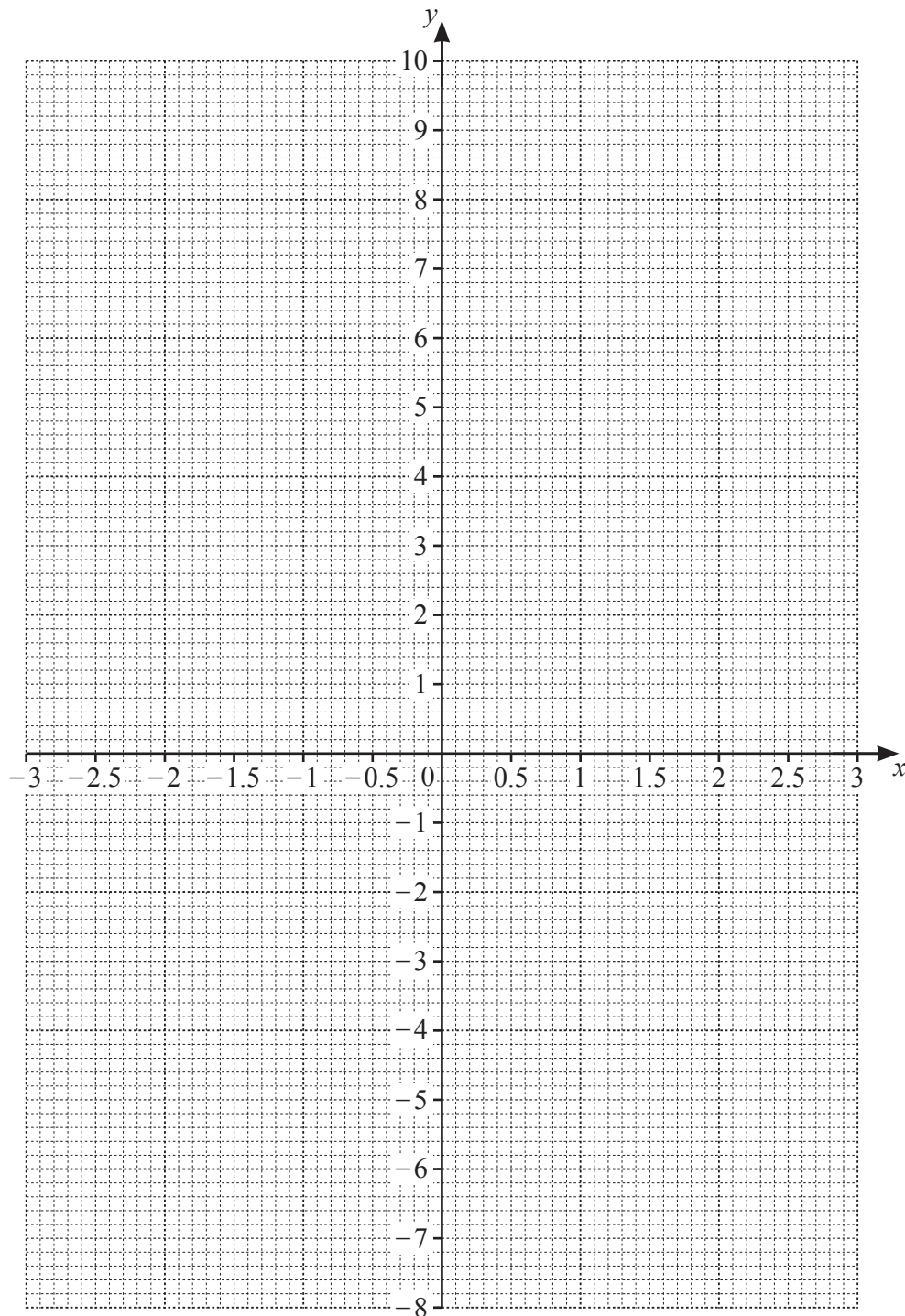
- 6 The table shows some values for $y = x^2 - \frac{3}{2x}$, $x \neq 0$, given correct to 1 decimal place.

x	-3	-2	-1	-0.5	-0.2		0.2	0.5	1	2	3
y			2.5	3.3	7.5		-7.5	-2.8	-0.5	3.3	

- (a) (i) Complete the table.

[3]

- (ii) On the grid, draw the graph of $y = x^2 - \frac{3}{2x}$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$.



[5]

- (b) By drawing a suitable straight line on the grid, solve the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

- (c) The solutions to the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ are also the solutions to an equation of the form $ax^3 + bx^2 + cx - 15 = 0$ where a , b and c are integers.

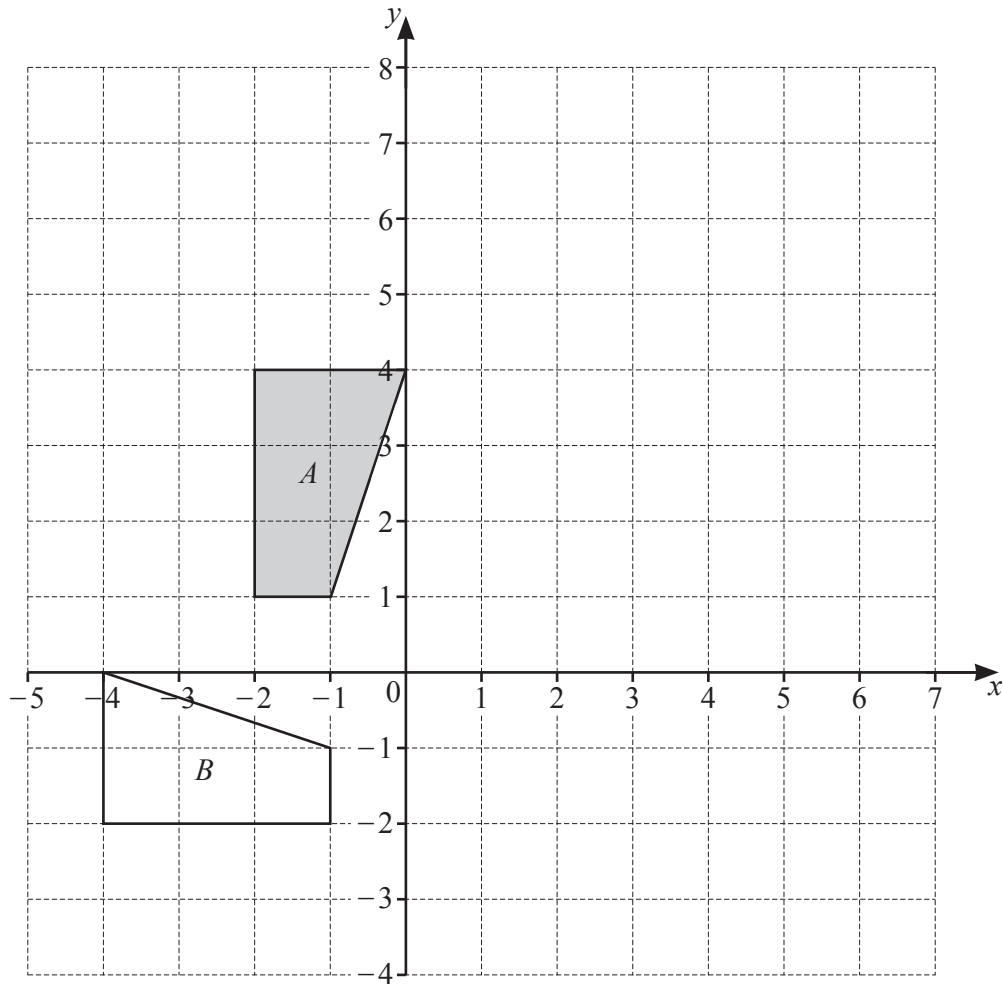
Find the values of a , b and c .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$ [4]

7 (a)



(i) On the grid, draw the image of

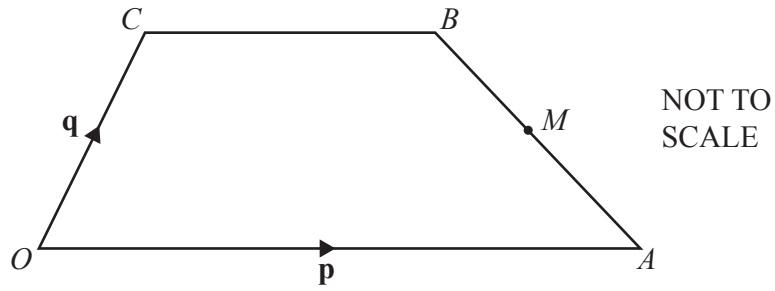
(a) shape A after an enlargement, scale factor 2, centre $(0, 1)$, [2]

(b) shape A after a reflection in the line $y = x - 1$. [3]

(ii) Describe fully the **single** transformation that maps shape A onto shape B .

..... [3]

(b)



$OABC$ is a trapezium and O is the origin.

M is the midpoint of AB .

$\vec{OA} = \mathbf{p}$, $\vec{OC} = \mathbf{q}$ and $OA = 2CB$.

Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, the position vector of M .
Give your answer in its simplest form.

..... [3]

8 (a) $f(x) = 3 - 5x$

(i) Find x when $f(x) = -5$.

$x = \dots\dots\dots$ [2]

(ii) Find $f^{-1}(x)$.

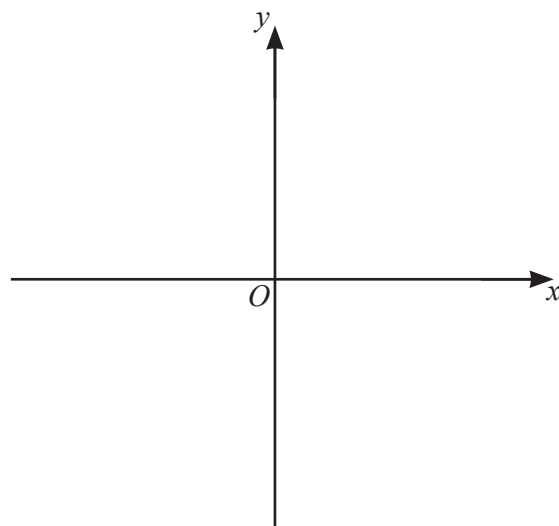
$f^{-1}(x) = \dots\dots\dots$ [2]

(b) $g(x) = 18 - 3x - x^2$

(i) Write $g(x)$ in the form $b - (a + x)^2$.

$\dots\dots\dots$ [3]

(ii) Sketch the graph of $y = g(x)$.
On your sketch, show the coordinates of the turning point.

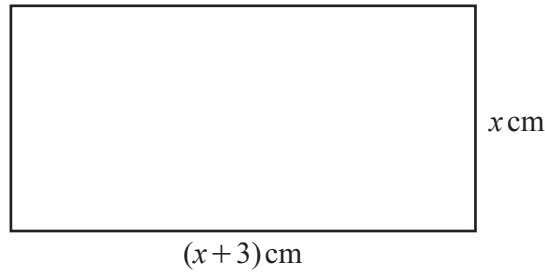


[3]

- (iii) Find the equation of the tangent to the graph of $y = 18 - 3x - x^2$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [6]

9 (a)



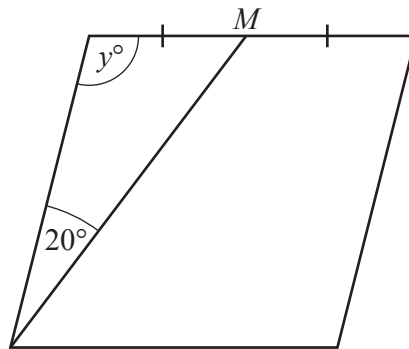
NOT TO
SCALE

This rectangle has perimeter 20 cm.

Find the value of x .

$x = \dots\dots\dots$ [3]

(b)



NOT TO
SCALE

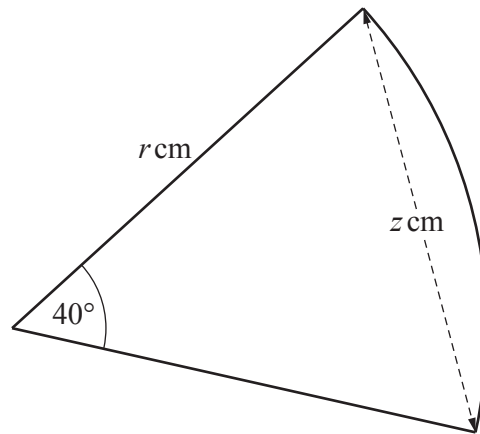
This rhombus has perimeter 20 cm and angle y is obtuse.
 M is the midpoint of one of the sides.

Find the value of y .

$y = \dots\dots\dots$ [5]

19

(c)



NOT TO
SCALE

This sector of a circle has radius r and perimeter 20 cm.

Find the value of z .

$z = \dots\dots\dots$ [6]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

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Question	Answer	Marks	Partial Marks
1(a)(i)	683	3	M2 for $[2]((19.4 \times 9.2) + (5.7 \times 9.2) + (19.4 \times 5.7))$ oe or M1 for one of 19.4×9.2 or 5.7×9.2 or 19.4×5.7
1(a)(ii)	1.93[0] or 1.932 to 1.933	3	M2 for $19.4 \times 9.2 \times 5.7 \times 1.9$ or M1 for $19.4 \times 9.2 \times 5.7$
1(b)	39 375	3	M2 for $9000 \div 200 \times 175 \times 5$ or M1 for $9000 \div 200$ soi or for $\frac{175}{200}$ soi
1(c)	10 th July	3	B2 for 4.1 to 4.2 or $4\frac{1}{6}$ or 4 days 1.5 hours Or M2 for answer 9 th July or 11 th July or M1 for $1500 \div (9 \times 40)$
1(d)	167 or 166.9 to 167.0...	3	B2 for answer with figs 167 or figs 1669 to 1670.. or M1 for $\pi \times 22.5^2 \times 105$ oe If 0 scored SC1 for answer 668 or 667.9 to 668.1
2(a)(i)	71.4 or 71.42 to 71.43	1	
2(a)(ii)	97 [min] 25 [s]	3	B2 for 13 min 55 sec seen or 97.4 or 97.41 to 97.42 seen or 5845 seen OR M2 for $55.66... \div 4 \times 7$ oe or $3340 \div 4 \times 7$ oe or for $7/4 \times 55 + 7/4 \times 40$ oe or M1 for 55 min 40 sec $\div 4$ oe or M1 for total time $\div 16$ soi
2(b)(i)	60.8[0]	2	M1 for $47.5 \times \left(1 + \frac{28}{100}\right)$ oe or B1 for 13.3[0]
2(b)(ii)	71.25	3	B2 for 118.75 Or M2 for $47.50 \div \left(1 - \frac{60}{100}\right) - 47.50$ or M1 for $x \times \left(1 - \frac{60}{100}\right) = 47.50$ oe or better

Question	Answer	Marks	Partial Marks
2(c)	15 380	4	M3 for $(1\,120\,000 - 5000) \div (70 + 2.5)$ oe or B2 for answer figs 15 379 to figs 15 380 or M2 for $(1\,120\,000 \pm 5000) \div (70 \pm 2.5)$ oe or M1 for one of figs 675, 725, 1115, 1125 seen
2(d)	1.8[0] or 1.801 to 1.802 [million] nfw	2	M1 for figs $16 \times \left(1 + \frac{2.4}{100}\right)^5$ oe
3(a)	Correct box-and-whisker plot	4	B1 for lowest value and highest value at 30 and 90 B1 for LQ and UQ at 50 and 72 B1 for median at 63
3(b)(i)	56	2	M1 for 24 soi
3(b)(ii)	16	2	B1 for 64 written
3(c)(i)	14, 22	1	
3(c)(ii)	61.5	4	M1 for 35, 45, 55, 65, 75, 85 soi M1 for Σfx M1 dep for $their \Sigma fx \div (8 + 12 + their\ 14 + their\ 22 + 14 + 10)$ or $\Sigma fx \div 80$
3(c)(iii)	$\frac{35}{69}$ oe	3	M2 for $[2] \left(\frac{10}{24} \times \frac{14}{23} \right)$ oe or M1 for $\frac{10}{24}$ or $\frac{14}{24}$ oe seen If 0 scored, SC1 for answer $\frac{35}{72}$ oe
4(a)(i)	$\frac{10}{3}$ or $3\frac{1}{3}$ or 3.33[3...]	3	M1 for $42 - 12x = 3x - 8$ oe or for $7 - 2x = \frac{3x}{6} - \frac{8}{6}$ oe M1 for reaching $ax = b$ correctly FT <i>their</i> first step
4(a)(ii)	-2.5 or $-2\frac{1}{2}$ or $-\frac{5}{2}$	3	M1 for $3 \times 2x = 2(x - 5)$ oe M1 for reaching $ax = b$ correctly FT <i>their</i> first step

Question	Answer	Marks	Partial Marks
4(b)(i)	$2(x + 12y)(x - 12y)$ final answer	3	B2 for $(2x + 24y)(x - 12y)$ or $(2x - 24y)(x + 12y)$ or for $2(x + 12y)(x - 12y)$ seen OR M2 for $k(x + 12y)(x - 12y)$ or M1 for $2(x^2 - 144y^2)$
4(b)(ii)	$(5x - 8)(x + 5)$ final answer	2	M1 for $5x(x + 5) - 8(x + 5)$ or $x(5x - 8) + 5(5x - 8)$ or for $(5x + a)(x + b)$ where $ab = -40$ or $a + 5b = 17$
4(c)	$4x^2 - 17x + 9 [= 0]$ oe	B1	
	$\frac{[- -]17 \pm \sqrt{([- -]17)^2 - 4(4)(9)}}{2 \times 4}$	B2	FT their 3 term quadratic B1FT for $\sqrt{([- -]17)^2 - 4(4)(9)}$ or better or $\left(x - \frac{17}{8}\right)^2$ oe or $\sqrt{\frac{([- -]17)^2 - 4(4)(9)}{4}}$ or better and B1FT for $\frac{[- -]17 + \sqrt{q}}{2(4)}$ or $\frac{[- -]17 - \sqrt{q}}{2(4)}$ or better or $\frac{17}{8} + \sqrt{\frac{145}{64}}$ oe or $\frac{17}{8} - \sqrt{\frac{145}{64}}$ oe or $\frac{[- -]17}{2} + \sqrt{q}$ or $\frac{[- -]17}{2} - \sqrt{q}$ 4 4
	0.62 and 3.63 cao	B2	B1 for each SC1 for 0.6[0] or 0.619 to 0.620 and 3.6[0] or 3.6301 to 3.6302 or 0.62 and 3.63 seen in working or -0.62 and -3.63 as final answers
5(a)(i)	62 and Angle at centre is twice angle at circumference oe	2	B1 for either
5(a)(ii)	117 and Isosceles [triangle] and Opposite angles in a cyclic quadrilateral are supplementary	4	B2 for 117 or B1 for [angle $OCD =$] 28 B1dep for isosceles [triangle] and B1 for opposite angles in a cyclic quadrilateral are supplementary

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Question	Answer	Marks	Partial Marks
5(b)	24.9 or 24.94 to 24.95	5	B1 for angle $PQS = 42$ M2 for $QS = 5.9 \div \cos 42$ oe or M1 for $\cos 42 = \frac{5.9}{QS}$ oe M1dep for <i>their</i> $SQ \times \pi$ oe
6(a)(i)	9.5, 4.8 and 8.5	3	B1 for each
6(a)(ii)	correct curve	5	B4 for correct curve, but branches joined or touching y axis or B3FT for 9 or 10 correct plots or B2FT for 7 or 8 correct plots or B1FT for 5 or 6 correct plots AND B1 indep two separate branches not touching or cutting y-axis
6(b)	$y = \frac{24}{5} - 2x$ ruled and – 0.4 to – 0.2 and 1.45 to 1.7	4	B2 for correct ruled line crossing curve twice or B1 for correct freehand or for short ruled line or for line with negative gradient through (0, 4.8) or for line with gradient – 2 B1 for each value
6(c)	$[a =] 10$ $[b =] 20$ $[c =] -48$	4	B3 for $10x^3 - 15 = 48x - 20x^2$ oe or better or B2 for 2 correct values or B1 for 1 correct value or for $5x^2 - \frac{15}{2x} = 24 - 10x$ or better or for $2x^3 - 3 = \frac{48}{5}x - 4x^2$ or better or for $x^3 - \frac{3}{2} = \frac{24}{5}x - 2x^2$ After 0 scored SC1 for correct elimination of a denominator of 5, x or 2x from a four term expression.
7(a)(i)(a)	Shape at (–2, 1) (–4, 1) (–4, 7) (0, 7)	2	B1 for 3 correct points or for enlargement SF2 from any centre
7(a)(i)(b)	Shape at (2, –2) (2, –3) (5, –1) (5, –3)	3	B2 for correct orientation but wrong position or for 3 correct points or B1 for $y = x - 1$ drawn

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Question	Answer	Marks	Partial Marks
7(a)(ii)	Rotation 90 [anticlockwise] oe (0, 0) oe	3	B1 for each
7(b)	$\frac{3}{4}\mathbf{p} + \frac{1}{2}\mathbf{q}$ or $\frac{1}{4}(3\mathbf{p} + 2\mathbf{q})$ or $\frac{3\mathbf{p} + 2\mathbf{q}}{4}$ final answer	3	M2 for $AM = \overrightarrow{AM} = \frac{1}{2}\left(-\mathbf{p} + \mathbf{q} + \frac{1}{2}\mathbf{p}\right)$ oe or M1 for correct route for $\overrightarrow{AB}$ oe soi by $-\frac{1}{2}\mathbf{p} + \mathbf{q}$ or for $\overrightarrow{OM}$ soi
8(a)(i)	1.6 oe	2	M1 for $3 - 5x = -5$
8(a)(ii)	$\frac{3-x}{5}$ oe final answer	2	M1 for $x = 3 - 5y$ or $\frac{y}{5} = \frac{3}{5} - x$ or better, or $y - 3 = -5x$ oe
8(b)(i)	$20.25 - (1.5 + x)^2$	3	Method 1 B1 for $(\pm 1.5 \pm x)^2$ seen B1 for [b =] 18 + <i>their</i> 1.5 ² OR Method 2 B1 for $b - a^2 - 2ax - x^2$ or for b = 20.25 B1 for a = 1.5
8(b)(ii)	Correct sketch with max in correct quadrant at (-1.5, 20.25)	3	FT <i>their</i> $20.25 - (\text{their } 1.5 + x)^2$ provided in that form B1 for $\cap$ shape or for $\cup$ shape if in form $c + (d + x)^2$ in part (b)(i) B1 for TP at (-1.5, k) or (k, 20.25) FT <i>their</i> $20.25 \pm (\text{their } 1.5 + x)^2$ or for (-1.5, 20.25) seen
8(b)(iii)	[y =] 34 - 11x	6	B2 for $-3 - 2x$ or B1 for either $kx - 3$, $k \neq 0$ or $-2x + n$ or for $18 - 3 - 2x$ M1dep for gradient = <i>their</i> $(-3 - 2(4))$ B1 for y-value at x = 4, is -10 M1dep for <i>their</i> $-10 = (\text{their } -11)4 + c$ oe

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Question	Answer	Marks	Partial Marks
9(a)	3.5 oe	3	M1 for $2(x + x + 3) = 20$ oe M1 for correct $ax = b$ for <i>their</i> linear equation
9(b)	116.8 or 116.83 to 116.85 nfw	5	M2 for $\sin p = \frac{5 \sin 20}{2.5}$ or M1 for $\frac{2.5}{\sin 20} = \frac{5}{\sin p}$ A1 for 43.2 or 43.15 to 43.17 M1dep for $180 - (20 + \text{their } 43.2)$ After 0 scored, SC1 for length of side = 5
9(c)	5.07 or 5.068 to 5.071	6	B3 for 7.41 or 7.412 to 7.413 or M2 for $r + r + \frac{40}{360} \times 2 \times \pi \times r = 20$ oe or M1 for $\frac{40}{360} \times 2 \times \pi \times r$ oe seen M2 for $2 \times 7.41 \times \sin 20$ oe or $7.41^2 + 7.41^2 - 2(7.41^2) \cos 40$ oe or $\frac{7.41 \sin 40}{\sin 70}$ oe or M1 for implicit version



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MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2021

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) Malena has 450 fruit trees.
The fruit trees are in the ratio apple : pear : plum = 8 : 7 : 3.

(i) Show that Malena has 200 apple trees.

[2]

(ii) Find the number of plum trees.

..... [1]

(iii) Malena wants to increase the number of pear trees by 32%.

Calculate the number of extra pear trees she needs.

..... [2]

(iv) Each apple tree produces 48.5 kg of apples.
The apples have an average mass of 165 g each.

Calculate the total number of apples produced by the 200 trees.
Give your answer correct to the nearest 1000 apples.

..... [3]

(b) Malena's land is valued at three million and seventy-five thousand dollars.

(i) Write this number in figures.

..... [1]

(ii) Write your answer to **part (b)(i)** in standard form.

..... [1]

(c) In 2020, each plum tree produced 37.7 kg of plums.
This was 16% more than in 2019.

Calculate the mass of plums produced by each plum tree in 2019.

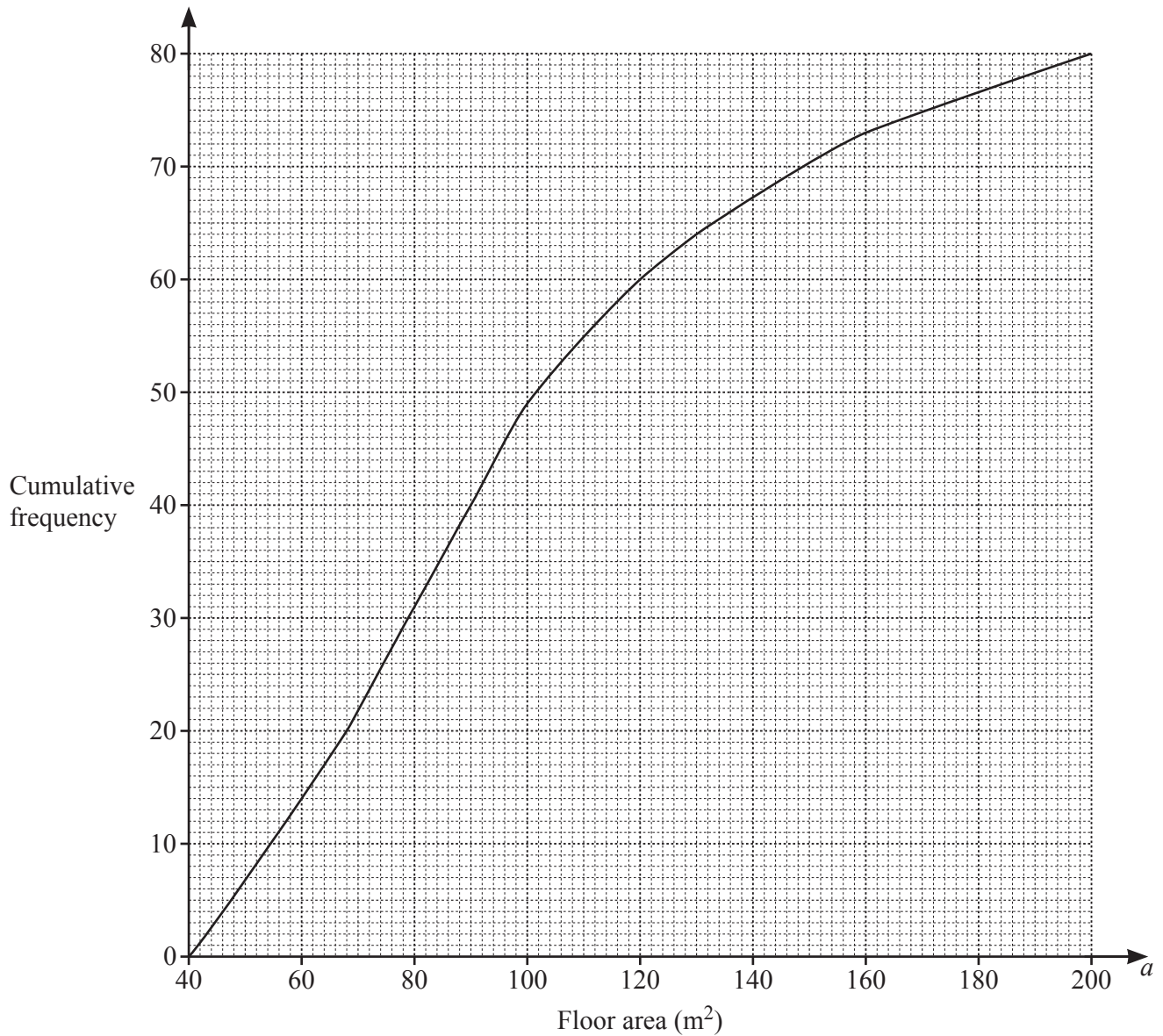
..... kg [2]

(d) Malena invests \$1800 at a rate of 2.1% per year compound interest.

Calculate the value of her investment at the end of 15 years.

\$ [2]

- 2 (a) The cumulative frequency diagram shows information about the floor area, $a \text{ m}^2$, of each of 80 houses.



Use the diagram to find an estimate of

- (i) the median, ... m^2 [1]
- (ii) the lower quartile, ... m^2 [1]
- (iii) the interquartile range, ... m^2 [1]
- (iv) the number of houses with a floor area greater than 120 m^2 .

..... [2]

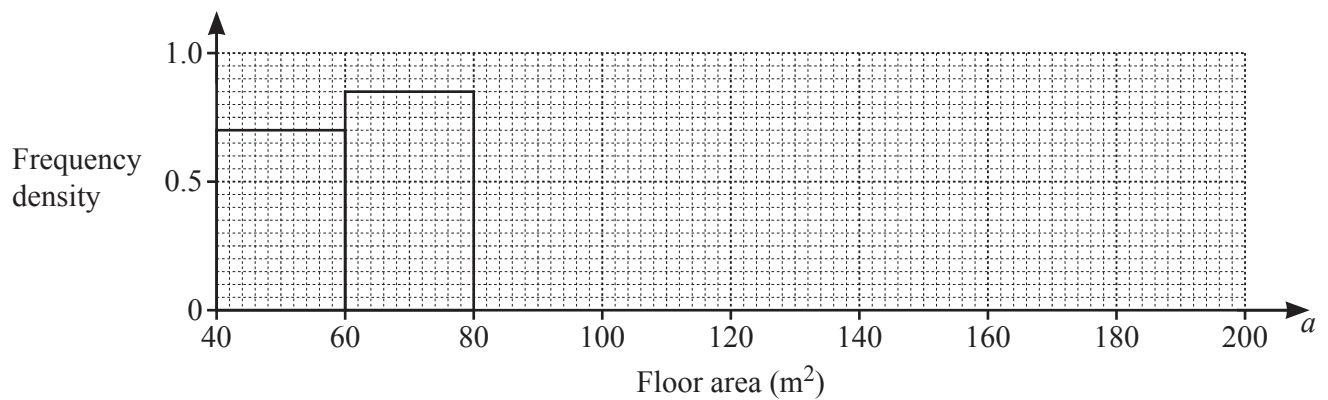
(b) The information about the 80 floor areas is shown in this frequency table.

Floor area ($a \text{ m}^2$)	$40 < a \leq 60$	$60 < a \leq 80$	$80 < a \leq 100$	$100 < a \leq 130$	$130 < a \leq 160$	$160 < a \leq 200$
Frequency	14	17	18	15	9	7

(i) Calculate an estimate of the mean floor area.

..... m^2 [4]

(ii) Complete the histogram to show the information in the frequency table.



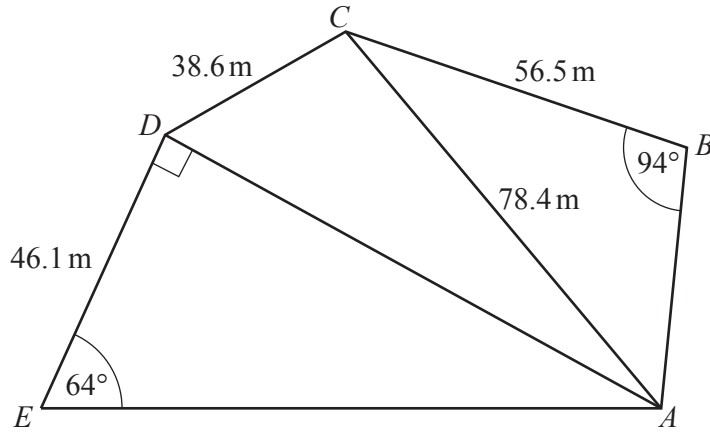
[4]

(iii) Two of the houses are picked at random.

Find the probability that one of the houses has a floor area greater than 130 m^2 and the other has a floor area 60 m^2 or less.

..... [3]

3 (a)



NOT TO
SCALE

$ABCDE$ is a pentagon.

- (i) Calculate AD and show that it rounds to 94.5 m, correct to 1 decimal place.

[2]

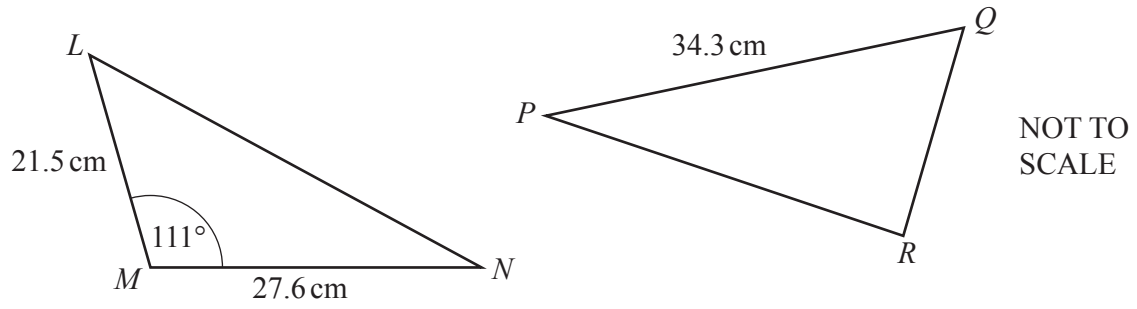
- (ii) Calculate angle BAC .

Angle $BAC = \dots\dots\dots$ [3]

- (iii) Calculate the largest angle in triangle CAD .

$\dots\dots\dots$ [4]

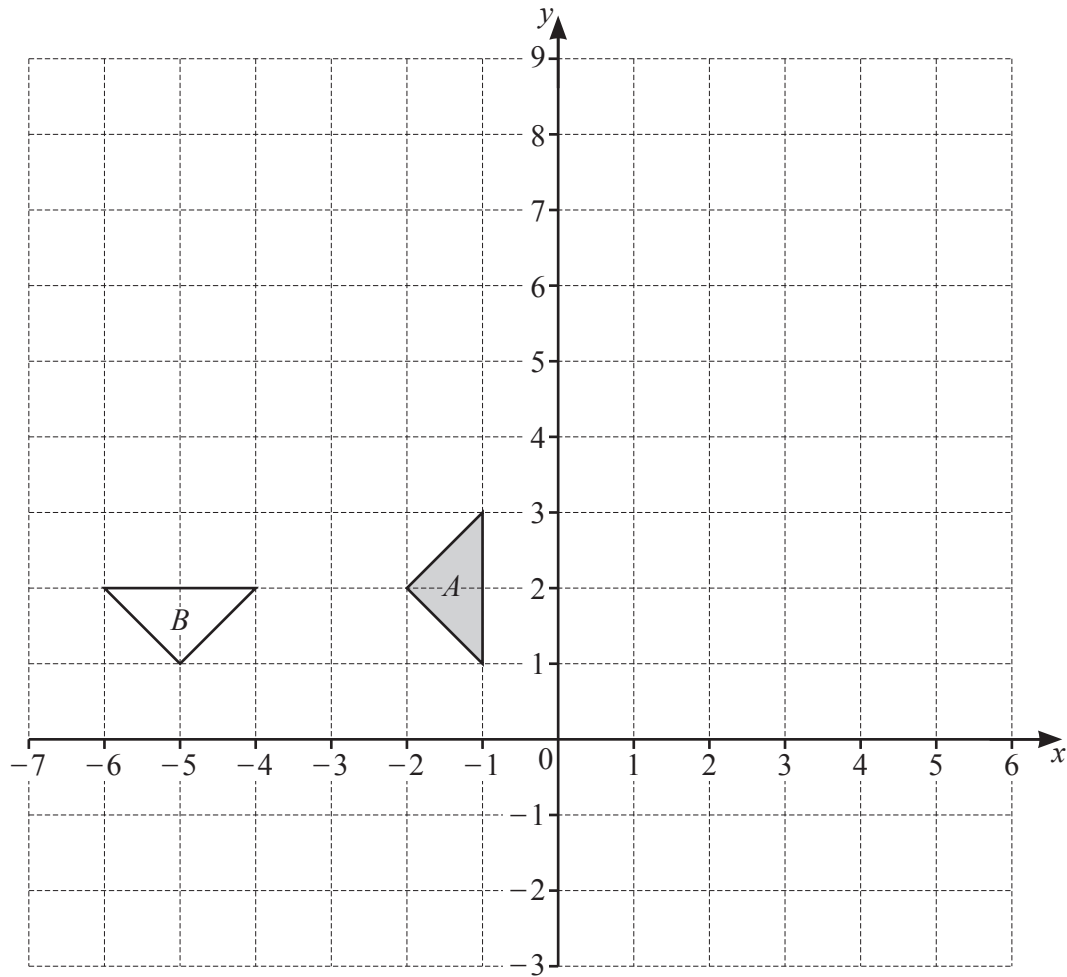
(b)



Triangle PQR has the same area as triangle LMN .

Calculate the shortest distance from R to the line PQ .

..... cm [3]



(a) On the grid, draw the image of triangle A after

(i) a translation by the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$, [2]

(ii) a reflection in the line $x = 1$, [2]

(iii) an enlargement, scale factor 2 and centre $(-5, -2)$. [2]

(b) Describe fully the **single** transformation that maps triangle A onto triangle B .

.....

..... [3]

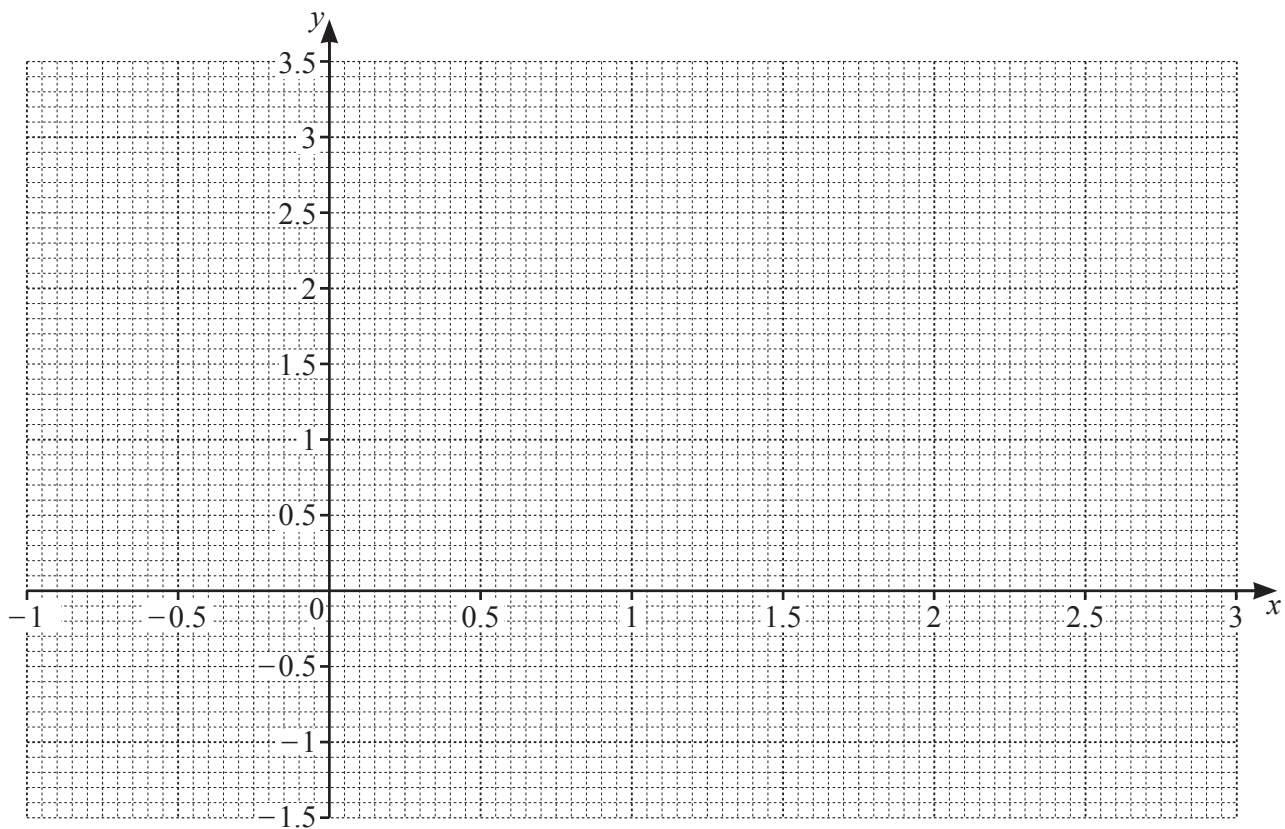
- 5 The table shows some values for $y = x^3 - 3x^2 + 3$.

x	-1	-0.5	0	0.5	1	1.5	2	2.5	3
y		2.125	3	2.375	1		-1	-0.125	

- (a) Complete the table.

[3]

- (b) On the grid, draw the graph of $y = x^3 - 3x^2 + 3$ for $-1 \leq x \leq 3$.



[4]

- (c) By drawing a suitable straight line on the grid, solve the equation $x^3 - 3x^2 + x + 1 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

6 (a) Solve.

(i) $4(2x - 3) = 24$

$x = \dots\dots\dots$ [3]

(ii) $6x + 14 > 6$

$\dots\dots\dots$ [2]

(b) Rearrange the formula $V = 2x^3 - 3y^3$ to make y the subject.

$y = \dots\dots\dots$ [3]

(c) Show that $(2n - 5)^2 - 13$ is a multiple of 4 for all integer values of n .

[3]

(d) The expression $5 + 12x - 2x^2$ can be written in the form $q - 2(x + p)^2$.

(i) Find the value of p and the value of q .

$p = \dots\dots\dots$, $q = \dots\dots\dots$ [3]

(ii) Write down the coordinates of the maximum point of the curve $y = 5 + 12x - 2x^2$.

($\dots\dots\dots$, $\dots\dots\dots$) [1]

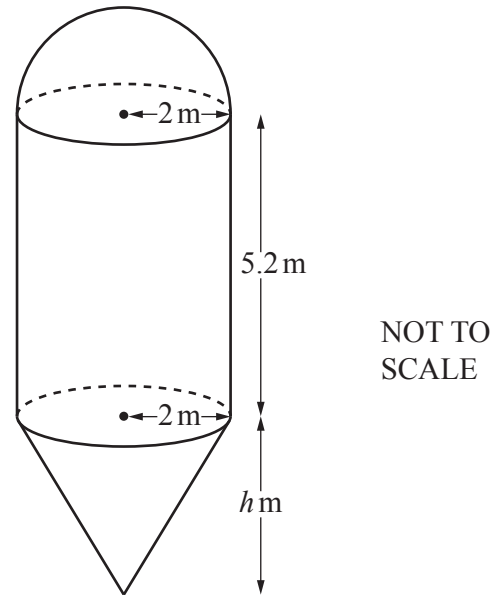
(e) The energy of a moving object is directly proportional to the square of its speed.
The speed of the object is increased by 30%.

Calculate the percentage increase in the energy of the object.

$\dots\dots\dots$ % [2]

- 7 (a) The diagram shows a container for storing grain.

The container is made from a hemisphere, a cylinder and a cone, each with radius 2 m. The height of the cylinder is 5.2 m and the height of the cone is h m.



- (i) Calculate the volume of the hemisphere.
Give your answer as a multiple of π .

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... m^3 [2]

- (ii) The total volume of the container is $\frac{88\pi}{3} \text{ m}^3$.

Calculate the value of h .

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

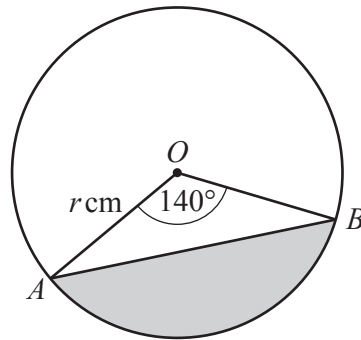
$h =$ [4]

- (iii) The container is full of grain.
Grain is removed from the container at a rate of 35 000 kg per hour.
 1 m^3 of grain has a mass of 620 kg.

Calculate the time taken to empty the container.
Give your answer in hours and minutes.

..... h min [3]

(b)



NOT TO
SCALE

A and B are points on a circle, centre O , radius r cm.
The area of the shaded segment is 65 cm^2 .

Calculate the value of r .

$r =$ [4]

- 8 (a) Kaito runs along a 12 km path at an average speed of x km/h.

- (i) Write down an expression, in terms of x , for the number of hours he takes.

..... hours [1]

- (ii) Yuki takes 1.5 hours longer to walk along the same path as Kaito.
She walks at an average speed of $(x - 4)$ km/h.

Write down an equation, in terms of x , and show that it simplifies to $x^2 - 4x - 32 = 0$.

[4]

- (iii) Solve by factorisation.

$$x^2 - 4x - 32 = 0$$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

- (iv) Find the number of hours it takes Yuki to walk along the 12 km path.

..... hours [2]

15

- (b) A bus travels 440 km, correct to the nearest 10 km.
The time taken to complete the journey is 6 hours, correct to the nearest half hour.

Calculate the lower bound of the speed of the bus.

..... km/h [3]

- 9 (a) F is the point $(5, -2)$ and $\overrightarrow{FG} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$.

Find

- (i) the coordinates of point G ,

(....., ...) [1]

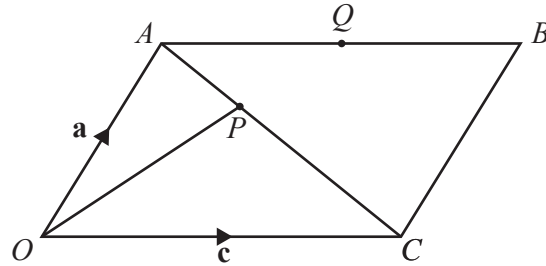
- (ii) $5\overrightarrow{FG}$,

$\begin{pmatrix} \\ \end{pmatrix}$ [1]

- (iii) $|\overrightarrow{FG}|$.

..... [2]

(b)



NOT TO
SCALE

$OABC$ is a parallelogram.

P is a point on AC and Q is the midpoint of AB .

$\vec{OA} = \mathbf{a}$ and $\vec{OC} = \mathbf{c}$.

(i) Find, in terms of $\mathbf{a}$ and/or $\mathbf{c}$

(a) $\vec{AQ}$,

$$\vec{AQ} = \dots\dots\dots [1]$$

(b) $\vec{OQ}$.

$$\vec{OQ} = \dots\dots\dots [1]$$

(ii) $\vec{OP} = \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}$

(a) Show that O , P and Q lie on a straight line.

[2]

(b) Write down the ratio $OP : OQ$.
Give your answer in the form $1 : n$.

$$1 : \dots\dots\dots [1]$$

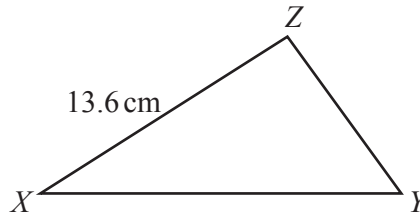
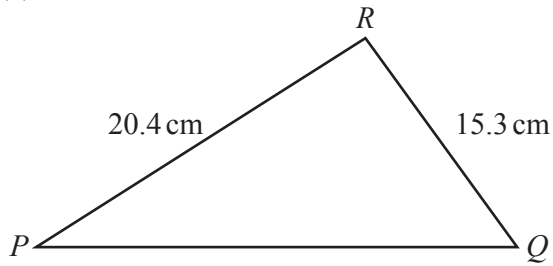
- 10 (a) Find the coordinates of the turning points of the graph of $y = x^3 - 12x + 6$.
You must show all your working.

(..... , ...) and (..... , ...) [5]

- (b) Determine whether each turning point is a maximum or a minimum.
Show how you decide.

[3]

11 (a)



NOT TO
SCALE

Triangle PQR is mathematically similar to triangle XYZ .

(i) Find YZ .

$YZ = \dots\dots\dots$ cm [2]

(ii) The area of triangle XYZ is 63.6 cm^2 .

Calculate the area of triangle PQR .

$\dots\dots\dots \text{ cm}^2$ [3]

(b) Two containers are mathematically similar.

The larger container has a capacity of 64.8 litres and a surface area of 0.792 m^2 .

The smaller container has a capacity of 37.5 litres.

Calculate the surface area of the smaller container.

$\dots\dots\dots \text{ m}^2$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **10** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$\frac{450}{8+7+3} \times 8$ oe	2	M1 for $\frac{450}{8+7+3}$
1(a)(ii)	75	1	
1(a)(iii)	56	2	M1 for $\frac{32}{100} \times (450 - 200 - \text{their } 75)$ oe or $\frac{32}{100} \times \frac{450}{8+7+3} \times 7$ oe If 0 scored, SC1 for answer 231
1(a)(iv)	59 000 nfw	3	B2 for 58 600 to 58 800 or B1 for 293 to 294 or M1 for $\frac{\text{figs } 485 \times 200}{165}$ oe If 0 scored, SC1 for <i>their</i> more accurate answer seen and rounded to the nearest 1000
1(b)(i)	3 075 000	1	
1(b)(ii)	3.075×10^6	1	FT <i>their</i> (b)(i)
1(c)	32.5	2	M1 for $x \times \left(1 + \frac{16}{100}\right) = 37.7$ or better
1(d)	2460 or 2458. ...	2	M1 for $1800 \left(1 + \frac{2.1}{100}\right)^{15}$ oe
2(a)(i)	90	1	
2(a)(ii)	68	1	
2(a)(iii)	52	1	FT 120 – <i>their</i> (a)(ii)
2(a)(iv)	20	2	B1 for 60 in working or as answer
2(b)(i)	97.5	4	M1 for mid-points soi (50, 70, 90, 115, 145, 180) M1 for use of Σfm with m in correct interval including both boundaries M1 for (dep on 2nd M1) for $\Sigma fm \div 80$
2(b)(ii)	Bars with heights 0.9, 0.5, 0.3, 0.175 and with correct widths	4	B1 for each correct bar If 0 scored, SC1 for 3 or 4 correct frequency densities

Question	Answer	Marks	Partial Marks
2(b)(iii)	$\frac{28}{395}$ oe	3	M2 for $[2 \times] \frac{16}{80} \times \frac{14}{79}$ oe or M1 for $\frac{16}{80}$ or $\frac{16}{79}$ oe or $\frac{14}{80}$ oe or $\frac{14}{79}$ oe seen If 0 scored, SC1 for answer $\frac{7}{100}$ oe
3(a)(i)	$\frac{AD}{46.1} = \tan 64$ oe or better	M1	
	94.51 to 94.52	A1	
3(a)(ii)	46[.0] or 45.96... nfw	3	M2 for $56.5 \times \frac{\sin 94}{78.4}$ oe or M1 for $\frac{56.5}{\sin BAC} = \frac{78.4}{\sin 94}$ oe
3(a)(iii)	102.3 or 102.4 or 102.34 to 102.38	4	M2 for $[\cos C =] \frac{38.6^2 + 78.4^2 - 94.5^2}{2 \times 38.6 \times 78.4}$ or M1 for $94.5^2 = 38.6^2 + 78.4^2 - 2 \times 38.6 \times 78.4 \times \cos C$ and A1 for -0.214 or -0.2144 to -0.2137 If 0 scored, SC2 for $[CAD =] 23.5$ or 23.51 to 23.52 or for $[CDA =] 54.1$ or $54.14...$
3(b)	16.2 or 16.15...	3	M2 for $\frac{1}{2} \times 21.5 \times 27.6 \sin 111 = \frac{1}{2} \times 34.3 \times d$ oe or M1 for $\frac{1}{2} \times 21.5 \times 27.6 \sin 111$ seen or $\frac{1}{2} \times 34.3 \times d$ oe soi
4(a)(i)	Image at $(-5, 6)$ $(-5, 8)$ $(-6, 7)$	2	B1 for translation by $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 5 \end{pmatrix}$
4(a)(ii)	Image at $(3, 1)$ $(3, 3)$ $(4, 2)$	2	B1 for reflection in $y = 1$ or $x = k$
4(a)(iii)	Image at $(3, 4)$ $(3, 8)$ $(1, 6)$	2	B1 for enlargement, sf 2, in wrong position
4(b)	Rotation 90° [anticlockwise] oe $(-3, 0)$	3	B1 for each

Question	Answer	Marks	Partial Marks
5(a)	$-1, -0.375, 3$	3	B1 for each
5(b)	Correct graph	4	B3FT for 8 or 9 correct points or B2FT for 6 or 7 correct points or B1FT for 4 or 5 correct points
5(c)	$y = 2 - x$ ruled correctly AND -0.45 to -0.35 1 2.35 to 2.45	4	B2 for $y = 2 - x$ ruled or B1 for $[y =] 2 - x$ soi or $y = k - x$ ruled or $y = kx + 2$ ruled, but not $y = 2$ B2 for all three values or B1 for any two values
6(a)(i)	$4.5, 4\frac{1}{2}$ or $\frac{9}{2}$	3	M1 for $8x - 12 = 24$ or $2x - 3 = 6$ M1 for reaching $ax = b$ correctly FT <i>their</i> first step
6(a)(ii)	$x > -\frac{4}{3}$ or $x > -1\frac{1}{3}$ final answer	2	M1 for $6x > 6 - 14$ or $x + \frac{14}{6} > 1$
6(b)	$[y =] \sqrt[3]{\frac{2x^3 - V}{3}}$ oe final answer	3	M1 for isolating term in y M1 for division by 3 or FT <i>their</i> first step M1 for cube root or FT <i>their</i> previous step to the final answer
6(c)	$4n^2 - 20n + 12$	M2	B1 for $4n^2 - 10n - 10n + 25$
	$4(n^2 - 5n + 3)$ or correct explanation linked to expression	A1	with no errors seen e.g. 4, $[-]20$ and 12 are all multiples of 4 or divides each term or each coefficient by 4
6(d)(i)	$p = -3$ and $q = 23$	3	B2 for $23 - 2(x - 3)^2$ OR M1 for $[q] - 2x^2 - 4px - 2p^2$ or $-2(x - 3)^2$ seen B1 for either $p = -3$ or $q = 23$ or FT $q = 5 + 2(\text{their } p)^2$
6(d)(ii)	$(3, 23)$	1	FT <i>their</i> (d)(i)
6(e)	69	2	M1 for figs 13^2 oe
7(a)(i)	$\frac{16\pi}{3}$ or $5\frac{1}{3}\pi$ final answer	2	M1 for $\frac{1}{2} \times \frac{4}{3}\pi \times 2^3$ oe

Question	Answer	Marks	Partial Marks
7(a)(ii)	2.4[0]	4	B3 for answer in range 2.396... to 2.40... OR M3 for <i>their</i> $\frac{16\pi}{3} + \pi \times 2^2 \times 5.2 +$ $\frac{1}{3}\pi \times 2^2 \times h = \frac{88\pi}{3}$ oe or M2 for $\frac{88\pi}{3} - \text{their } \frac{16\pi}{3} - \pi \times 2^2 \times 5.2$ oe or M1 for $\pi \times 2^2 \times 5.2$ oe or $\frac{1}{3}\pi \times 2^2 \times h$ oe soi
7(a)(iii)	1 hour 38 min or 1 hour 37.8 min to 1 hour 37.9... min	3	B2 for 1.63[2...] or 98 [mins] or 97.8 to 97.9...] or M1 for $\frac{88\pi}{3} \times 620$ $\frac{3}{35000}$ [$\times 60$] oe
7(b)	8.5[0] or 8.496 to 8.497	4	M3 for $[r=] \sqrt{\frac{65}{\frac{140}{360}\pi - \frac{1}{2}\sin 140}}$ oe or M2 for $\frac{140}{360}\pi \times r^2 - \frac{1}{2}r^2 \times \sin 140 [=65]$ oe or M1 for either area expression seen
8(a)(i)	$\frac{12}{x}$ or $12 \div x$ final answer	1	
8(a)(ii)	$\frac{12}{x-4} - \text{their } \frac{12}{x} = 1.5$ oe	M1	Accept 3 or more term equivalents
	$12x - 12(x-4) = 1.5x(x-4)$ or $\frac{12x - 12(x-4)}{x(x-4)} [= 1.5]$	M1	Correctly clearing fractions, or correctly collecting into a 'single fraction' FT <i>their</i> expression dep on two fractions both with algebraic denominators
	$12x - 12x + 48 = 1.5x^2 - 6x$	M1	Correctly multiplying <i>their</i> two sets of brackets FT <i>their</i> expression dep on two fractions both with algebraic denominators or first M1 given
	$[1.5x^2 - 6x - 48 = 0]$ $x^2 - 4x - 32 = 0$	A1	One further step either 3 term equation or division throughout by 1.5 leading to solution With no errors or omissions seen, dep on M3

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Question	Answer	Marks	Partial Marks
8(a)(iii)	$(x + 4)(x - 8)$	M2	M1 for $(x + a)(x + b)$ where $ab = -32$ or $a + b = -4$ or for $x(x + 4) - 8(x + 4)$ or $x(x - 8) + 4(x - 8)$
	-4 and 8	B1	
8(a)(iv)	3	2	FT $\frac{12}{\text{their } 8 - 4}$ M1 for $\frac{12}{\text{their } 8 - 4}$ or $\frac{12}{\text{their } 8} + 1.5$ oe or for answer $\frac{12}{\text{their } 8}$
8(b)	69.6	3	M2 for $\frac{430 \text{ to } 440}{6 + 0.25}$ or $\frac{440 - 5}{6 \text{ to } 6.5}$ oe or M1 for $440 + 5$ oe or $440 - 5$ oe or $6 + 0.25$ oe or $6 - 0.25$ oe seen
9(a)(i)	(3, 1)	1	
9(a)(ii)	$\begin{pmatrix} -10 \\ 15 \end{pmatrix}$	1	
9(a)(iii)	3.61 or 3.605 to 3.606	2	M1 for $(-2)^2 + 3^2$ oe
9(b)(i)(a)	$\frac{1}{2} \mathbf{c}$	1	
9(b)(i)(b)	$\mathbf{a} + \frac{1}{2} \mathbf{c}$ oe	1	FT $\mathbf{a} + \text{their (b)(i)(a)}$

Question	Answer	Marks	Partial Marks
9(b)(ii)(a)	$\overrightarrow{OP} = \frac{1}{3}(2\mathbf{a} + \mathbf{c})$ oe and $\overrightarrow{OQ} = \frac{1}{2}(2\mathbf{a} + \mathbf{c})$ oe OR $\overrightarrow{OP} = \frac{2}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ OR $\overrightarrow{PQ} = \frac{1}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ and correct comment e.g. have the same base vector or that they are multiples of one another and they share a common point OR e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$	2	B1 for $\overrightarrow{OP}$ or $\overrightarrow{PQ}$ factorised or for correct multiplicative statement on relationship without factorised vectors e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $\frac{2}{3}\overrightarrow{OQ} = \overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$, $1.5\left(\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}\right) = \mathbf{a} + \frac{1}{2}\mathbf{c}$
9(b)(ii)(b)	1.5 oe	1	
10(a)	(2, -10) and (-2, 22)	5	B2 for $3x^2 - 12$ isw or B1 for $3x^2 + k$ or $px^2 - 12$ ($p \neq 0$) or for $3x^2 - 12 + 6$ isw M1 for setting <i>their</i> derivative = 0 or $\frac{dy}{dx} = 0$ B1 for $x = \pm 2$ or for one correct coordinate pair
10(b)	(2, -10) minimum with correct reason or sketch (-2, 22) maximum with correct reason or sketch	3	B2 for 1 correct with correct reasoning or B2FT for correct evaluation with correct 2nd derivative for both of <i>their</i> different x values or M1 for showing [2nd derivative =] $6x$ or gradients for one value on either side of one correct stationary point or for reasonable sketch of cubic
11(a)(i)	10.2	2	M1 for $\frac{YZ}{13.6} = \frac{15.3}{20.4}$ oe or better

Question	Answer	Marks	Partial Marks
11(a)(ii)	143.1	3	M2 for $\left(\frac{20.4}{13.6}\right)^2 \times 63.6$ oe or M1 for $\left(\frac{20.4}{13.6}\right)^2$ or $\left(\frac{13.6}{20.4}\right)^2$ oe Alt method M2 for $\frac{1}{2} \times 20.4 \times 15.3 \times \sin R$ where R is $\sin^{-1}\left(\frac{63.6}{0.5 \times 13.6 \times \text{their(a)(i)}}\right)$ or M1 for $R = \sin^{-1}\left(\frac{63.6}{0.5 \times 13.6 \times \text{their(a)(i)}}\right)$
11(b)	0.55	3	M2 for [ratio of areas] = $\left(\sqrt[3]{\frac{37.5}{64.8}}\right)^2$ or $\left(\sqrt[3]{\frac{64.8}{37.5}}\right)^2$ oe or M1 for [ratio of lengths] = $\sqrt[3]{\frac{37.5}{64.8}}$ or $\sqrt[3]{\frac{64.8}{37.5}}$ oe or for $\left(\frac{0.792}{x}\right)^3 = \left(\frac{64.8}{37.5}\right)^2$ oe



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MATHEMATICS**0580/43**

Paper 4 (Extended)

October/November 2021**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

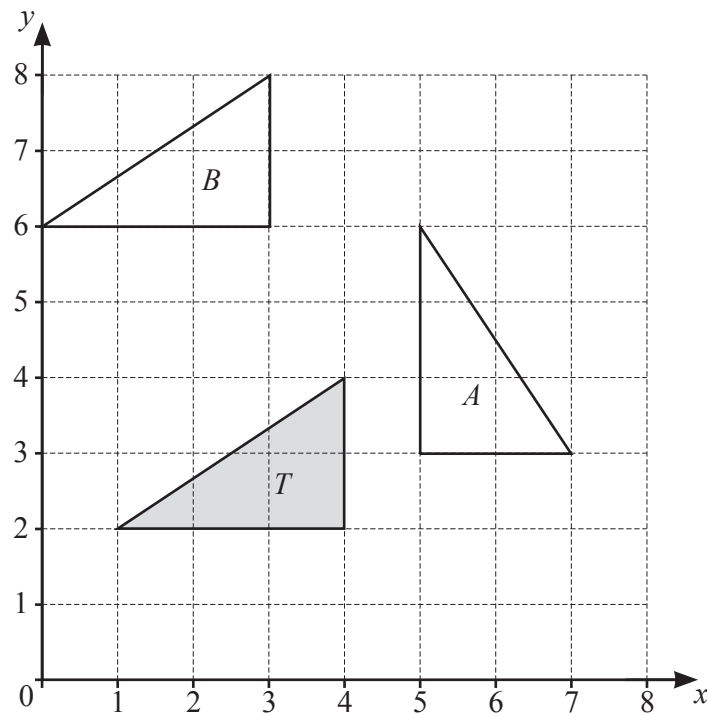
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 The diagram shows three triangles, T , A , and B , drawn on a 1 cm^2 grid.



- (a) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....
 [3]

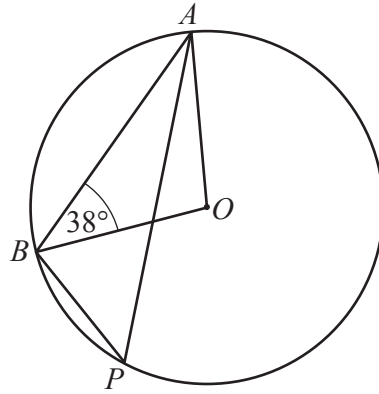
- (b) (i) Describe fully the **single** transformation that maps triangle T onto triangle B .

.....
 [2]

- (ii) Calculate the distance that each point of triangle T moves when it is mapped onto triangle B .

..... cm [2]

2 (a)



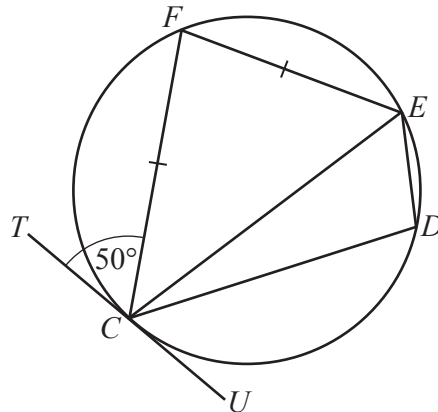
NOT TO
SCALE

A , B and P are points on a circle, centre O and angle $OBA = 38^\circ$.

Find angle APB .

Angle $APB = \dots\dots\dots$ [3]

(b)



NOT TO
SCALE

$CDEF$ is a cyclic quadrilateral and $FC = FE$.
 TU is a tangent to the circle at C and angle $TCF = 50^\circ$.

Find

(i) angle EFC ,

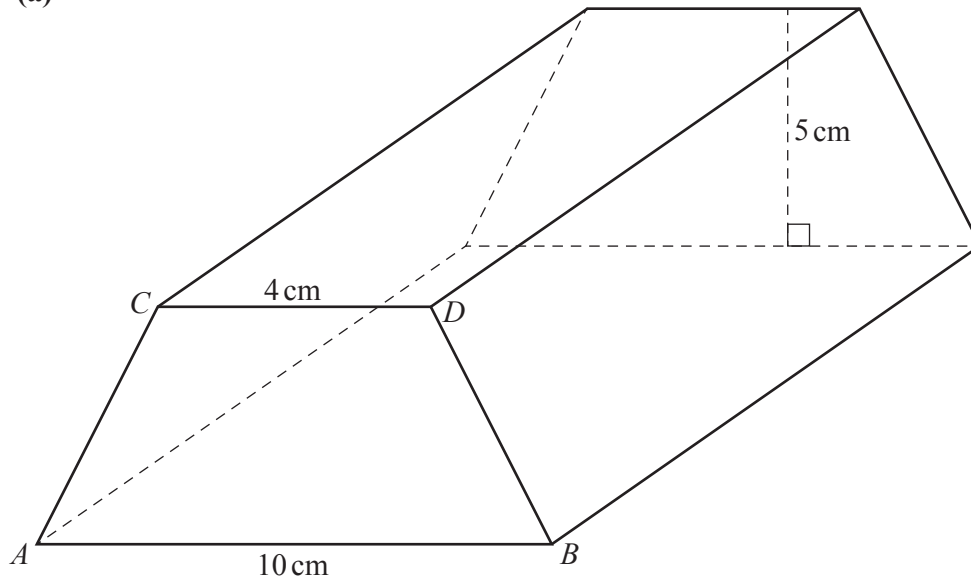
Angle $EFC = \dots\dots\dots$ [2]

(ii) angle CDE .

Angle $CDE = \dots\dots\dots$ [1]

4

3 (a)



NOT TO
SCALE

The diagram shows a prism.

The cross-section of the prism is a trapezium with CD parallel to AB and $AC = BD$.

$AB = 10\text{ cm}$, $CD = 4\text{ cm}$ and the height of the trapezium is 5 cm .

The volume of the prism is 525 cm^3 .

- (i) The prism is made of iron.
 1 cm^3 of iron has a mass of 7.8 g .

Calculate the mass of the prism.
 Give your answer in kilograms.

..... kg [2]

- (ii) Calculate the length of the prism.

..... cm [3]

- (iii) Calculate the total surface area of the prism.

..... cm^2 [6]

- (iv) In a mathematically similar prism, the height of the trapezium is 10 cm.

Calculate the volume of this prism.

..... cm^3 [3]

- (b) A cuboid measures 10 cm by 4 cm by 6 cm.
Each side is measured correct to the nearest centimetre.

Complete the inequality for the volume, V , of this cuboid.

..... $\text{cm}^3 \leq V < \dots \text{cm}^3$ [3]

- 4 (a) Solve the simultaneous equations.
You must show all your working.

$$2p - q = 7$$

$$3p + 2q = 7$$

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [3]$$

- (b) Solve the equation.

$$\frac{x}{4} + \frac{2x}{3} = 1$$

$$x = \dots\dots\dots [2]$$

- (c) $-8 < 3x - 2 \leq 7$

- (i) Solve the inequality.

$$\dots\dots\dots [3]$$

- (ii) Find the integer values of x that satisfy the inequality.

$$\dots\dots\dots [1]$$

(d) Factorise completely.

$$16a - 4a^2$$

..... [2]

(e) Write each of the following as a single fraction, in its simplest form.

(i) $\frac{1}{2a} \div \frac{3}{4b}$

..... [2]

(ii) $2 - \frac{x}{x-1}$

..... [2]

- 5 (a) \$500 is invested at a rate of 3% per year.

Calculate the total interest earned at the end of 7 years when

- (i) simple interest is paid,

\$ [2]

- (ii) compound interest is paid.

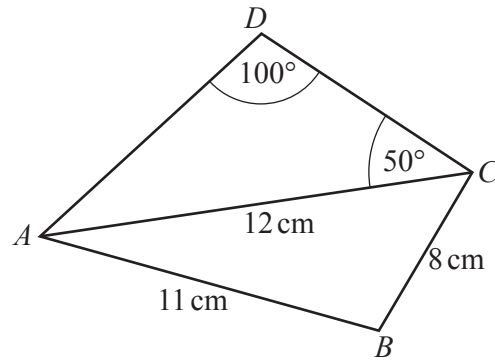
\$ [3]

- (b) The value of a car decreases exponentially by 10% each year.
The value now is \$6269.40 .

Calculate the value of the car 3 years ago.

\$ [3]

6



NOT TO
SCALE

- (a) Calculate AD .

$AD = \dots\dots\dots \text{ cm}$ [3]

- (b) Calculate angle BAC and show that it rounds to 40.42° , correct to 2 decimal places.

[4]

- (c) Calculate the area of the quadrilateral $ABCD$.

$\dots\dots\dots \text{ cm}^2$ [3]

- (d) Calculate the shortest distance from B to AC .

$\dots\dots\dots \text{ cm}$ [3]

- 7 (a) Amir buys 3 cakes that cost c cents each and 2 loaves of bread that cost $(2c - 11)$ cents each. He spends a total of \$5.87.

Find the value of c .

$$c = \dots\dots\dots [3]$$

- (b) A bottle of water costs \$ w .
A bottle of juice costs \$ $(w + 1)$.

Alex spends \$22 on bottles of water and \$42 on bottles of juice.
The number of bottles of water is equal to the number of bottles of juice.

Find the value of w .

$$w = \dots\dots\dots [3]$$

11

- (c) Alicia walks a distance of 9 km at a speed of x km/h.
She then runs a distance of 5 km at a speed of $(2x + 1)$ km/h.

The total time Alicia takes is 2.5 hours.

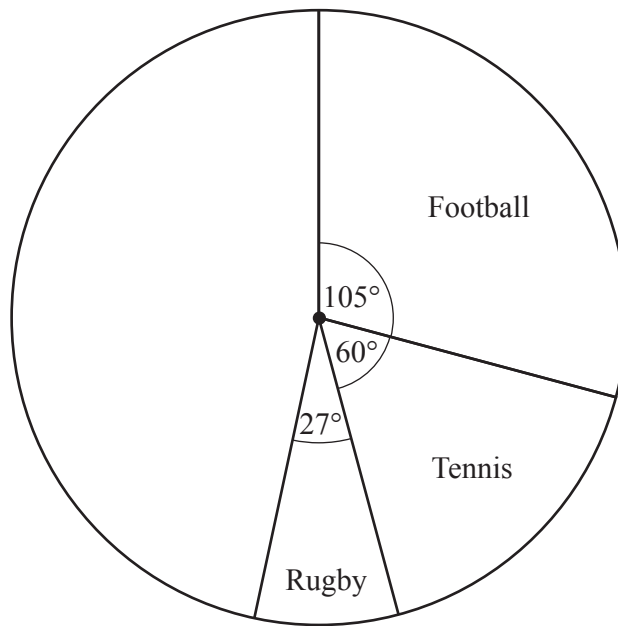
- (i) Show that $10x^2 - 41x - 18 = 0$.

[4]

- (ii) Work out Alicia's running speed.
You must show all your working.

..... km/h [4]

- 8 (a) Jean asks 600 people to choose their favourite sport.
The pie chart shows some of this information.



- (i) Show that 100 people choose tennis.

[1]

- (ii) Work out how many people choose rugby.

..... [2]

- (iii) 125 people choose cricket and the rest choose swimming.

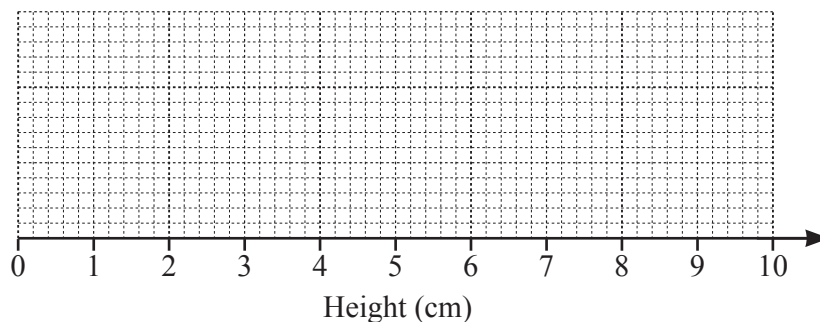
Complete the pie chart to show this information.

[2]

- (b) The heights of some plants are measured:

- smallest height = 0.6 cm
- range = 8.1 cm
- median = 5.2 cm
- lower quartile = 3.4 cm
- interquartile range = 4.1 cm.

On the grid, draw a box-and-whisker plot to show this information.



[3]

- (c) A dice is rolled 100 times.
The frequency table shows the results.

Score	1	2	3	4	5	6
Frequency	16	25	17	19	8	15

Find

- (i) the range,

..... [1]

- (ii) the mode,

..... [1]

- (iii) the median.

..... [1]

- (d) 50 students answer a mathematics question.
The table shows the time, t seconds, taken by each student to answer the question.

Time (t seconds)	$10 < t \leq 20$	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 50$	$50 < t \leq 80$
Frequency	2	8	12	16	12

Calculate an estimate of the mean.

..... s [4]

9 $f(x) = x(x-1)(x-2)$

(a) Find the coordinates of the points where the graph of $y = f(x)$ crosses the x -axis.

(..... , ...)

(..... , ...)

(..... , ...) [2]

(b) Show that $f(x) = x^3 - 3x^2 + 2x$.

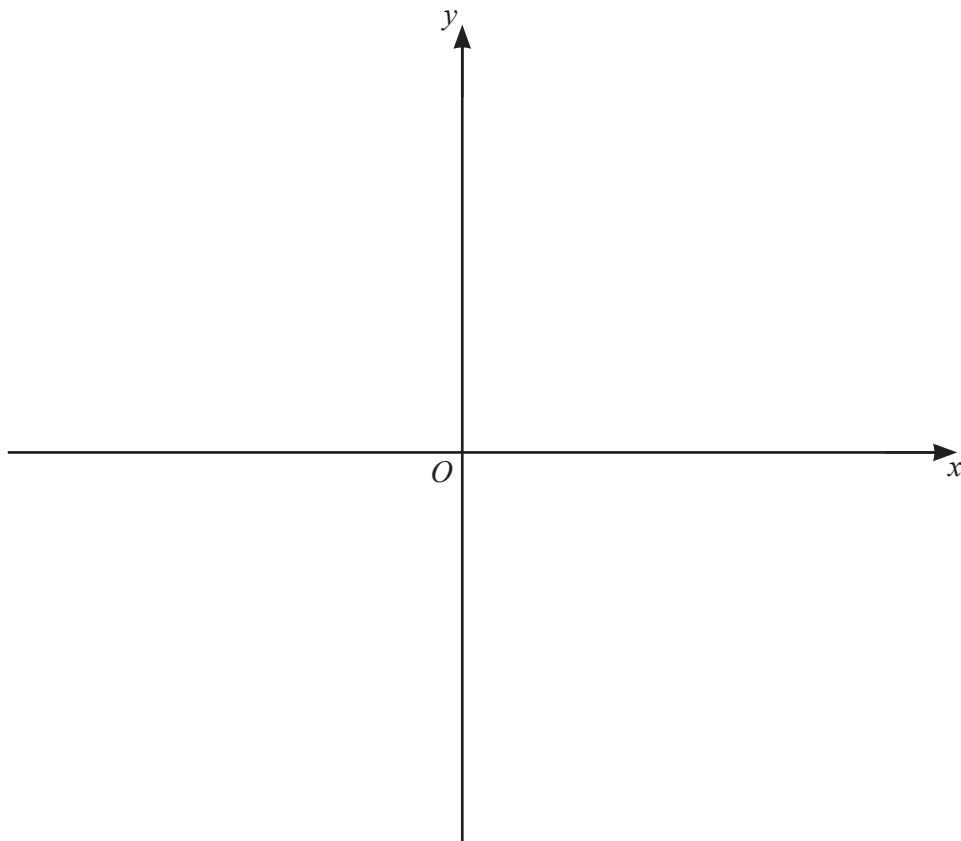
[2]

(c) Find the coordinates of the turning points of the graph of $y = f(x)$.
Show all your working and give your answers correct to 1 decimal place.

(..... , ...)

(..... , ...) [8]

(d) Sketch the graph of $y = f(x)$.



[2]

10 (a) Sarah spins a fair four-sided spinner numbered 0, 1, 1 and 3.

(i) What number is the spinner most likely to land on?

..... [1]

(ii) Sarah spins the spinner twice.

Find the probability that it lands on the number 1 both times.

..... [2]

(iii) Sarah spins the spinner until it lands on the number 3.

The probability that this happens on the n th spin is $\frac{729}{16384}$.

Find the value of n .

$n =$ [2]

(b) Scott takes an examination.

The examination is in two parts, a theory test and a practical test.

Both parts must be passed to pass the examination.

The probability that Scott passes the theory test is 0.9 .

The probability that Scott passes the practical test is 0.8 .

Find the probability that

(i) Scott passes the examination,

..... [2]

(ii) Scott passes the theory test or the practical test but not both.

..... [3]

11 $f(x) = 2x - 1$ $g(x) = x^2 + 2x$ $h(x) = 4^x$ $j(x) = 2^x$

(a) Find the value of

(i) $h(3)$,

..... [1]

(ii) $fh(3)$.

..... [1]

(b) Solve the equation $gf(x) = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

(c) $p^{-1}(x) = f(x)$

Find $p(x)$.

..... [2]

(d) $h(x)j(x) = \frac{1}{\sqrt{2}}$

Find the value of x .

$x = \dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

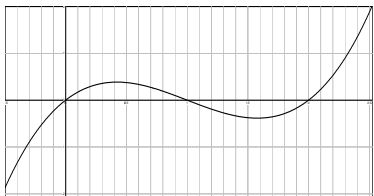
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	Rotation 90° clockwise oe [centre] (5, 2)	3	B1 for each
1(b)(i)	Translation $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$	2	B1 for each
1(b)(ii)	4.12 or 4.123...	2	M1 for $(their (-1))^2 + (their 4)^2$
2(a)	52°	3	M1 for $180 - 2 \times 38$, implied by 104 M1 for $their AOB \div 2$
2(b)(i)	80°	2	B1 for $FEC = 50$ or $FCE = 50$
2(b)(ii)	100°	1	FT 180 – <i>their (i)</i>
3(a)(i)	4.095	2	B1 for figs 4095 or M1 for $\frac{525 \times 7.8}{1000}$
3(a)(ii)	15	3	B2 for 35 OR M2 for $\frac{1}{2}(10+4) \times 5 \times L = 525$ oe M1 for $\frac{1}{2}(10+4) \times 5$ oe
3(a)(iii)	455 or 454.9...	6	M3 for $their [BD =] \sqrt{3^2 + 5^2} \times (their 15)$ [$\times 2$] or B2 for $\sqrt{34}$ or 5.83 or 5.830 to 5.831 or M1 for $5^2 + \left(\frac{1}{2}(10-4)\right)^2$ and M1 for $their 35 \times 2$ M1 for $(their 15) \times 10$ and $(their 15) \times 4$
3(a)(iv)	4200	3	M2 for $525 \times \left(\frac{10}{5}\right)^3$ oe or M1 for $\left(\frac{10}{5}\right)^3$ or $\left(\frac{5}{10}\right)^3$ oe

Question	Answer	Marks	Partial Marks
3(b)	182.875 ... 307.125 final answer	3	B2 for either seen or M1 for 10 ± 0.5 or 6 ± 0.5 or 4 ± 0.5 oe
4(a)	Correctly eliminate one variable	M1	
	$p = 3$ $q = -1$	A2	A1 for each If M0, SC1 for 2 values satisfying one of original equations If 0 scored SC1 for correct answers with no working
4(b)	$1\frac{1}{11}$ or $\frac{12}{11}$ 1.09 or 1.090 to 1.091	2	M1 for $\frac{3x}{12} + \frac{8x}{12} = 1$ or better
4(c)(i)	$-2 < x \leq 3$	3	B2 for $-2 < x$ or $x \leq 3$ or M1 for $-8 + 2 < 3x$ or $3x \leq 7 + 2$
4(c)(ii)	-1, 0, 1, 2, 3	1	FT dep on -ve and +ve values in <i>their</i> (c)(i)
4(d)	$4a(4 - a)$ final answer	2	B1 for any correct partial factorisation
4(e)(i)	$\frac{2b}{3a}$ final answer	2	M1 for $\frac{1}{2a} \times \frac{4b}{3}$ or better
4(e)(ii)	$\frac{x-2}{x-1}$ final answer nfw	2	B1 for $2(x-1) - x$ oe seen.
5(a)(i)	105	2	M1 for $\frac{3}{100} \times 500 [\times 7]$
5(a)(ii)	115 or 114.9...	3	M2 for $500 \times \left(1 + \frac{3}{100}\right)^7 [-500]$ or M1 for $500 \times \left(1 + \frac{3}{100}\right)^k, k \text{ integer } \geq 2$
5(b)	8600	3	M2 for $\frac{6269.4}{\left(1 - \frac{10}{100}\right)^3}$ oe or M1 for $C \times \left(1 - \frac{10}{100}\right)^3 = 6269.4$ oe
6(a)	9.33 or 9.334...	3	M2 for $\frac{12 \sin 50}{\sin 100}$ or M1 for $\frac{\sin 100}{12} = \frac{\sin 50}{AD}$ oe

Question	Answer	Marks	Partial Marks
6(b)	$[\cos =] \frac{11^2 + 12^2 - 8^2}{2 \times 11 \times 12}$	M2	M1 for $8^2 = 11^2 + 12^2 - 2 \times 11 \times 12 \cos(BAC)$
	40.415...	A2	A1 for 0.761... or $\frac{201}{264}$ or $\frac{67}{88}$
6(c)	70.8 or 70.77 to 70.79...	3	M1 for $\frac{1}{2} \times 12 \times \text{their (a)} \times \sin(180 - 100 - 50)$ M1 for $\frac{1}{2} \times 12 \times 11 \times \sin(40.42)$
6(d)	7.13 or 7.131 to 7.132...	3	M2 for $\frac{\text{dist}}{11} = \sin(40.42)$ or M1 for recognition that shortest distance is perpendicular to AC
7(a)	87	3	M2 for $3c + 4c = 587 + 22$ or better or M1 for $3c + 2(2c - 11) [= 587 \text{ or } 5.87]$
7(b)	1.1[0]	3	M2 for $22w + 22 = 42w$ or better or M1 for $\frac{22}{w} = \frac{42}{w+1}$ oe OR B2 for number of bottles = 20 or M1 for $Nw = 22$ and $N(w+1) = 42$
7(c)(i)	$\frac{9}{x} + \frac{5}{2x+1} = 2.5$ oe	M2	M1 for $\frac{9}{x}$ or $\frac{5}{2x+1}$
	$9(2x+1) + 5x = 2.5x(2x+1)$ oe or $\frac{9(2x+1) + 5x}{x(2x+1)} [= 2.5 \text{ oe}]$	M1	Correctly clearing fractions, or correctly collecting into a single fraction FT <i>their</i> expression dep on two fractions both with algebraic denominators
	All brackets expanded leading to $10x^2 - 41x - 18 = 0$ with no errors or omissions	A1	

Question	Answer	Marks	Partial Marks
7(c)(ii)	$(2x - 9)(5x + 2)$ or $\frac{-(-41) \pm \sqrt{(-41)^2 - 4(10)(-18)}}{2(10)}$	M2	B1 for $(ax + b)(cx + d)$ with $ac = 10$ and $bd = -18$ or $ad + bc = -41$ or $\sqrt{(-41)^2 - 4(10)(-18)}$ or $\frac{-(-41) + \sqrt{q}}{2(10)}$ oe or $\frac{-(-41) - \sqrt{q}}{2(10)}$ oe or both or M1 for $\left(x - \frac{41}{20}\right)^2 - \frac{18}{10} - \left(\frac{41}{20}\right)^2 = 0$ or better
	10	A2	A1 for $[x =] \frac{9}{2}$ oe or M1 for $2 \times \text{their positive root} + 1$
8(a)(i)	$\frac{60}{360} \times 600$ oe	1	
8(a)(ii)	45	2	M1 for $\frac{27}{360} \times 600$ oe
8(a)(iii)	Correct straight line on the pie chart	2	B1 for 75
8(b)	Correct diagram  0.6 3.4 5.2 7.5 8.7	3	B1 for any three of 0.6, 3.4, 5.2, 7.5, 8.7 correctly placed B1 for 7.5 and 8.7 seen
8(c)(i)	5	1	
8(c)(ii)	2	1	
8(c)(iii)	3	1	
8(d)	39.2	4	M1 for mid-values soi M1 for Σfx with x in correct interval including boundaries M1 dep for $\frac{\Sigma fx}{50}$ dep on second M1
9(a)	(0, 0), (1, 0), (2, 0)	2	B1 for any two correct If 0 scored, SC1 for all three x values clearly identified

Question	Answer	Marks	Partial Marks
9(b)	$x(x^2 - x - 2x + 2)$ or $(x^2 - x)(x - 2)$ or $(x - 1)(x^2 - 2x)$ leading to $x^3 - 3x^2 + 2x$ with no errors or omissions	2	B1 for $x(x^2 - x - 2x + 2)$ or $(x^2 - x)(x - 2)$ or $(x - 1)(x^2 - 2x)$
9(c)	$3x^2 - 6x + 2$	B2	B1 for 2 correct terms
	their $\frac{dy}{dx} = 0$	M1	
	their $\frac{-(-6) \pm \sqrt{(-6)^2 - 4(3)(2)}}{2(3)}$	M2	M1 for $\sqrt{(-6)^2 - 4(3)(2)}$ or for $p = -(-6)$ and $r = 2(3)$ if in form $\frac{p \pm \sqrt{q}}{r}$
	(0.4, 0.4) (1.6, -0.4)	B3	B2 for 0.4 or 0.42... and 1.6 or 1.57 to 1.58 or for one correct pair of coordinates or B1 for 0.4 or 0.42... or 1.6 or 1.57 to 1.58 If 0 scored SC1 for $1 + \sqrt{\frac{1}{3}}$ and $1 - \sqrt{\frac{1}{3}}$ or better or for one correct pair of coordinates in any form
9(d)	Correct sketch 	2	FT their (c) but must be cubic i.e. correct shape cubic through origin and max and min in correct quadrants B1 for cubic shape sketch
10(a)(i)	1	1	
10(a)(ii)	$\frac{1}{4}$ oe nfww	2	M1 for $\frac{2}{4} \times \frac{2}{4}$ oe
10(a)(iii)	7	2	M1 for trials with $\left(\frac{3}{4}\right)^k \times \frac{1}{4}$ soi
10(b)(i)	0.72 oe	2	M1 for 0.9×0.8
10(b)(ii)	0.26 oe	3	M2 for $0.9 \times 0.2 + 0.1 \times 0.8$ or $1 - \text{their (b)(i)} - 0.1 \times 0.2$ or M1 for 0.9×0.2 or 0.1×0.8 or $1 - \text{their (b)(i)}$ or $1 - 0.1 \times 0.2$
11(a)(i)	64	1	

Question	Answer	Marks	Partial Marks
11(a)(ii)	127	1	FT $2 \times$ their (a)(i) – 1
11(b)	$\pm \frac{1}{2}$ oe nfww	4	M1 for $(2x-1)^2 + 2(2x-1)$ B1 for $4x^2 - 2x - 2x + 1$ or $(2x-1)(2x-1+2)$ B1 for $4x^2 - 1 [= 0]$ or $(2x-1)(2x+1) [= 0]$ OR M1 for $x(x+2) = 0$ (solving $g(x) = 0$) A1 for $x = 0$ or -2 B1 for $2x - 1 = 0$ or $2x - 1 = -2$
11(c)	$\frac{x+1}{2}$ oe final answer	2	M1 for $y+1=2x$ or $\frac{y}{2}=x-\frac{1}{2}$ or $x=2y-1$
11(d)	$-\frac{1}{6}$ oe nfww	3	B2 for $3x = -\frac{1}{2}$ oe OR M1 for $2^{2x} \times 2^x$ oe or $4^{\frac{1}{2}x} \times 4^x$ oe or 8^x oe M1 for $2^{\frac{1}{2}}$ or $4^{\frac{1}{4}}$ or $8^{\frac{1}{6}}$ soi



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MATHEMATICS**0580/21**

Paper 2 (Extended)

May/June 2021**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

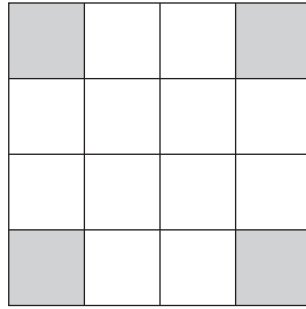
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Any blank pages are indicated.

1



(a) Write down the order of rotational symmetry of this diagram.

..... [1]

(b) On the diagram, draw all the lines of symmetry.

[2]

2 The probability that a train is late is 0.15 .

Write down the probability that the train is not late.

..... [1]

3 The stem-and-leaf diagram shows the number of hours that each of 16 students studied last week.

1	2	5	6	8	
2	0	1	1	7	9
3	2	3	4	5	
4	4	5	7		

Key: 1|2 represents 12 hours

Find

(a) the median,

..... h [1]

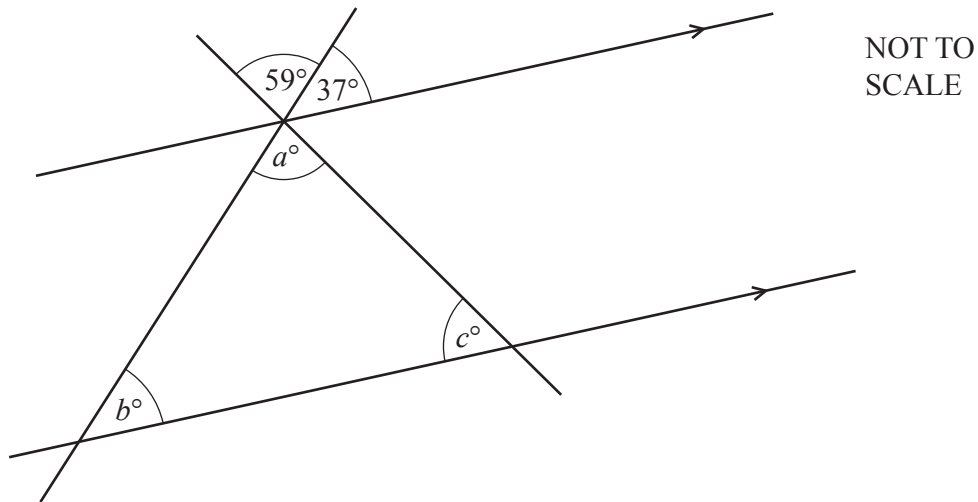
(b) the mode,

..... h [1]

(c) the range.

..... h [1]

4



The diagram shows two parallel lines intersected by two straight lines.

Find the values of a , b and c .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

$$c = \dots\dots\dots [3]$$

5 Work out.

(a) $\begin{pmatrix} 6 \\ -5 \end{pmatrix} + \begin{pmatrix} 8 \\ -1 \end{pmatrix}$

$$\begin{pmatrix} \\ \end{pmatrix} [1]$$

(b) $3 \begin{pmatrix} -4 \\ 7 \end{pmatrix}$

$$\begin{pmatrix} \\ \end{pmatrix} [1]$$

- 6 (a) The n th term of a sequence is $n^2 + 3n$.

Find the first three terms of this sequence.

....., ..., ... [2]

- (b) These are the first five terms of a different sequence.

25 18 11 4 -3

Find the n th term of this sequence.

..... [2]

- 7 Solve the simultaneous equations.
You must show all your working.

$$2x + y = 3$$

$$x - 5y = 40$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [3]$$

- 8 Without using a calculator, work out $1\frac{3}{8} - \frac{5}{6}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

- 9 A is the point $(5, -5)$ and B is the point $(9, 3)$.

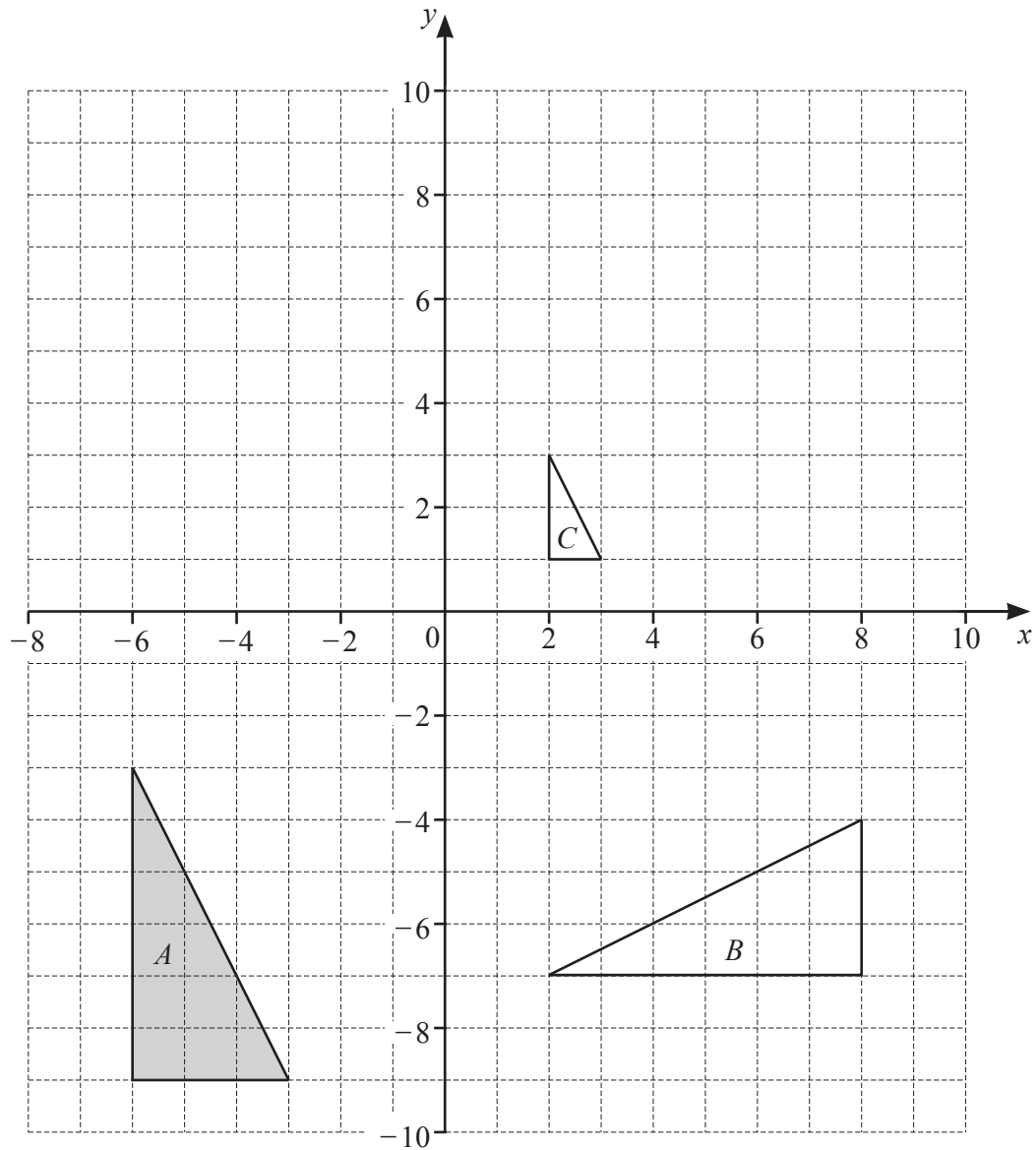
(a) Find the coordinates of the midpoint of AB .

(.....) [2]

(b) Find the length of AB .

..... [3]

10



(a) Describe fully the **single** transformation that maps

(i) triangle A onto triangle B ,

.....
 [3]

(ii) triangle A onto triangle C .

.....
 [3]

(b) Draw the image of triangle A after a translation by the vector $\begin{pmatrix} 2 \\ 10 \end{pmatrix}$. [2]

- 11 (a) Simplify fully.
 $(4ab^5)^4$

..... [2]

(b) $2p^{\frac{1}{3}} = 6$

Find the value of p .

$p =$ [1]

(c) $81^2 \div 3^t = 9$

Find the value of t .

$t =$ [2]

- 12 The profit a company makes decreases exponentially at a rate of 0.9% per year.
In 2014, the profit was \$9500.

Calculate the profit in 2019.

\$ [2]

- 13** On a map, a lake has an area of 32 cm^2 .
The scale of the map is $1 : 24\,000$.

Calculate the actual area of the lake.
Give your answer in km^2 .

..... km^2 [2]

- 14** y is directly proportional to the square root of $(x - 3)$.
When $x = 28$, $y = 20$.

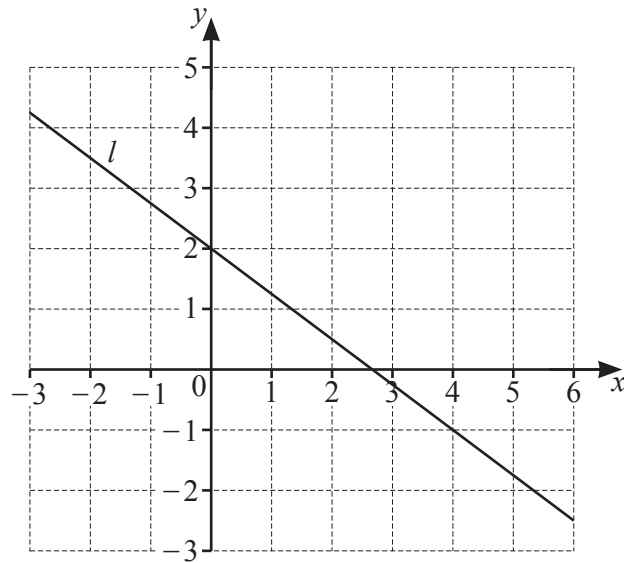
Find y when $x = 39$.

$y =$ [3]

- 15** Make h the subject of the formula $2mh = g(1 - h)$.

$h =$ [4]

16



- (a) Find the gradient of line l .

..... [2]

- (b) Find the equation of line l in the form $y = mx + c$.

$y =$ [2]

- (c) Find the equation of the line that is perpendicular to line l and passes through the point $(12, -7)$.
Give your answer in the form $y = mx + c$.

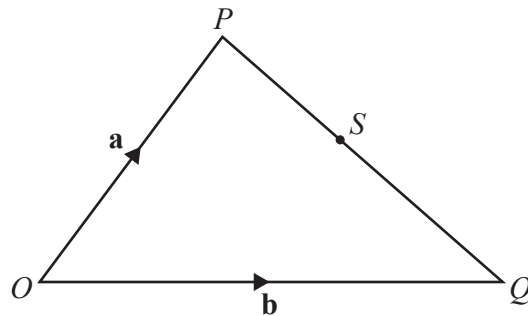
$y =$ [3]

- 17 A bag contains 3 blue buttons, 8 white buttons and 5 red buttons.
Two buttons are picked at random from the bag, without replacement.

Work out the probability that the two buttons are either both red or both white.

..... [3]

18



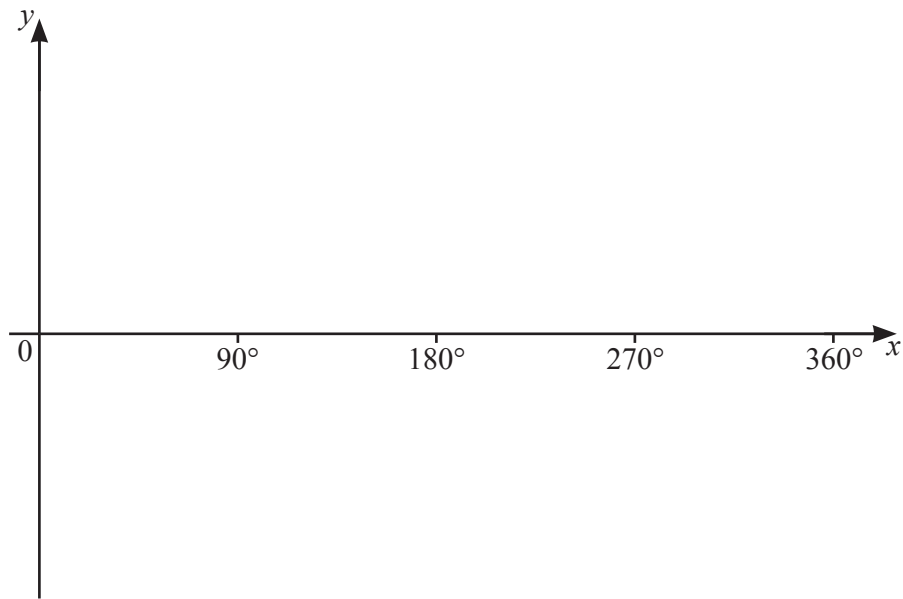
NOT TO
SCALE

S is a point on PQ such that $PS : SQ = 4 : 5$.

Find $\overrightarrow{OS}$, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form.

$\overrightarrow{OS} =$ [2]

- 19 (a) Sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (b) Solve the equation $5 \tan x = 1$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

- 20 The distance between two towns is 600 km, correct to the nearest 10 km.
A car takes 8 hours 40 minutes, correct to the nearest 10 minutes, to travel this distance.

Calculate the lower bound for the average speed of the car in km/h.

$\dots\dots\dots$ km/h [3]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 70

Published

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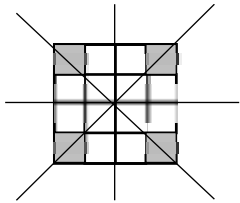
GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

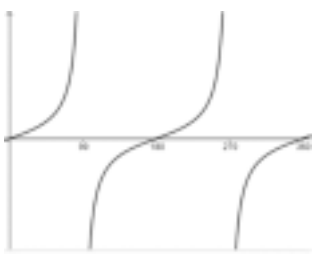
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks
1(a)	4	1	
1(b)		2	B1 for 2 or 3 correct lines drawn or for 4 correct lines and one wrong extra line
2	0.85 oe	1	
3(a)	28	1	
3(b)	21	1	
3(c)	35	1	
4	$[a =] 59$ $[b =] 37$ $[c =] 84$	3	B1 for each If 0 scored SC1 for <i>their</i> $(a + b + c) = 180$ if $a, b, c > 0$
5(a)	$\begin{pmatrix} 14 \\ -6 \end{pmatrix}$	1	
5(b)	$\begin{pmatrix} -12 \\ 21 \end{pmatrix}$	1	
6(a)	4 10 18	2	B1 for 2 correct
6(b)	$32 - 7n$ oe final answer	2	B1 for $32 - kn$ oe $k \neq 0$ or $j - 7n$ oe or $32 - 7n$ seen then spoilt
7	correctly eliminating 1 variable	M1	
	$x = 5$	A1	
	$y = -7$	A1	If M0 scored SC1 for two values satisfying one of the original equations

Question	Answer	Marks	Partial Marks
8	$\frac{11}{8} [-\frac{5}{6}] \quad \frac{3}{8} + \frac{1}{6}$	B1	Correct step for dealing with mixed number Allow $\frac{11k}{8k}$
	$\frac{33}{24}$ and $\frac{20}{24} \quad \frac{9}{24}$ and $\frac{4}{24}$	M1	Correct method to find common denominator e.g. $1 \frac{9}{24}$ and $\frac{20}{24}$
	$\frac{13}{24}$ cao	A1	
9(a)	(7, – 1)	2	B1 for each
9(b)	8.94 or 8.944...	3	M2 for $\sqrt{(9-5)^2 + (3--5)^2}$ oe or M1 for $(9-5)^2 + (3--5)^2$ oe
10(a)(i)	Rotation 90° anticlockwise oe (0, – 1)	3	B1 for each
10(a)(ii)	enlargement [s.f.] $\frac{1}{3}$ (6, 6)	3	B1 for each
10(b)	triangle at (– 4, 7) (– 4, 1) (– 1, 1)	2	B1 for translation by $\begin{pmatrix} k \\ 10 \end{pmatrix}$ or $\begin{pmatrix} 2 \\ k \end{pmatrix}$
11(a)	$256a^4b^{20}$ final answer	2	B1 for two correct elements in final answer
11(b)	27	1	
11(c)	6	2	M1 for $3^k \div 3^t = 3^2$ or $3^8 \div 3^t = 3^k$ oe or better or $3^t = 729$ oe
12	9080 or 9080.13	2	M1 for $9500 \times \left(1 - \frac{0.9}{100}\right)^5$
13	1.8432	2	M1 for $\frac{32 \times 24000 \times 24000}{100000 \times 100000}$ oe If 0 scored, SC1 for figs 184[32]... as answer

Question	Answer	Marks	Partial Marks
14	24	3	M1 for $y = k\sqrt{x-3}$ oe M1 for $y = \text{their } k\sqrt{39-3}$ oe
15	$\frac{g}{2m+g}$ final answer	4	M1 for expanding brackets or $\div g$ M1 for isolating terms in h M1 for factorising M1 for dividing by bracket to isolate h Incorrect/unsimplified final answer scores max 3 marks
16(a)	$-\frac{3}{4}$ or -0.75	2	M1 for correct rise over run or B1 for answer $\frac{3}{4}$ oe
16(b)	$[y =] -\frac{3}{4}x + 2$ oe	2	FT $[y =] \text{their } (a)x + 2$ oe B1 for $[y =] \text{their } (a)x + c$ or $[y =] mx + 2$.
16(c)	$[y =] \frac{4}{3}x - 23$ oe	3	M1 for gradient $\frac{-1}{\text{their } (a)}$ M1 for $(12, -7)$ substituted into $y = \text{their } mx + c$
17	$\frac{19}{60}$ oe	3	M2 for $\frac{8}{16} \times \frac{7}{15} + \frac{5}{16} \times \frac{4}{15}$ or M1 for $\frac{8}{16} \times \frac{7}{15}$ or $\frac{5}{16} \times \frac{4}{15}$ If 0 scored SC1 for $\frac{89}{256}$ oe
18	$\frac{5}{9}a + \frac{4}{9}b$	2	M1 for $\frac{4}{9}(b-a)$ or $\frac{5}{9}(a-b)$ or a correct route
19(a)	Correct sketch 	2	1 for one correct branch or correct sketch but with branches joined
19(b)	11.3 or 11.30 to 11.31 and 191.3 or 191.30 to 191.31	2	B1 for each If 0 scored SC1 for two answers with a difference of 180°

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Question	Answer	Marks	Partial Marks
20	68 nfw	3	M2 for $\frac{600-5}{8h40 \text{ to } 8h50}$ or $\frac{590 \text{ to } 600}{8h40 + 5[m]}$ oe or M1 for $600 - 5$ oe or $8h\ 40 + 5[m]$ oe or $520 + 5$ oe[m] seen



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CENTRE
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NUMBER

MATHEMATICS**0580/22**

Paper 2 (Extended)

May/June 2021**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

- 1 The probability that Jane wins a game is $\frac{7}{10}$.

(a) Find the probability that Jane does not win the game.

..... [1]

(b) Jane plays this game 50 times.

Find the number of times she is expected to win the game.

..... [1]

- 2 Calculate $\sqrt[4]{0.0256}$.

..... [1]

- 3 Emma has 15 mathematics questions to complete.
The stem-and-leaf diagram shows the time, in minutes, it takes her to complete each question.

0	3	5	6	7	7	8	8
1	1	2	2	3	6	6	6
2	0						

Key: 2 | 0 = 20 minutes

Complete the table.

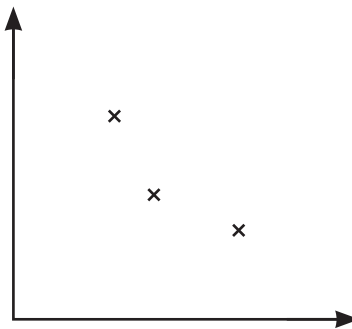
Mode	 min
Median	 min
Range	 min

[3]

- 4 Write down an expression for the range of k consecutive integers.

..... [1]

- 5 (a) Henrik draws this scatter diagram.



Put a ring around the **one** correct statement about this scatter diagram.

It shows
no correlation.

It is not possible to tell if
there is correlation as there
are not enough points.

It shows negative
correlation.

It shows positive
correlation.

[1]

- (b) Each of the four scatter diagrams shows the same set of data.
A line has been drawn on each diagram.

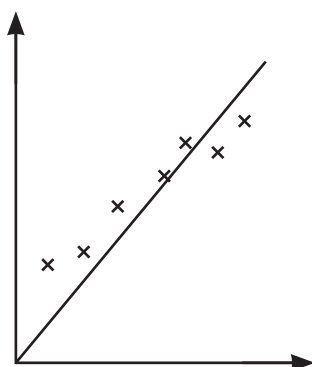


Diagram A

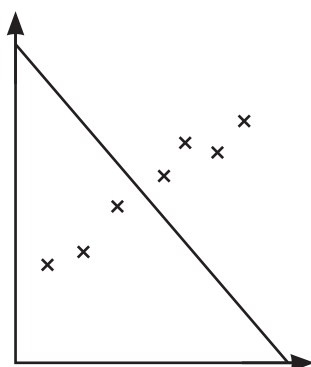


Diagram B

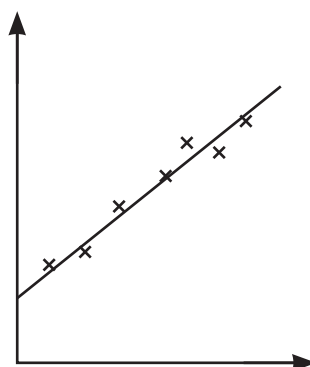


Diagram C

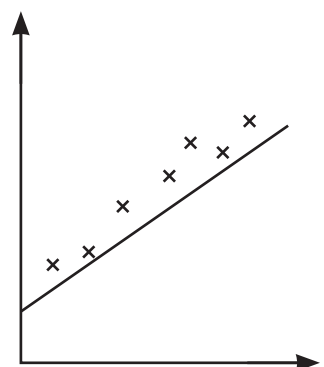


Diagram D

Complete the statement.

The line in Diagram is the most appropriate line of best fit.

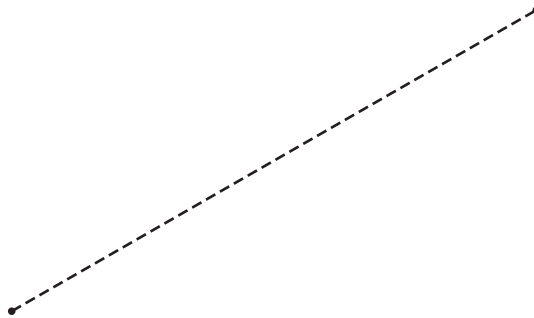
[1]

- 6 A rhombus has side length 6.5 cm.
The rhombus can be constructed by drawing two triangles.

Using a ruler and compasses only, construct the rhombus.

Leave in your construction arcs.

One diagonal of the rhombus has been drawn for you.



[2]

- 7 (a) Complete these statements.

The reciprocal of 0.2 is

A prime number between 90 and 100 is

[2]

(b)

$$\frac{7}{5}$$

$$0.6$$

$$\sqrt{7}$$

$$8$$

$$\sqrt{9}$$

From this list, write down an irrational number.

..... [1]

8 $a = \frac{b^2}{5c}$

Find b when $a = 5.625$ and $c = 2$.

$b = \dots\dots\dots$ [2]

9 **Without using a calculator**, work out $\frac{2}{3} \div 1\frac{3}{7}$.

You must show all your working and give your answer as a fraction in its simplest form.

$\dots\dots\dots$ [3]

10 (a) Write 0.006 54 in standard form.

$\dots\dots\dots$ [1]

(b) The number 1.467×10^{102} is written as an ordinary number.

Write down the number of zeros that follow the digit 7.

$\dots\dots\dots$ [1]

11 Write $0.\dot{0}\dot{4}$ as a fraction in its simplest form.

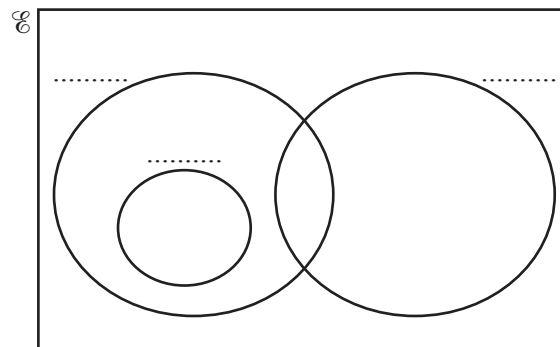
..... [1]

- 12 (a) $\mathcal{E} = \{\text{integers greater than 2}\}$
 $A = \{\text{prime numbers}\}$
 $B = \{\text{odd numbers}\}$
 $C = \{\text{square numbers}\}$

(i) Describe the type of numbers in the set $B' \cap C$.

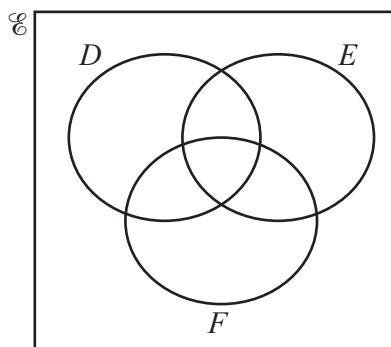
..... [1]

(ii) Complete the set labels on the Venn diagram.



[1]

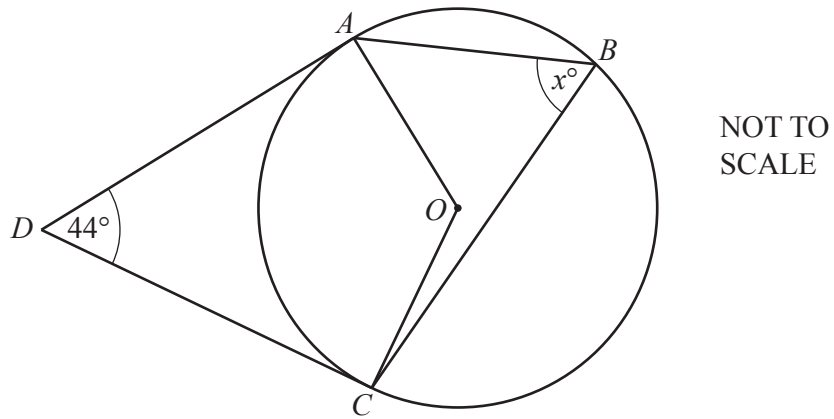
(b)



Shade the region $D' \cup (E \cap F)'$.

[1]

13

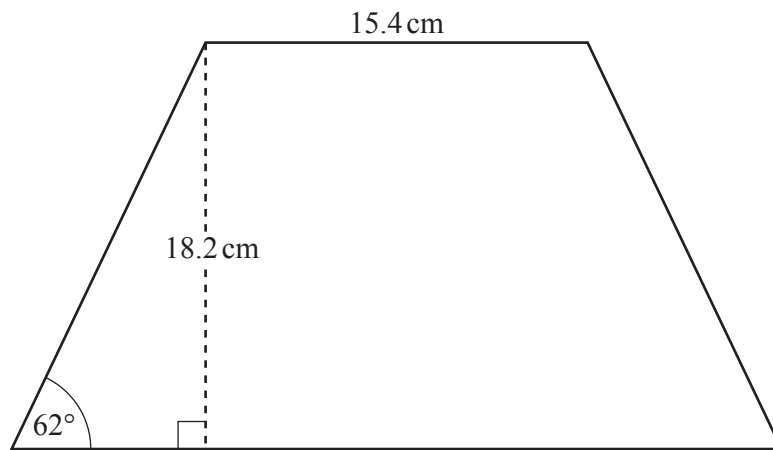


A , B and C are points on a circle, centre O .
 DA and DC are tangents.
Angle $ADC = 44^\circ$.

Work out the value of x .

$x = \dots\dots\dots$ [3]

14

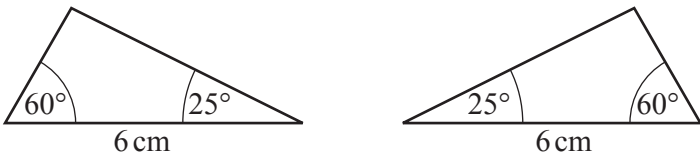
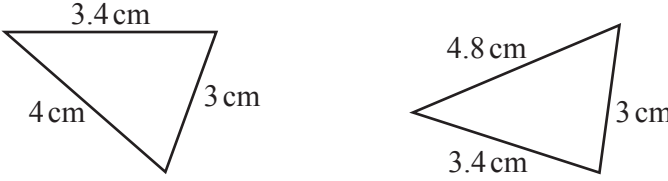
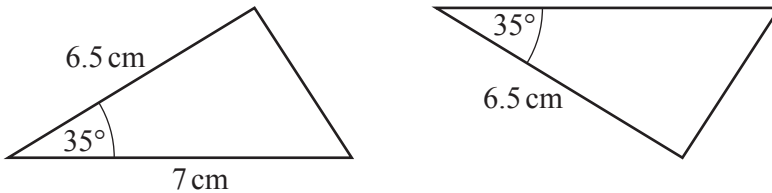
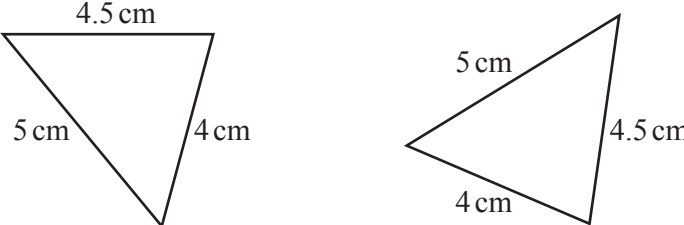
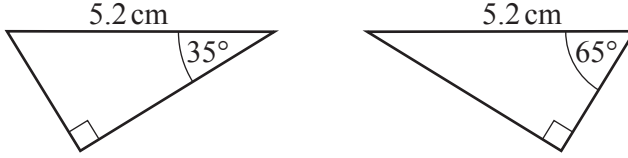
NOT TO
SCALE

The diagram shows a trapezium.
The trapezium has one line of symmetry.

Work out the area of the trapezium.

..... cm^2 [4]

- 15 Complete the table showing information about the congruence of pairs of triangles. The first two rows have been completed for you. All diagrams are not to scale.

Pair of triangles	Congruent or not congruent	Congruence criterion
	Congruent	ASA
	Not congruent	None
		
		
		

[3]

16 A is the point $(5, 7)$ and B is the point $(9, -1)$.

(a) Find the length AB .

..... [3]

(b) Find the equation of the line AB .

..... [3]

17 Find the gradient of the line that is perpendicular to the line $3y = 4x - 5$.

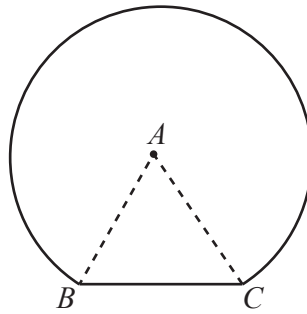
..... [2]

18 $f(x) = x^2 - 25$ $g(x) = x + 4$

Solve $fg(x+1) = gf(x)$.

$x = \dots\dots\dots$ [4]

19 (a)

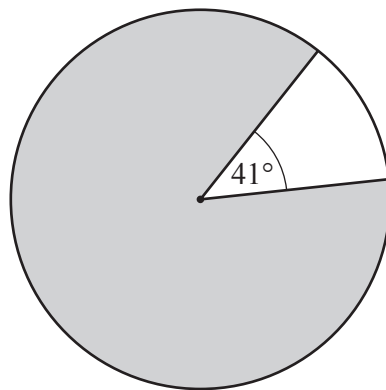
NOT TO
SCALE

The diagram shows a shape made from an equilateral triangle ABC and a sector of a circle. Points B and C lie on the circle, centre A . The side length of the equilateral triangle is 12.4 cm.

Work out the perimeter of the shape.

..... cm [3]

(b)

NOT TO
SCALE

The diagram shows two sectors of a circle. The major sector is shaded. The area of the major sector is 74.5 cm^2 .

Calculate the radius of the circle.

..... cm [3]

20 Expand and simplify.

$$(x-2)(2x+5)(x+3)$$

..... [3]

21 The force of attraction, F Newtons, between two magnets is inversely proportional to the square of the distance, d cm, between the magnets.

When $d = 1.5$, $F = 48$.

(a) Find an expression for F in terms of d .

$F =$ [2]

(b) When the distance between the two magnets is doubled the new force is n times the original force.

Work out the value of n .

$n =$ [1]

22 Simplify.

$$\frac{2x^2 - 5x - 12}{3x^2 - 12x}$$

..... [4]

23 Find all the solutions of $4 \sin x = 3$ for $0^\circ \leq x \leq 360^\circ$.

..... [2]

24 Solve.

$$\frac{1}{x+1} + \frac{9}{x+9} = 1$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [5]$$

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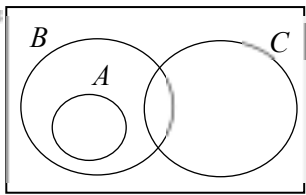
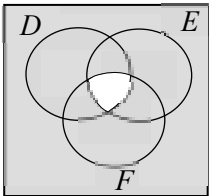
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks						
1(a)	$\frac{3}{10}$ oe	1							
1(b)	35	1							
2	0.4 or $\frac{2}{5}$	1							
3	<table border="1"><tr><td>Mode</td><td>16</td></tr><tr><td>Median</td><td>11</td></tr><tr><td>Range</td><td>17</td></tr></table>	Mode	16	Median	11	Range	17	3	B1 for each
Mode	16								
Median	11								
Range	17								
4	$k - 1$	1							
5(a)	It is not possible to tell if there is correlation as there are not enough points.	1							
5(b)	C	1							
6	Accurate construction of rhombus with sides 6.5 cm and correct construction arcs.	2	B1 for accurate diagram with no/wrong arcs or for one triangle (6.5 cm, 6.5 cm, 8 cm) correctly constructed with correct arcs or for four correct arcs						
7(a)	$\frac{5}{97}$	2	B1 for each						
7(b)	$\sqrt{7}$	1							
8	$[\pm] 7.5$ oe	2	M1 for $5.625 = \frac{b^2}{2 \times 5}$ or better						
9	$\frac{2}{3} \times \frac{7}{10}$ or $\frac{14}{21} \div \frac{30}{21}$ oe with common denominator	M2	B1 for $\frac{10}{7}$ oe or M1 for $\frac{2}{3} \times \text{their } \frac{7}{10}$						
	$\frac{7}{15}$ cao	A1							
10(a)	6.54×10^{-3}	1							
10(b)	99	1							
11	$\frac{4}{99}$ cao	1							
12(a)(i)	Even square numbers oe	1							

Question	Answer	Marks	Partial Marks
12(a)(ii)		1	
12(b)		1	
13	68	3	M1 for correctly identifying 90° angle soi or $DAC / DCA = 68$ M1 for [obtuse angle] AOC identified as $2x$ soi or $x = \text{their } DAC / DCA$
14	456 or 456.4...	4	M2 for $\frac{18.2}{\tan 62}$ oe or M1 for $\tan 62 = \frac{18.2}{x}$ oe M1 for $\frac{1}{2}((\text{their trapezium base}) + 15.4) \times 18.2$ oe
15	Congruent SAS Congruent SSS Not congruent None	3	B1 for each correct row
16(a)	8.94 or 8.944...	3	M2 for $\sqrt{(9-5)^2 + (-1-7)^2}$ oe or M1 for $(9-5)^2 + (-1-7)^2$ oe
16(b)	$y = -2x + 17$ oe final answer	3	B2 for answer $-2x + 17$ OR M1 for $\frac{-1-7}{9-5}$ oe M1 for correct substitution of (5, 7) or (9, -1) into $y = \text{their } mx + c$ oe
17	$-\frac{3}{4}$ or -0.75	2	M1 for $y = \frac{4x-5}{3}$ or better or for $\frac{-1}{\text{their gradient}}$

Question	Answer	Marks	Partial Marks
18	$[x =] -2.1$ oe	4	M3 for $x^2 + 10x = x^2 - 21$ or better OR M1 for $(x + 1 + 4)^2 - 25$ or better M1 for $x^2 - 25 + 4$ or better If 0 scored SC1 for answer $-\frac{11}{6}$ oe
19(a)	77.3 or 77.32 to 77.33...	3	M2 for $\frac{360-60}{360} \times \pi \times 12.4 \times 2$ oe [$\pm n \times 12.4$] or M1 for angle 60° or 300° soi or for $\frac{k}{360} \times \pi \times 12.4 \times 2$ oe [$\pm n \times 12.4$]
19(b)	5.17 or 5.172 to 5.173...	3	M2 for $\frac{74.5}{\pi} \times \frac{360}{360-41} = r^2$ oe or better or M1 for $74.5 = \frac{360-41}{360} \times \pi r^2$ oe or for $\sqrt{\frac{74.5}{\pi} \times \frac{360}{k}}$ oe
20	$2x^3 + 7x^2 - 7x - 30$ final answer	3	B2 for unsimplified expansion with at most one error or for simplified four-term expression of correct form with three terms correct or B1 for correct expansion of two brackets with at least three terms out of four correct
21(a)	$[F =] \frac{108}{d^2}$ final answer	2	M1 for $F = \frac{k}{d^2}$ oe or better
21(b)	$[n =] \frac{1}{4}$ or 0.25	1	
22	$\frac{2x+3}{3x}$ final answer	4	B2 for $(x-4)(2x+3)$ or B1 for $(x+a)(2x+b)$ where $ab = -12$ or $2a + b = -5$ or $x(2x+3) - 4(2x+3)$ or $2x(x-4) + 3(x-4)$ B1 for $3x(x-4)$
23	48.6 or 48.59... and 131.4 or 131.4...	2	B1 for each If 0 scored SC1 for two answers with a sum of 180°

PUBLISHED

Question	Answer	Marks	Partial Marks
24	$x = 3, x = -3$ nfww	5	M2 for $x + 9 + 9(x + 1) = (x + 1)(x + 9)$ oe or better or M1 for $x + 9 + 9(x + 1)$ or $(x + 1)(x + 9)$ oe or better B1 for $x^2 + x + 9x + 9$ seen M1 dep for $[0 =]x^2 - 9$ oe simplified or better



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CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/23**

Paper 2 (Extended)

May/June 2021**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

- 1 Write down the number that is 23 less than -1.6 .

..... [1]

- 2 Write as a fraction in its simplest form.

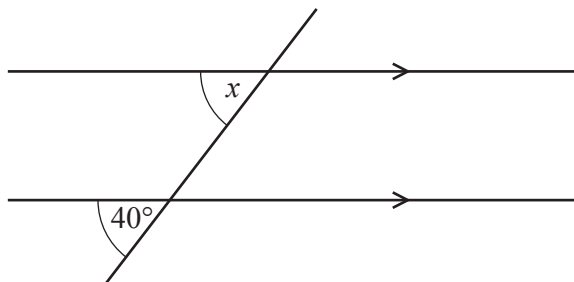
(a) 72%

..... [1]

(b) 0.004

..... [1]

3



NOT TO
SCALE

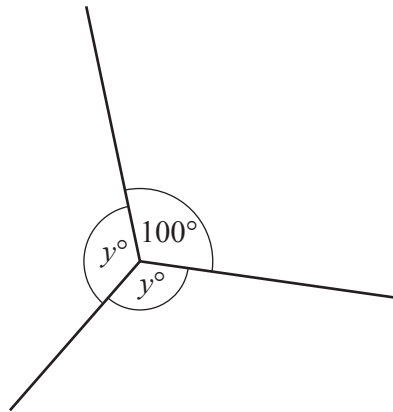
The diagram shows a pair of parallel lines and a straight line.

Complete the statement with the correct geometrical reason.

$x = 40^\circ$ because the angles are [1]

3

4

NOT TO
SCALEFind the value of y . $y = \dots\dots\dots$ [2]

- 5 Jo invests \$600 for 7 years at a rate of 1.5% per year simple interest.

Calculate the total interest earned during the 7 years.

\$ \dots\dots\dots\$ [2]

- 6 Maria buys n pencils that cost p cents each.
She pays with a \$ y note.

Find, in terms of n , p and y , the amount of change Maria receives.
Give your answer in cents.

 $\dots\dots\dots$ cents [2]

4

7 12 18 29 49 91 125

From the list of numbers, write down

(a) a cube number,

..... [1]

(b) a prime number.

..... [1]

8 Alex changes 190 euros (€) into pounds (£) when £1 = €1.1723 .

Calculate the amount Alex receives.

Give your answer correct to 2 decimal places.

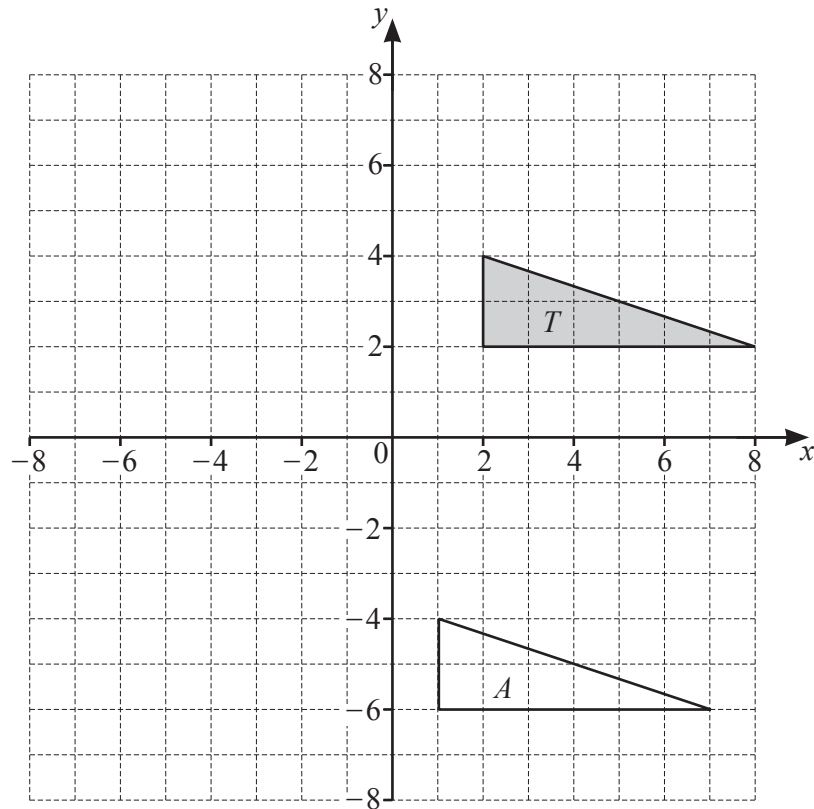
£ [2]

9 **Without using a calculator**, work out $1\frac{2}{3} \div 7\frac{1}{2}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

10



- (a) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....
 [2]

- (b) Draw the image of triangle T after an enlargement, scale factor $-\frac{1}{2}$, centre $(0, 0)$.

[2]

11 Simplify $3x^3 \times 4x^4$.

..... [2]

- 12 x is an integer and $-3 \leq 2x - 1 < 3$.

Find the values of x .

..... [2]

- 13 Expand and simplify.

$$6(t - q) - 2(t - 3q)$$

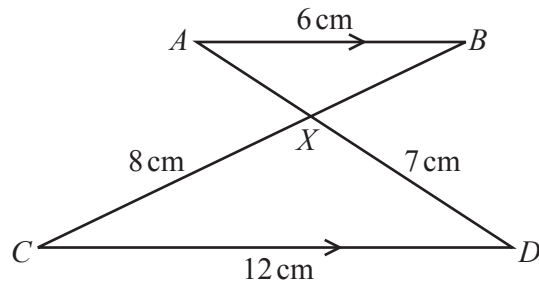
..... [2]

- 14 The magnitude of the vector $\begin{pmatrix} 20 \\ k \end{pmatrix}$ is 29.

Find the value of k .

$k =$ [3]

15

NOT TO
SCALE

In the diagram, AB is parallel to CD .
 AD and BC intersect at X .
 $AB = 6\text{ cm}$, $CD = 12\text{ cm}$, $CX = 8\text{ cm}$ and $DX = 7\text{ cm}$.

(a) Complete the statement.

Triangle ABX is to triangle DCX . [1]

(b) Work out the length of BX .

$BX = \dots\dots\dots\text{ cm}$ [2]

(c) The area of triangle DCX is 26.906 cm^2 .

Use this value to find the area of

(i) triangle ABX ,

$\dots\dots\dots\text{ cm}^2$ [2]

(ii) triangle ACX .

$\dots\dots\dots\text{ cm}^2$ [1]

- 16 The sides of a regular hexagon are 80 mm, correct to the nearest millimetre.

Calculate the lower bound of the perimeter of the hexagon.

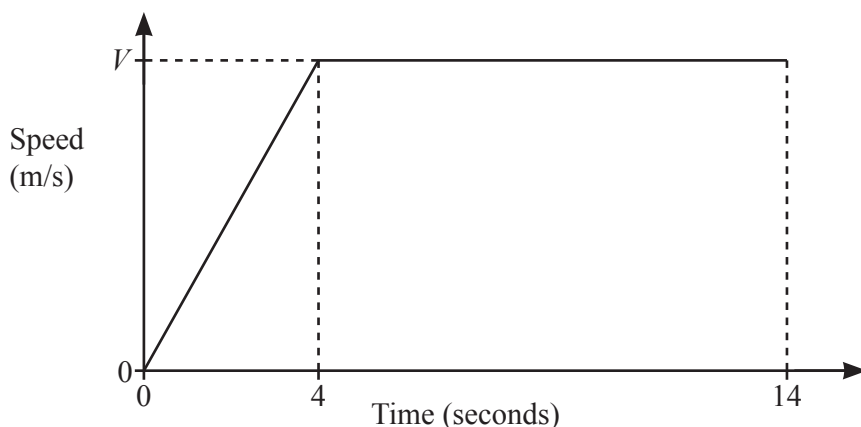
..... mm [2]

- 17 The interior angle of a regular polygon is 175° .

Calculate the number of sides.

..... [2]

- 18 A car starts from rest and accelerates at a rate of 3 m/s^2 for 4 seconds.
The car then travels at a constant speed for 10 seconds.



NOT TO
SCALE

The diagram shows the speed–time graph for this journey.

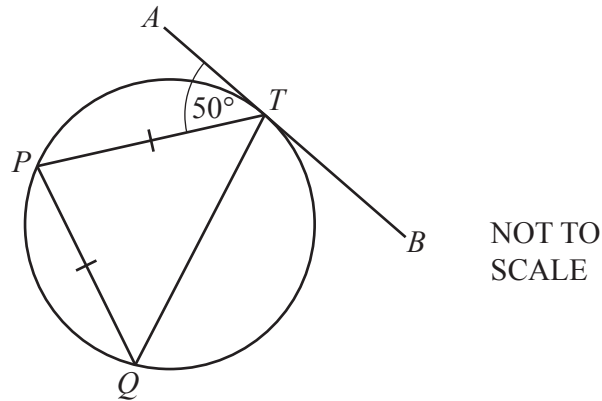
- (a) Find the value of V .

$V =$ [1]

- (b) Calculate the total distance travelled by the car during the 14 seconds.

..... m [2]

19 (a)

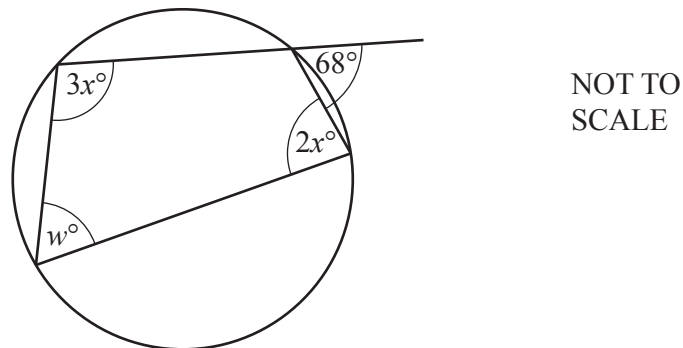


P , Q and T are points on a circle.
 ATB is a tangent to the circle at T and $PT = PQ$.

Find angle TPQ .

Angle $TPQ = \dots\dots\dots$ [2]

(b)



The diagram shows a cyclic quadrilateral with an exterior angle of 68° .

Find the value of w and the value of x .

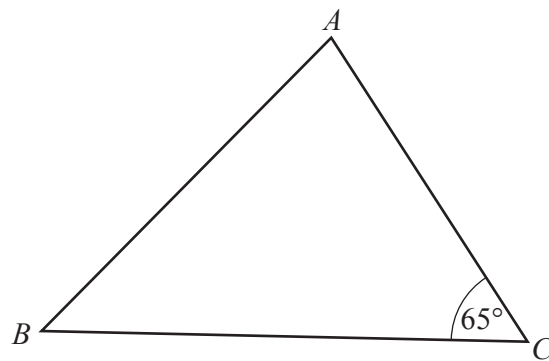
$w = \dots\dots\dots$

$x = \dots\dots\dots$ [3]

- 20 Simplify $2.1 \times 10^p + 2.1 \times 10^{p-1}$.
Give your answer in standard form.

..... [2]

21



NOT TO
SCALE

The shortest distance from B to AC is 12.8 cm.

Calculate BC .

$BC =$ cm [3]

- 22 z is inversely proportional to the square of $(y-2)$.
When $y = 5$, $z = 9$.

Find z in terms of y .

$z =$ [2]

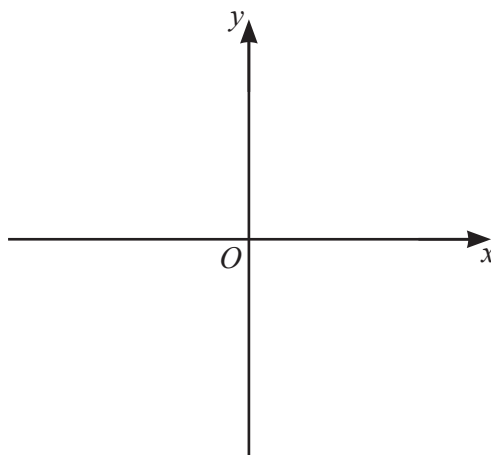
- 23 A triangle has sides of length 11 cm, 10 cm and 9 cm.

Calculate the largest angle in the triangle.

..... [4]

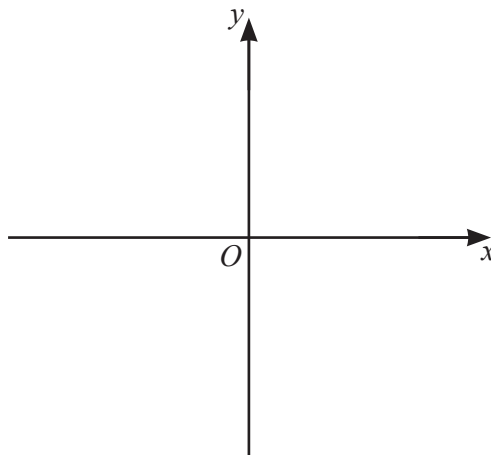
- 24 On the axes, sketch the graph of each of these functions.

(a) $y = \frac{2}{x}$



[2]

(b) $y = 2^{-x}$



[2]

Questions 25 and 26 are printed on the next page.

- 25 Find the x -coordinates of the points on the graph of $y = x^5 - 5x^4$ where the gradient is 0.

..... [4]

- 26 Malik goes to a shop every day to buy bread.

On any day, the probability that Malik goes to the shop in the morning is 0.7 .

If he goes in the morning, the probability that there is bread for Malik to buy is 0.95 .

If he goes later, the probability that there is bread for Malik to buy is 0.6 .

Calculate the probability that, on any day, there is bread for Malik to buy.

..... [3]

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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **6** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

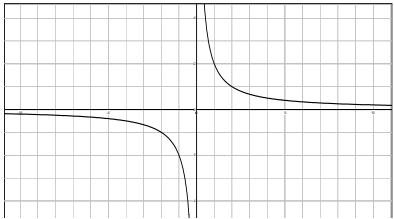
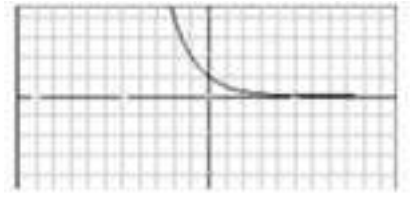
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Question	Answer	Marks	Partial Marks
1	-24.6	1	
2(a)	$\frac{18}{25}$ cao	1	
2(b)	$\frac{1}{250}$ cao	1	
3	Corresponding	1	
4	130	2	M1 for $360 - 100$ or better
5	63	2	M1 for $600 \times \frac{1.5}{100}$ oe or better If 0 scored SC1 for answer 663
6	$100y - np$	2	B1 for $100y$ seen or for answer $[10^k]y - np$
7(a)	125	1	
7(b)	29	1	
8	162.07 cao	2	M1 for $190 \div 1.1723$
9	$\frac{5}{3} \times \frac{2}{15}$ oe or $\frac{10}{6} \div \frac{45}{6}$ oe with common denominator	M2	B1 for $\frac{5}{3}$ oe or $\frac{15}{2}$ oe or M1 for $their \frac{5}{3} \times their \frac{2}{15}$
	$\frac{2}{9}$ cao	A1	
10(a)	Translation $\begin{pmatrix} -1 \\ -8 \end{pmatrix}$	2	B1 for each
10(b)	Image at $(-1, -1)$, $(-4, -1)$, $(-1, -2)$	2	B1 for image correct scale factor and orientation but wrong position or for enlargement scale factor $\frac{1}{2}$ centre $(0, 0)$
11	$12x^7$ final answer	2	B1 for $12x^j$ or kx^7 ($j, k \neq 0$) as final answer
12	-1, 0, 1 final answer	2	B1 for $-1 \leq x < 2$ or two correct answers and no extras or three correct answers and one extra/wrong
13	$4t$ final answer	2	B1 for $6t - 6q$ or $-2t + 6q$ or $2t - 6q$ or for $4t$ or $0q$ in the final answer

Question	Answer	Marks	Partial Marks
14	$[\pm] 21$	3	M2 for $29^2 - 20^2$ oe or better or M1 for $20^2 + k^2 = 29^2$ oe
15(a)	Similar	1	
15(b)	4	2	M1 for $\frac{12}{6} = \frac{8}{BX}$ oe or better If 0 scored SC1 for answer 3.5
15(c)(i)	6.7265 or 6.73 or 6.726 to 6.727	2	M1 for scale factor 2^2 or $\left(\frac{1}{2}\right)^2$ oe soi
15(c)(ii)	13.453 or 13.5 or 13.45 to 13.46	1	FT <i>their (c)(i) × 2</i>
16	477	2	M1 for $80 - 0.5$ oe or better seen
17	72	2	M1 for $\frac{360}{180-175}$ oe or $\frac{180(n-2)}{n} = 175$ oe
18(a)	12	1	
18(b)	144	2	FT $12 \times \text{their } V$ M1 for any relevant area FT <i>their V</i>
19(a)	80	2	B1 for angle $PQT = 50$
19(b)	$[w =] 68$ $[x =] 36$	3	B1 for 68 B2 for 36 or M1 for $3x + 2x + 68 + 112 = 360$ or better
20	2.31×10^p	2	B1 for $21 \times 10^{p-1}$ or 0.21×10^p or answer with figs 231
21	14.1 or 14.12...	3	M2 for $\sin 65 = \frac{12.8}{BC}$ oe or better or M1 for recognition that the line from B is perpendicular to AC
22	$\frac{81}{(y-2)^2}$ final answer	2	M1 for $z = \frac{k}{(y-2)^2}$ oe or better

Question	Answer	Marks	Partial Marks
23	70.5 or 70.52 to 70.53	4	B3 for 59(.0) or 58.99... or 50.5 or 50.47 to 50.48 OR M2 for $\frac{10^2 + 9^2 - 11^2}{2 \times 10 \times 9}$ oe or equivalent expression for smaller angle or M1 for $11^2 = 10^2 + 9^2 - 2 \times 10 \times 9 \cos(\dots)$ oe or equivalent expression for smaller angle A1 for $\frac{1}{3}$ oe
24(a)	Correct sketch 	2	B1 for one correct branch or attempt at correct shape
24(b)	Correct sketch 	2	B1 for correct shape but crossing x-axis or for correct shape but just drawn in one quadrant
25	0 and 4 final answer	4	B3 for $5x^3(x - 4)$ or better or B2 for $5x^4 - 20x^3$ or B1 for $5x^4$ or $-20x^3$
26	0.845 oe	3	M2 for $0.7 \times 0.95 + (1 - 0.7) \times 0.6$ oe or M1 for one of these products



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NUMBER

MATHEMATICS**0580/41**

Paper 4 (Extended)

May/June 2021**2 hours 30 minutes**

You must answer on the question paper.

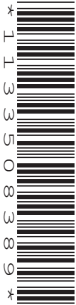
You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1 (a) The total cost of a taxi journey is calculated as

- \$0.50 per kilometre
- plus
- \$0.40 per minute.

(i) Calculate the total cost of a journey of 32 km that takes 30 minutes.

\$ [2]

(ii) The total cost of a journey of 100 km is \$98.

Show that the time taken is 2 hours.

[3]

(b) Three taxi drivers travel a total of 8190 km in the ratio 5 : 2 : 7.

Calculate the distance each driver travels.

Driver 1 km

Driver 2 km

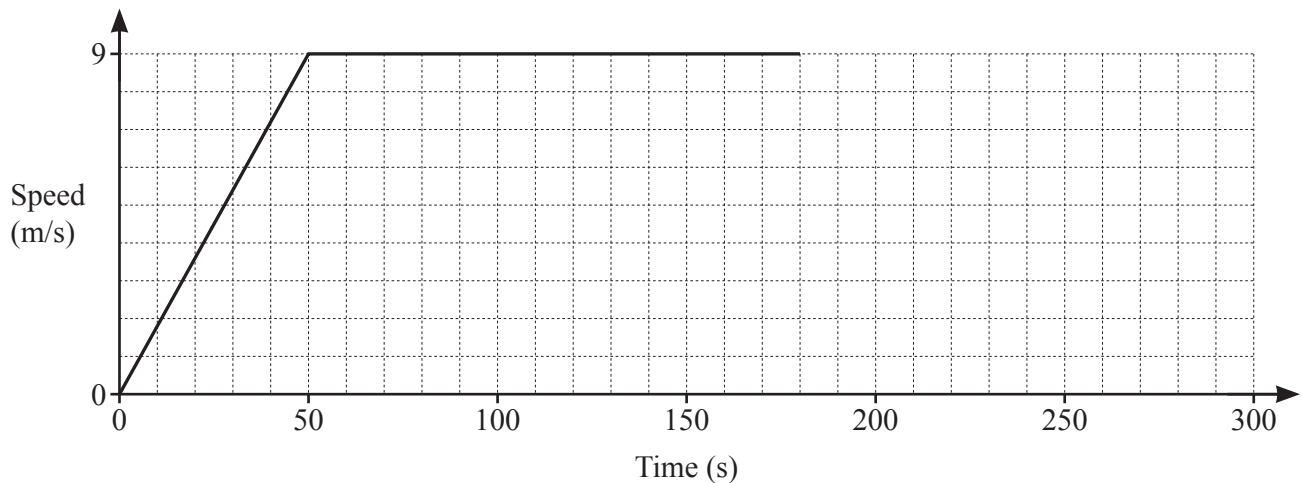
Driver 3 km [3]

(c) After midnight, the cost of any taxi journey increases by 45%.
One journey costs \$84.10 after midnight.

Calculate the cost of the same journey before midnight.

\$ [2]

- 2 The diagram shows the speed–time graph for the first 180 seconds of a train journey.



- (a) Find the acceleration, in m/s^2 , of the train during the first 50 seconds.

..... m/s^2 [1]

- (b) After 180 seconds, the train decelerates at a constant rate of 1944 km/h^2 .

Show that the train decelerates for 60 seconds until it stops.

[2]

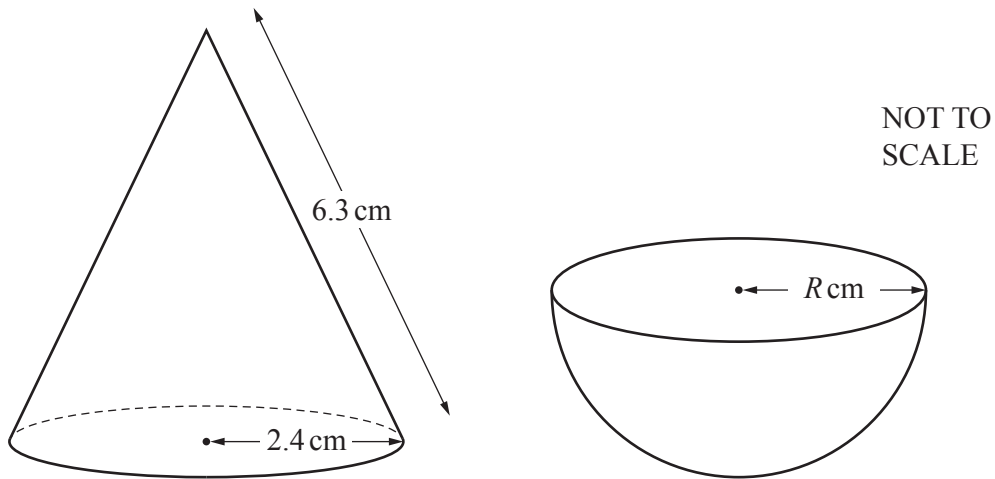
- (c) Complete the speed–time graph.

[1]

- (d) Calculate the average speed of the train for the whole journey.

..... m/s [4]

3 (a)



The diagram shows a solid cone and a solid hemisphere.

The cone has radius 2.4 cm and slant height 6.3 cm.

The hemisphere has radius R cm.

The **total** surface area of the cone is equal to the **total** surface area of the hemisphere.

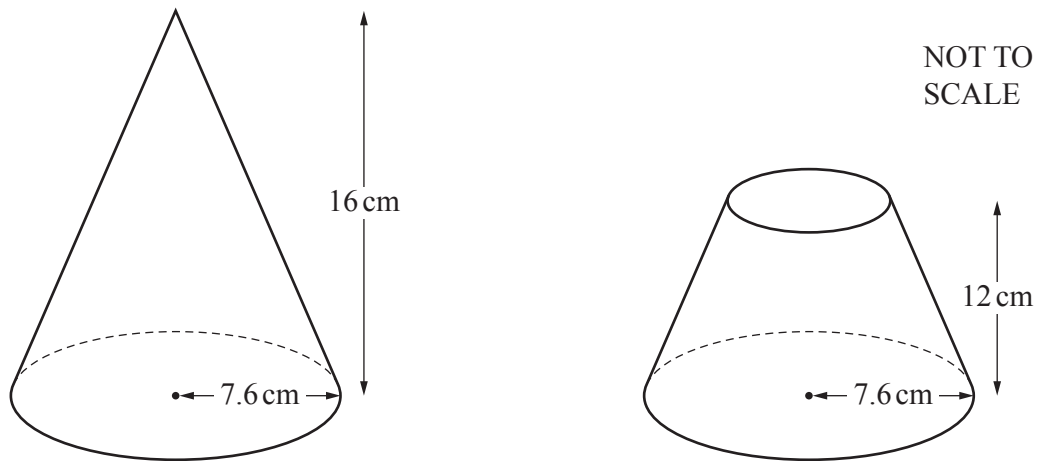
Calculate the value of R .

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi r l$.]

[The curved surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

$R = \dots\dots\dots$ [4]

(b)



The diagram shows a solid cone with radius 7.6 cm and height 16 cm.
A cut is made parallel to the base of the cone and the top section is removed.
The remaining solid has height 12 cm, as shown in the diagram.

Calculate the volume of the remaining solid.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm³ [4]

4 (a) The exchange rate is 1 euro = \$1.142 .

(i) Johann changes \$500 into euros.

Calculate the number of euros Johann receives.
Give your answer correct to the nearest euro.

..... euros [2]

(ii) Johann buys a computer for \$329.
The same computer costs 275 euros.

Calculate the difference in cost in dollars.

\$ [2]

(b) Lucy spends $\frac{3}{8}$ of the money she has saved this month on a book that costs \$5.25 .

Calculate how much money Lucy has saved this month.

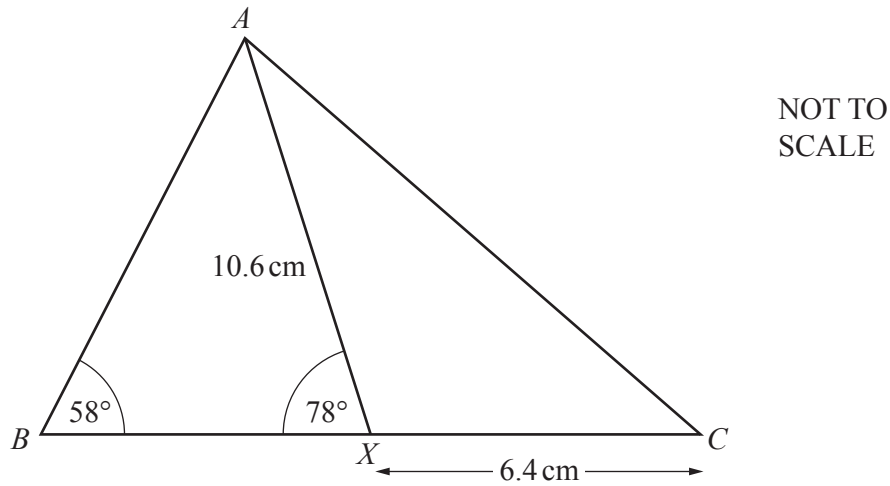
\$ [2]

(c) Kamal invests \$6130 at a rate of $r\%$ per year compound interest.
The value of his investment at the end of 5 years is \$6669.

Calculate the value of r .

$r =$ [3]

5



The diagram shows triangle ABC .

X is a point on BC .

$AX = 10.6\text{ cm}$, $XC = 6.4\text{ cm}$, angle $ABC = 58^\circ$ and angle $AXB = 78^\circ$.

(a) Calculate AC .

$AC = \dots\dots\dots\text{ cm}$ [4]

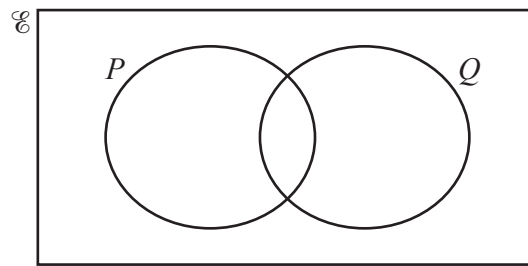
(b) Calculate BX .

$BX = \dots\dots\dots\text{ cm}$ [4]

(c) Calculate the area of triangle ABC .

$\dots\dots\dots\text{ cm}^2$ [3]

- 6 (a) In the Venn diagram, shade the region $P' \cup Q$.



[1]

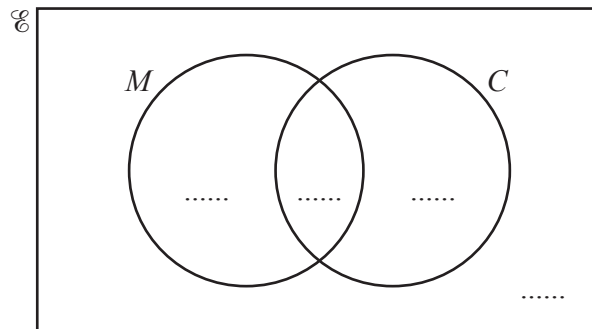
- (b) There are 50 students in a group.

34 have a mobile phone (M).

39 have a computer (C).

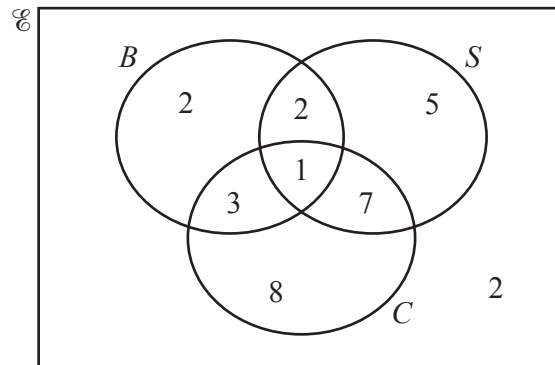
5 have no mobile phone and no computer.

Complete the Venn diagram to show this information.



[2]

- (c) The Venn diagram shows the number of students in a group of 30 who have brothers (B), sisters (S) or cousins (C).



- (i) Write down the number of students who have brothers.
 [1]
- (ii) Write down the number of students who have cousins but do not have sisters.
 [1]
- (iii) Find $n(B \cup S \cup C)$.
 [1]
- (iv) Use set notation to describe the set of students who have both cousins and sisters but do not have brothers.
 [1]
- (v) One student is picked at random from the 30 students.
 Find the probability that this student has cousins.
 [1]
- (vi) Two students are picked at random from the students who have cousins.
 Calculate the probability that both these students have brothers.
 [3]
- (vii) One student is picked at random from the 30 students.
 Event A This student has sisters.
 Event B This student has cousins but does not have brothers.
 Explain why event A and event B are equally likely.

 [1]

7 (a) Simplify.

$$\frac{x^2 - 25}{x^2 - x - 20}$$

..... [3]

(b) Write as a single fraction in its simplest form.

$$\frac{x+5}{x} + \frac{x+8}{x-1}$$

..... [3]

(c) A curve has equation $y = 2x^3 - 4x^2 + 6$.

(i) Find $\frac{dy}{dx}$, the derived function of y .

..... [2]

(ii) Calculate the gradient of the curve $y = 2x^3 - 4x^2 + 6$ at $x = 4$.

..... [2]

(iii) Find the coordinates of the two stationary points on the curve.

(..... , ...) and (..... , ...) [4]

- 8 (a) The table shows information about the mass, in kilograms, of each of 50 children.

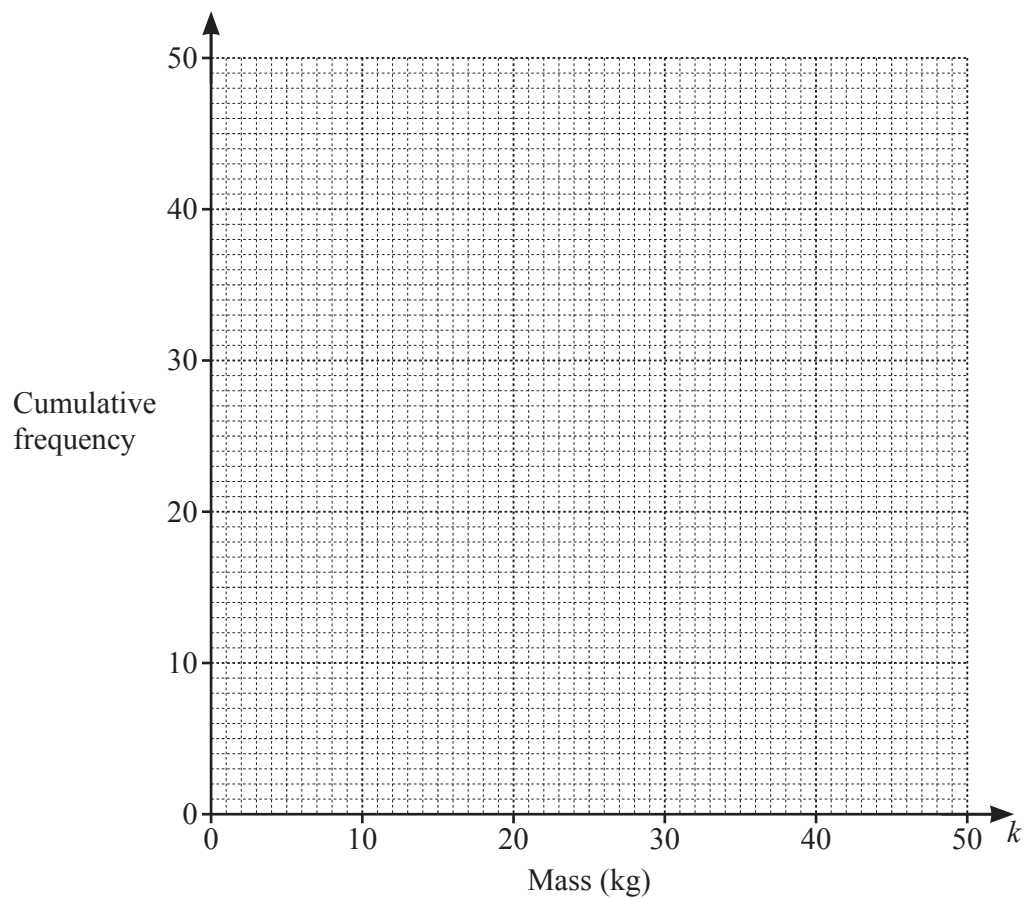
Mass (k kg)	$0 < k \leq 10$	$10 < k \leq 25$	$25 < k \leq 35$	$35 < k \leq 40$	$40 < k \leq 50$
Frequency	3	19	21	5	2

- (i) Complete the cumulative frequency table.

Mass (k kg)	$k \leq 10$	$k \leq 25$	$k \leq 35$	$k \leq 40$	$k \leq 50$
Cumulative frequency					

[2]

- (ii) On the grid, draw a cumulative frequency diagram to show this information.

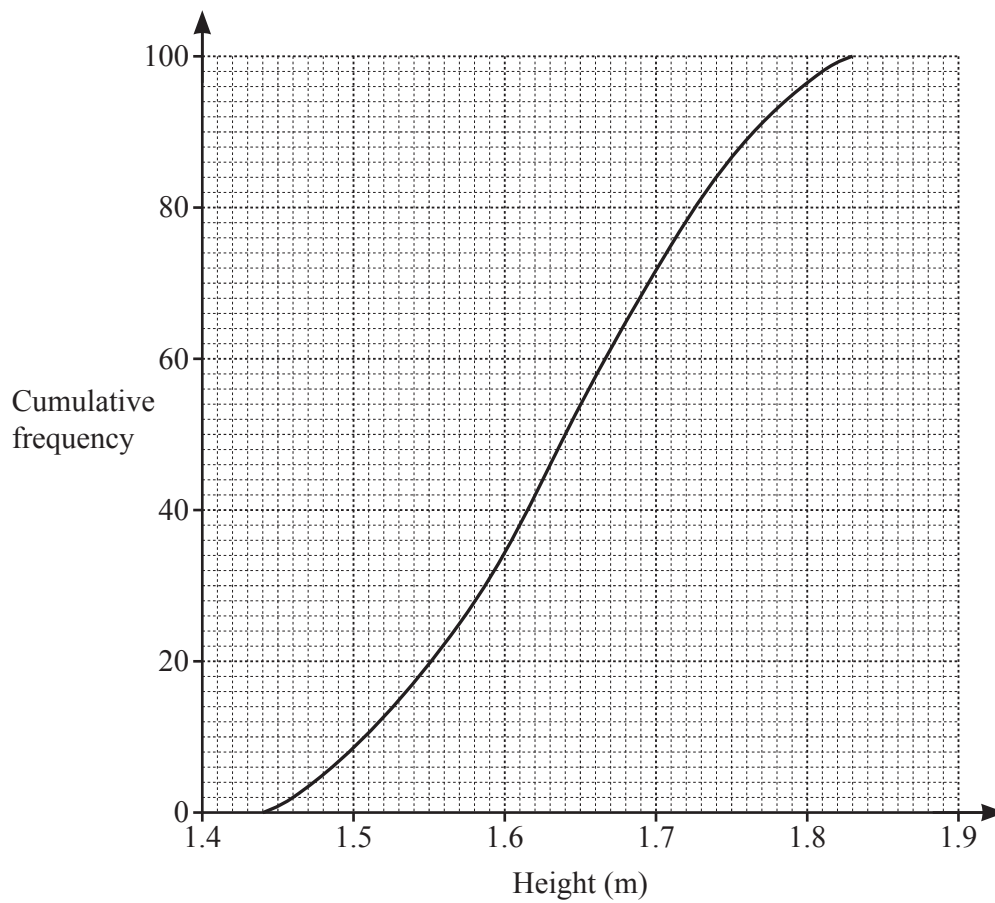


[3]

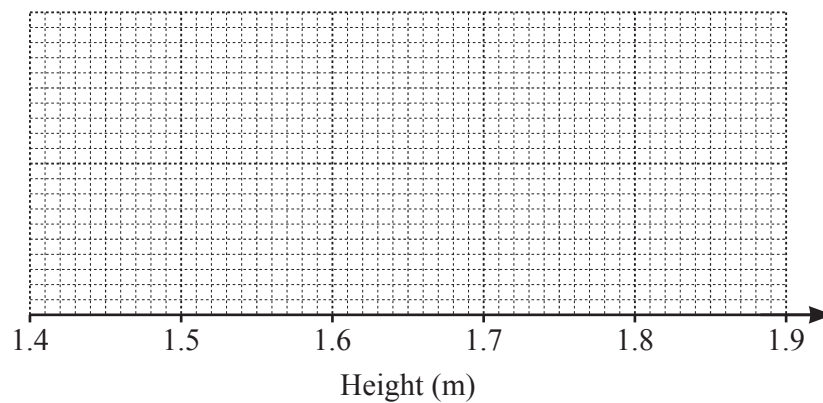
- (iii) Use your diagram to find an estimate of the number of children with a mass of 32 kg or less.

..... [1]

- (b) This cumulative frequency diagram shows information about the height, in metres, of each of 100 students.

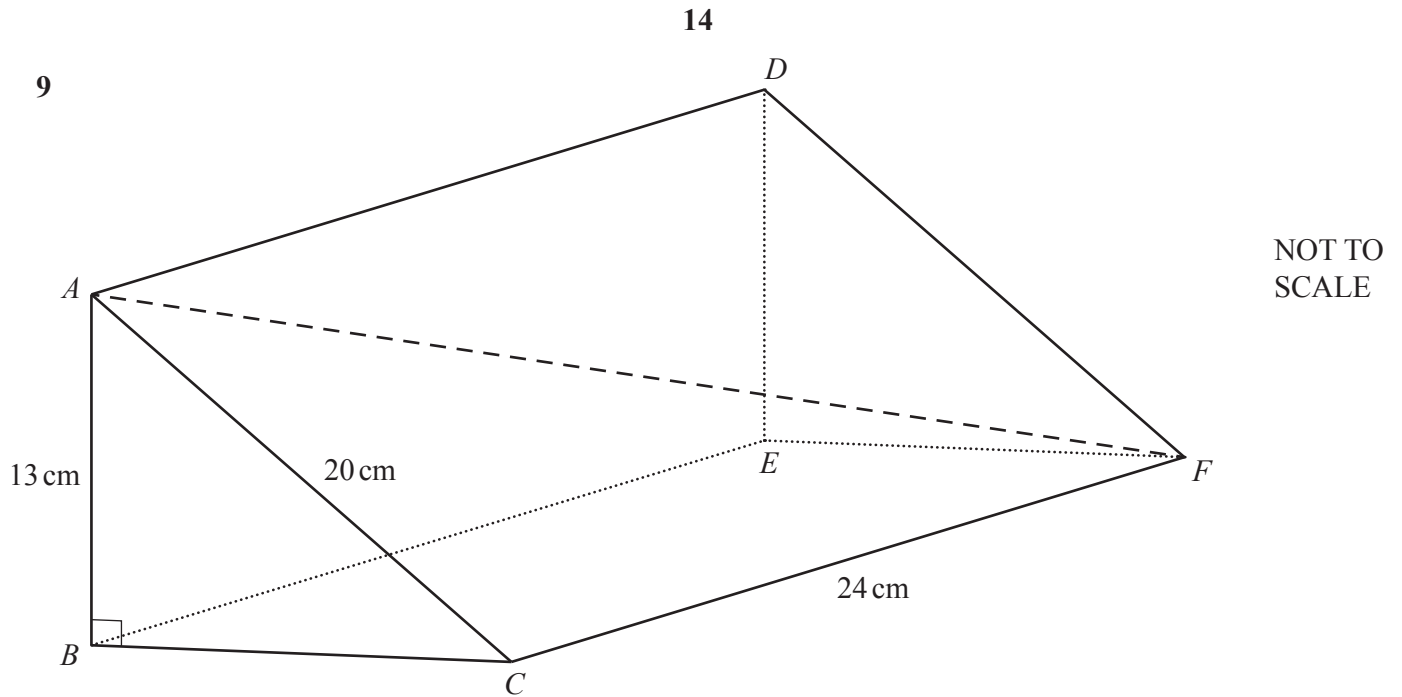


The height of the tallest student is 1.83 metres.
The height of the shortest student is 1.45 metres.



On this grid, draw a box-and-whisker plot for the heights of the 100 students.

[4]



The diagram shows a prism, $ABCDEF$.
 $AB = 13$ cm, $AC = 20$ cm, $CF = 24$ cm and angle $ABC = 90^\circ$.

(a) Calculate the total surface area of the prism.

..... cm^2 [6]

(b) Calculate the volume of the prism.

..... cm^3 [1]

(c) Calculate the angle that AF makes with the base $BCFE$.

..... [4]

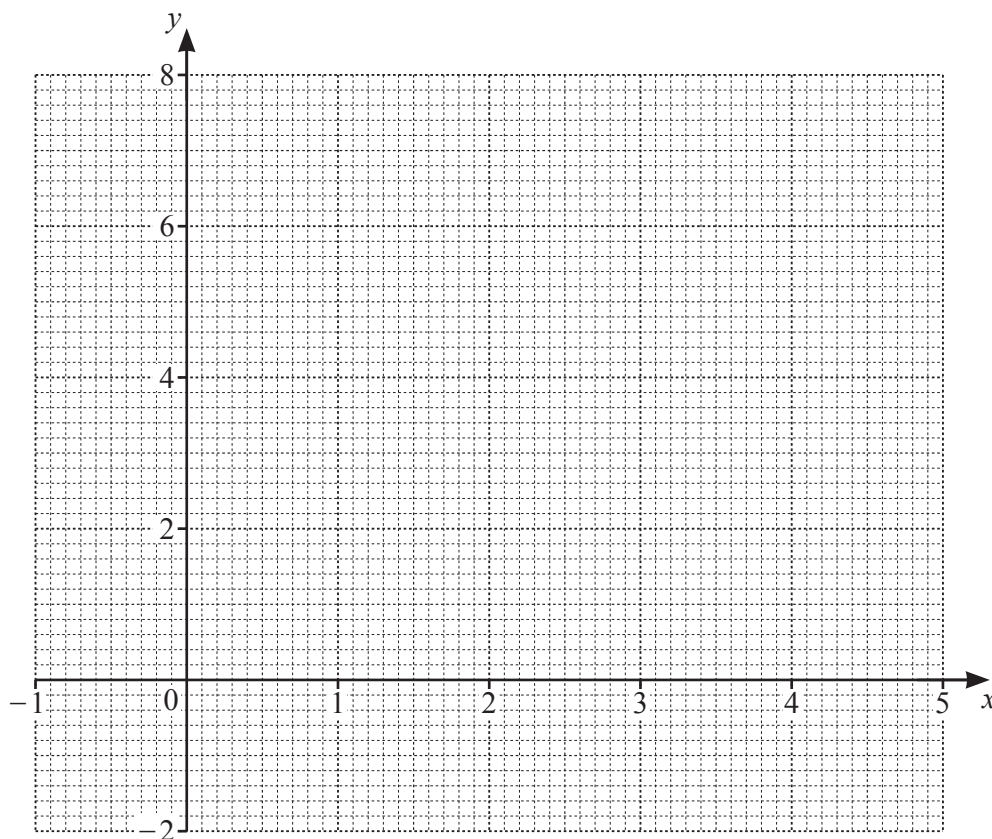
- 10 The table shows some values of $y = 3 + 4x - x^2$ for $-1 \leq x \leq 5$.

x	-1	-0.5	0	1	2	3	4	4.5	5
y	-2			6		6			-2

(a) Complete the table.

[3]

(b) On the grid, draw the graph of $y = 3 + 4x - x^2$ for $-1 \leq x \leq 5$.



[4]

(c) Write down an **integer** value of k for which the equation $3 + 4x - x^2 = k$ has no solutions.

..... [1]

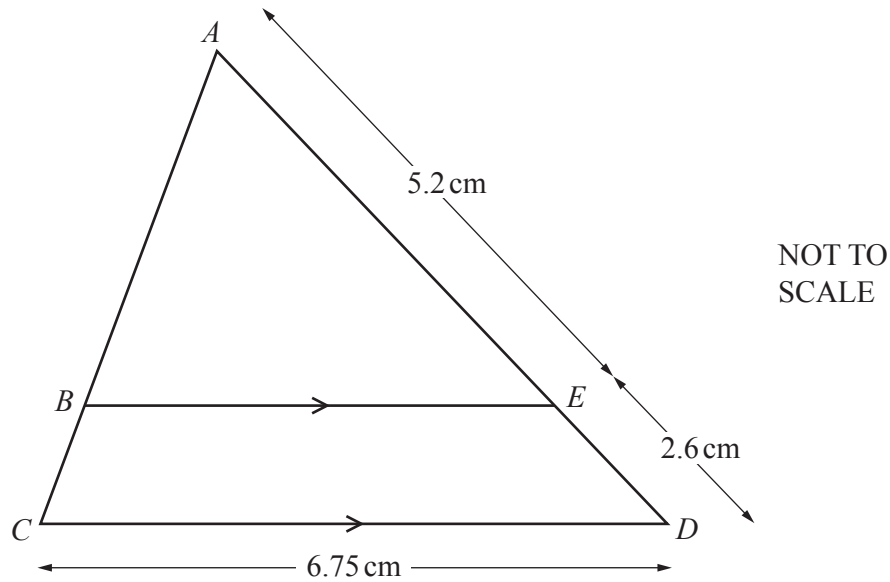
(d) By drawing a suitable straight line on the grid, solve the equation $-1 + \frac{9}{2}x - x^2 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

- 11 (a) Find the size of an exterior angle of a regular polygon with 18 sides.

..... [2]

(b)



In triangle ACD , B lies on AC and E lies on AD such that BE is parallel to CD .
 $AE = 5.2\text{ cm}$ and $ED = 2.6\text{ cm}$.

Calculate BE .

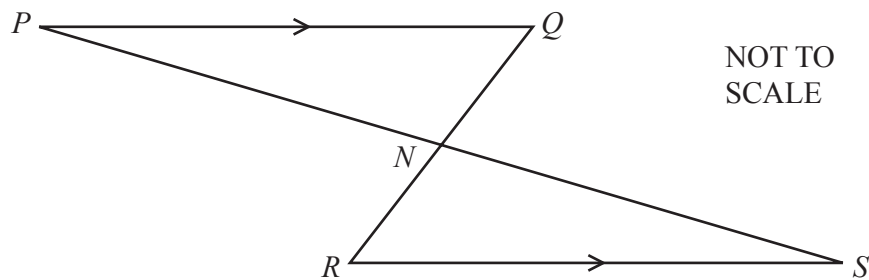
$BE =$ cm [2]

- (c) Two solids are mathematically similar.
The smaller solid has height 2 cm and volume 32 cm^3 .
The larger solid has volume 780 cm^3 .

Calculate the height of the larger solid.

..... cm [3]

(d)



PQ is parallel to RS , PNS is a straight line and N is the midpoint of RQ .

Explain, giving reasons, why triangle PQN is congruent to triangle SRN .

.....

 [4]

12 $f(x) = 3 - 2x$ $g(x) = x^2 + 5$ $h(x) = x^3$

(a) Find $f(-5)$.

..... [1]

(b) Find $ff(x)$.
Give your answer in its simplest form.

..... [2]

(c) Solve $g(x) = f(x) + 37$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

(d) Find $f^{-1}(x)$.

$$f^{-1}(x) = \dots\dots\dots [2]$$

(e) Find $hf(x) + g(x)$.
Give your answer in its simplest form.

$$\dots\dots\dots [5]$$

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

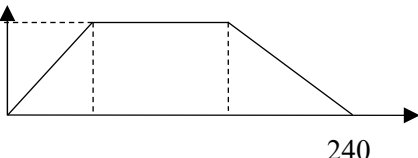
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

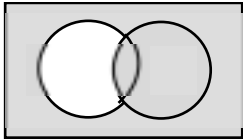
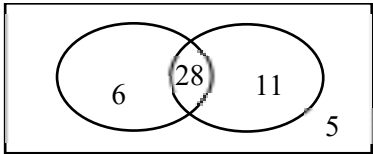
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	28	2	M1 for $32 \times 0.50 + 30 \times 0.40$
1(a)(ii)	$98 - 100 \times 0.5$ $48 \div 0.4 = 120$ [minutes] = 2 [hrs]	M3	M1 for $100 \times 0.50 + x \times 0.40 = 98$ M1 for $50 + 0.4x = 98$ or $0.4x = 48$ M1 for $x = \frac{48}{0.4}$ $x = 120$ [min] = 2 [hr] OR M1 for $100 \times 0.5 [= 50]$ M1 for $98 - 50 [= 48]$ M1 for $48 \div 0.4 = 120$ [min] = 2 [hr]
1(b)	2925 1170 4095	3	B2 for one correct answer or M1 for $8190 \div (5 + 2 + 7)$
1(c)	58	2	M1 for $\left(1 + \frac{45}{100}\right)k = 84.1$ oe
2(a)	0.18 or $\frac{9}{50}$	1	
2(b)	$1944 \times \frac{1000}{3600 \times 3600}$	M1	
	$9 \div 0.15 = 60$	M1	
2(c)		1	ruled line to axis with point of contact at 240
2(d)	6.9375	4	M2 for area = $\frac{1}{2} \times (130 + 240) \times 9$ oe or M1 for one correct partial area M1dep for <i>their</i> total area $\div 240$
3(a)	2.64 or 2.638...	4	M3 for $[R^2 =] \frac{\pi \times 2.4^2 + \pi \times 2.4 \times 6.3}{\pi + 2\pi}$ oe or M2 for $\pi \times 2.4^2 + \pi \times 2.4 \times 6.3 = \pi R^2 + \frac{1}{2} \times 4\pi R^2$ or M1 for $[\pi \times 2.4^2] + \pi \times 2.4 \times 6.3$ oe or $[\pi R^2] + \frac{1}{2} \times 4\pi R^2$ oe

Question	Answer	Marks	Partial Marks
3(b)	953 or 952.6 to 952.8	4	M3 for $\frac{1}{3} \times \pi \times 7.6^2 \times 16 \times \left(1 - \left(\frac{16-12}{16}\right)^3\right)$ or $\frac{1}{3} \times \pi \times 7.6^2 \times 16 - \frac{1}{3} \times \pi \times 1.9^2 \times (16-12)$ OR B1 for top radius = 1.9 or $\left(\frac{16-12}{16}\right)^3$ oe M2 for $\frac{1}{3} \times \pi \times 7.6^2 \times 16 - \frac{1}{3} \times \pi \times (\text{their } 1.9)^2 \times (16-12)$ or $\frac{1}{3} \times \pi \times 7.6^2 \times 16 \times \left(1 - \text{their } \left(\frac{16-12}{16}\right)^3\right)$ or M1 for $\frac{1}{3} \times \pi \times 7.6^2 \times 16$ or for $\frac{1}{3} \times \pi \times (\text{their } 1.9)^2 \times (16-12)$
4(a)(i)	438 cao	2	M1 for $\frac{500}{1.142}$
4(a)(ii)	14.95	2	M1 for $[329 -] 275 \times 1.142$ oe
4(b)	14	2	M1 for $5.25 \times \frac{8}{3}$ oe
4(c)	1.7[0] or 1.699...	3	M2 for $\sqrt[5]{\frac{6669}{6130}}$ or M1 for $6669 = 6130 (k)^5$
5(a)	13.5 or 13.47...	4	B1 for angle 102 seen M2 for $\sqrt{10.6^2 + 6.4^2 - 2 \times 10.6 \times 6.4 \times \cos(180 - 78)}$ OR M1 for $10.6^2 + 6.4^2 - 2 \times 10.6 \times 6.4 \times \cos(180 - 78)$ A1 for 181.5...
5(b)	8.68 or 8.682 to 8.683 nfw	4	B1 for angle = 44 M2 for $\sin(180 - 58 - 78) \times \frac{10.6}{\sin 58}$ oe or M1 for $\frac{\sin(180 - 58 - 78)}{x} = \frac{\sin 58}{10.6}$ oe

Question	Answer	Marks	Partial Marks
5(c)	78.2 or 78.17 to 78.19...	3	M2 for $\frac{1}{2} \times 10.6 \times (6.4 + \text{their } 8.68) \times \sin(78)$ oe OR M1 for $\frac{1}{2} \times 10.6 \times 6.4 \times \sin(180 - 78)$ oe M1 for $\frac{1}{2} \times 10.6 \times \text{their } 8.68 \times \sin 78$ oe
6(a)		1	
6(b)		2	B1 for 2 or 3 correct elements or M1 for $34 - x$, x and $39 - x$ correctly placed on diagram and $x = 28$
6(c)(i)	8	1	
6(c)(ii)	11	1	
6(c)(iii)	2	1	
6(c)(iv)	$C \cap S \cap B'$ oe	1	
6(c)(v)	$\frac{19}{30}$ oe	1	
6(c)(vi)	$\frac{2}{57}$ oe	3	M2 for $\frac{4}{19} \times \frac{3}{18}$ or M1 for $\frac{4}{19}$ seen
6(c)(vii)	Equal numbers 15 or equal probability $\frac{15}{30}$ oe	1	
7(a)	$\frac{x+5}{x+4}$ final answer	3	B1 for $(x-5)(x+5)$ B1 for $(x-5)(x+4)$
7(b)	$\frac{2x^2+12x-5}{x(x-1)}$ or $\frac{2x^2+12x-5}{x^2-x}$ final answer	3	B1 for common denominator $x(x-1)$ oe B1 for $(x-1)(x+5) + x(x+8)$ or better
7(c)(i)	$6x^2 - 8x$ final answer	2	B1 for each term in final answer or M1 for correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
7(c)(ii)	64	2	FT <i>their</i> (c)(i) correctly evaluated provided at least 2 terms but not the original equation M1 for substituting $x = 4$ into <i>their</i> (c)(i)
7(c)(iii)	$(0, 6)$ $\left(\frac{4}{3}, \frac{98}{27}\right)$ oe	4	M1 for <i>their</i> derivative = 0 or $\frac{dy}{dx} = 0$ soi B1 for $x = 0$ and $x = \frac{4}{3}$ M1dep for substituting one of <i>their</i> x values into $y = 2x^3 - 4x^2 + 6$ soi
8(a)(i)	3 22 43 48 50	2	B1 for 4 correct or M1 for one error in adding.
8(a)(ii)	correct diagram	3	B1FT <i>their</i> (a)(i) for 5 correct heights B1 for 5 points at upper ends of intervals on correct vertical line B1FT dep on at least B1 for increasing curve through <i>their</i> 5 points After 0 scored, SC1 for 4 of <i>their</i> points correctly plotted
8(a)(iii)	35 to 38	1	
8(b)	Correct box-and-whisker diagram  1.45 1.57 1.64 1.71 1.83	4	B1 for median 1.64 drawn B1 for LQ 1.57 drawn B1 for UQ 1.71 drawn If 0 scored SC1 for 1.64, 1.57 or 1.71 seen
9(a)	1350 or 1354....	6	M2 for $20^2 - 13^2$ or M1 for $BC^2 + 13^2 = 20^2$ A1 for $\sqrt{231}$ or 15.2 or 15.19 to 15.20 M1 for 20×24 and 13×24 and <i>their</i> 15.2×24 M1 for $[\frac{1}{2} \times]$ <i>their</i> 15.2×13
9(b)	2370 or 2369 to 2371... cao	1	
9(c)	24.6 or 24.58 to 24.59	4	M3 for $\sin [...] = \frac{13}{\sqrt{20^2 + 24^2}}$ oe or M2 for $\sqrt{20^2 + 24^2}$ or $\sqrt{24^2 + 20^2 - 13^2}$ or M1 for $AF^2 = 20^2 + 24^2$ or $24^2 + 20^2 - 13^2$ or M1 for correct angle identified
10(a)	0.75 3 7 3 0.75	3	B2 for 4 or 3 correct or B1 for 2 correct

Question	Answer	Marks	Partial Marks
10(b)	correct curve 	4	B3FT for 8 or 9 correct plots B2FT for 6 or 7 correct plots B1FT for 4 or 5 correct plots
10(c)	Accept any integer ≥ 8	1	
10(d)	line $y = 4 - \frac{1}{2}x$ ruled	B3	B2 for $[y =]4 - \frac{1}{2}x$ identified or B1 for ruled line with gradient $-\frac{1}{2}$ or B1 for ruled line through (0, 4) but not $y = 4$
	0.2 to 0.3 4.2 to 4.3	B1	
11(a)	20	2	M1 for $\frac{360}{18}$ or $180 - \frac{16 \times 180}{18}$
11(b)	4.5	2	M1 for $\frac{BE}{6.75} = \frac{5.2}{5.2 + 2.6}$ oe
11(c)	5.8[0] or 5.798 to 5.799	3	M2 for $2 \times \sqrt[3]{\frac{780}{32}}$ oe or M1 for $\sqrt[3]{\frac{780}{32}}$ or $\sqrt[3]{\frac{32}{780}}$ or $\frac{2^3}{l^3} = \frac{32}{780}$
11(d)	$QN = NR$ [given]	B1	
	Two correct pairs of angles with reasons from angle $PQN =$ angle SRN alternate angle $QPN =$ angle RSN alternate angle $PNQ =$ angle SNR [vertically] opposite	B2	B1 for any correct pair of angles with reason or two correct pairs of angles with no/wrong reasons
	ASA [implies congruent]	B1	dep on B1 B2

Question	Answer	Marks	Partial Marks
12(a)	13	1	
12(b)	$4x - 3$ final answer	2	M1 for $3 - 2(3 - 2x)$
12(c)	-7 5	4	M1 for $x^2 + 2x - 35 [= 0]$ or $x^2 + 2x = 35$ M2 for $(x + 7)(x - 5)$ or $x(x - 5) + 7(x - 5)$ or $x(x + 7) - 5(x + 7)$ or M1 for $(x + a)(x + b)$ where a, b are integers with $ab = -35$ or $a + b = 2$
12(d)	$\frac{3-x}{2}$ oe final answer	2	M1 for a correct first step: $x = 3 - 2y$ or $y - 3 = -2x$, $2x = 3 - y$ or $\frac{y}{2} = \frac{3}{2} - x$
12(e)	$32 - 54x + 37x^2 - 8x^3$ final answer	5	B4 for $27 - 36x - 18x + 24x^2 + 12x^2 - 8x^3 + x^2 + 5$ oe OR B1 for $(3 - 2x)^3 + x^2 + 5$ and B2 for expansion of the 3 brackets, allow one error or B1 for correct expansion of 2 of the brackets with at least 3 terms correct



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MATHEMATICS**0580/42**

Paper 4 (Extended)

May/June 2021**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages.

- 1 (a) A 2.5-litre tin of paint costs \$13.50 .
In a sale, the cost is reduced by 14%.

(i) Work out the sale price of this tin of paint.

\$ [2]

(ii) Work out the cost of buying 42.5 litres of paint at this sale price.

\$ [2]

- (b) Henri buys some paint in the ratio red paint : white paint : green paint = 2 : 8 : 5.

(i) Find the percentage of this paint that is white.

..... % [1]

(ii) Henri buys a total of 22.5 litres of paint.

Find the number of litres of green paint he buys.

..... litres [2]

- (c) Maria paints a rectangular wall.

The length of the wall is 20.5 m and the height is 2.4 m, both correct to 1 decimal place.

One litre of paint covers an area of exactly 10 m^2 .

Calculate the smallest number of 2.5-litre tins of paint she will need to be sure all the wall is painted.

Show all your working.

..... [4]

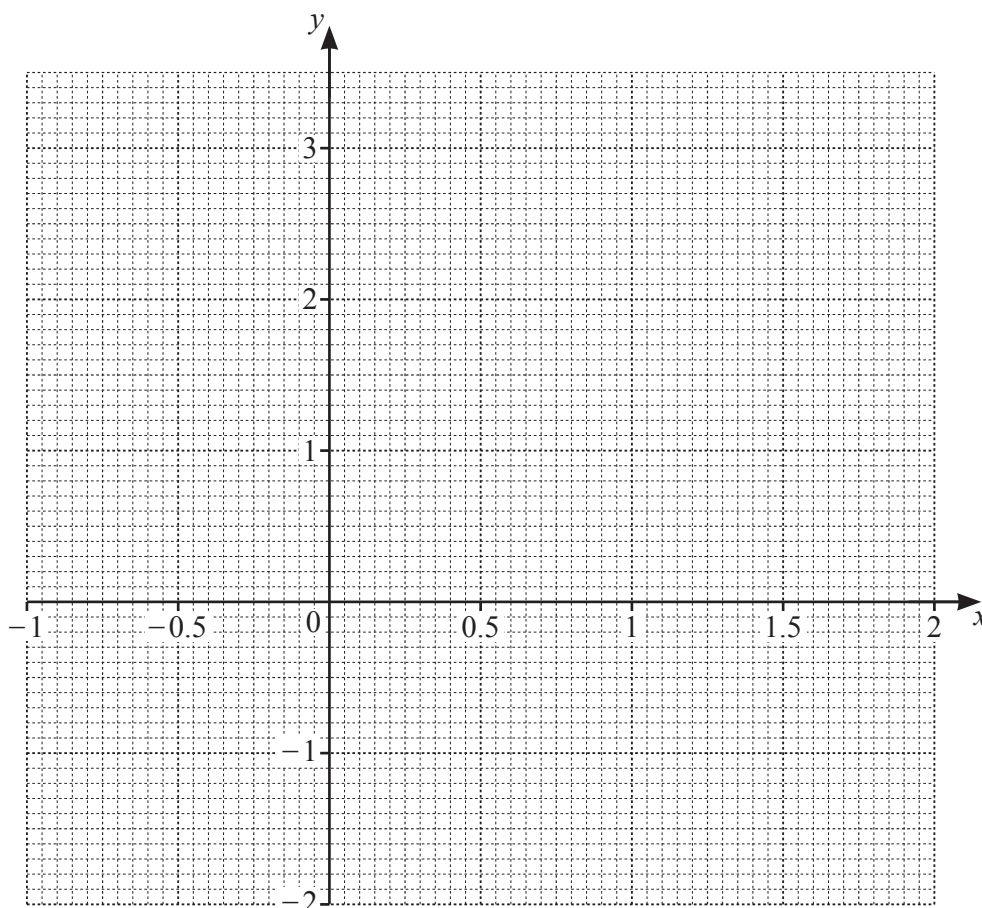
- 2 The table shows some values for $y = 2 \times 0.5^x - 1$.

x	-1	-0.5	0	0.5	1	1.5	2
y	3	1.83		0.41	0	-0.29	

- (a) (i) Complete the table.

[2]

- (ii) On the grid, draw the graph of $y = 2 \times 0.5^x - 1$ for $-1 \leq x \leq 2$.



[4]

- (b) By drawing a suitable straight line, solve the equation $2 \times 0.5^x + 2x - 3.5 = 0$ for $-1 \leq x \leq 2$.

$x =$ [3]

- (c) There are no solutions to the equation $2 \times 0.5^x - 1 = k$ where k is an integer.

Complete the following statements.

The highest possible value of k is

The equation of the asymptote to the graph of $y = 2 \times 0.5^x - 1$ is [2]

3 (a) Simplify, giving your answer as a single power of 7.

(i) $7^5 \times 7^6$

..... [1]

(ii) $7^{15} \div 7^5$

..... [1]

(iii) $42 + 7$

..... [1]

(b) Simplify.

$(5x^2 \times 2xy^4)^3$

..... [3]

(c) $P = 2^5 \times 3^3 \times 7$ $Q = 540$

(i) Find the highest common factor (HCF) of P and Q .

..... [2]

(ii) Find the lowest common multiple (LCM) of P and Q .

..... [2]

(iii) $P \times R$ is a cube number, where R is an integer.

Find the smallest possible value of R .

..... [2]

(d) Factorise the following completely.

(i) $x^2 - 3x - 28$

..... [2]

(ii) $7(a + 2b)^2 + 4a(a + 2b)$

..... [2]

(e) $3^{2x-1} = \frac{1}{9^x} \times 3^{2y-x}$

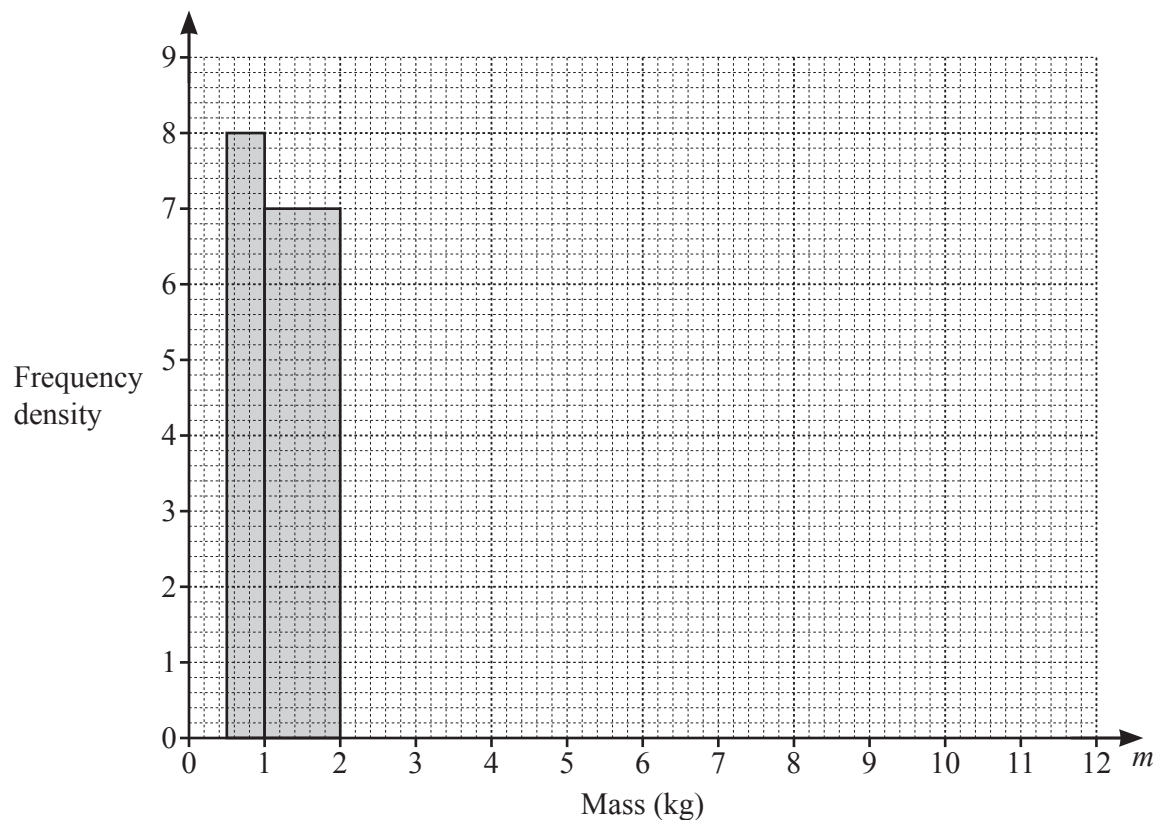
Find an expression for y in terms of x .

$y =$ [4]

- 4 (a) The mass, m kg, of each of 40 parcels in a warehouse is recorded.
The table shows information about the masses of these parcels.

Mass (m kg)	$0.5 < m \leq 1$	$1 < m \leq 2$	$2 < m \leq 4$	$4 < m \leq 7$	$7 < m \leq 12$
Frequency	4	7	15	10	4

- (i) Complete the histogram to show this information.



[3]

- (ii) Calculate an estimate of the mean mass of the parcels.

..... kg [4]

- (iii) A parcel is picked at random from the 40 parcels.

Find the probability that this parcel has a mass of 2 kg or less.

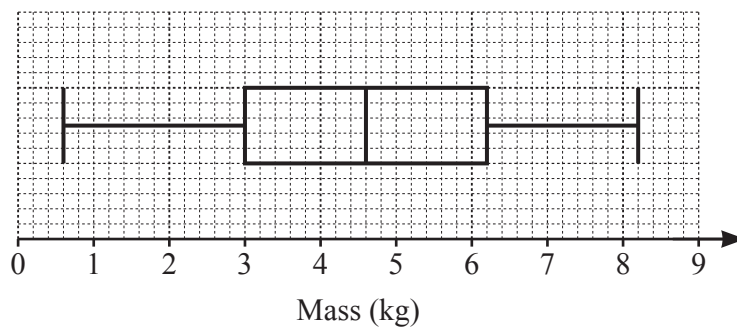
..... [1]

- (iv) Two parcels are picked at random without replacement from those with a mass **greater than 2 kg**.

Work out the probability that one of them has a mass greater than 7 kg and the other has a mass of 4 kg or less.

..... [3]

- (b) A van delivers parcels from a different warehouse.
The box-and-whisker plot shows information about the masses of the parcels in the van.



- (i) Find the median.

..... kg [1]

- (ii) Find the interquartile range.

..... kg [1]

- (iii) Two parcels are removed from the van at the first delivery.
The masses of these parcels are 2.4 kg and 5.8 kg.

Describe the effect that removing these parcels has on the median mass of the remaining parcels.

Give a reason for your answer.

.....

..... [2]

5 (a) $\mathbf{a} = \begin{pmatrix} -3 \\ 8 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$

(i) Find

(a) $\mathbf{b} - \mathbf{a}$,

$$\begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(b) $2\mathbf{a} + \mathbf{b}$,

$$\begin{pmatrix} \\ \end{pmatrix} \quad [2]$$

(c) $|\mathbf{b}|$.

..... [2]

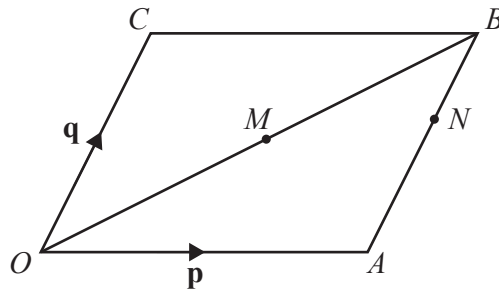
(ii) $\mathbf{a} + k\mathbf{b} = \begin{pmatrix} 13 \\ m \end{pmatrix}$, where k and m are integers.

Find the value of k and the value of m .

$$k = \dots\dots\dots$$

$$m = \dots\dots\dots [3]$$

(b)

NOT TO
SCALE

$OACB$ is a parallelogram and O is the origin.

M is the midpoint of OB .

N is the point on AB such that $AN : NB = 3 : 2$.

$\vec{OA} = \mathbf{p}$ and $\vec{OC} = \mathbf{q}$.

(i) Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, in its simplest form.

(a) $\vec{OB}$

$\vec{OB} = \dots\dots\dots$ [1]

(b) $\vec{CM}$

$\vec{CM} = \dots\dots\dots$ [2]

(c) $\vec{MN}$

$\vec{MN} = \dots\dots\dots$ [2]

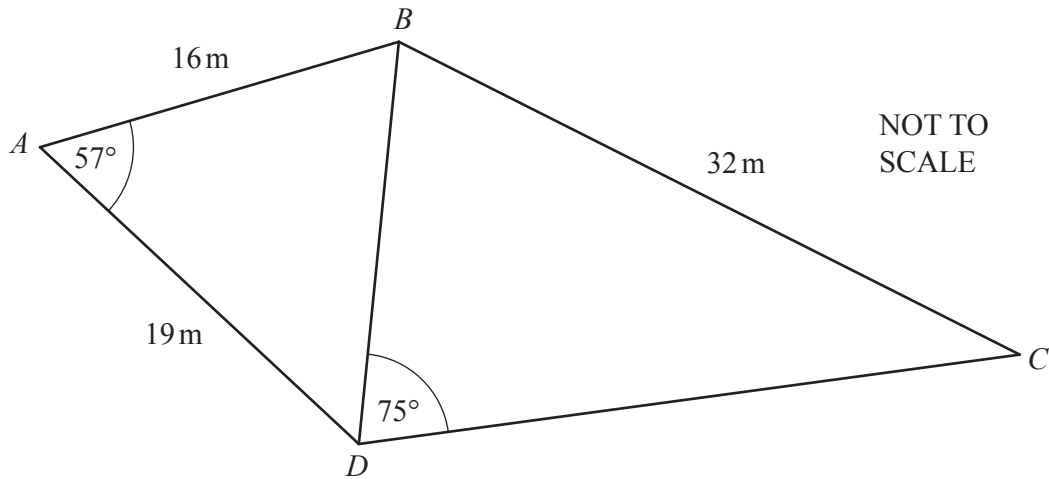
(ii) CB and ON are extended to meet at D .

Find the position vector of D in terms of $\mathbf{p}$ and $\mathbf{q}$.

Give your answer in its simplest form.

$\dots\dots\dots$ [3]

6



The diagram shows a quadrilateral $ABCD$ made from two triangles, ABD and BCD .

(a) Show that $BD = 16.9\text{m}$, correct to 1 decimal place.

[3]

(b) Calculate angle CBD .

Angle $CBD = \dots\dots\dots$ [4]

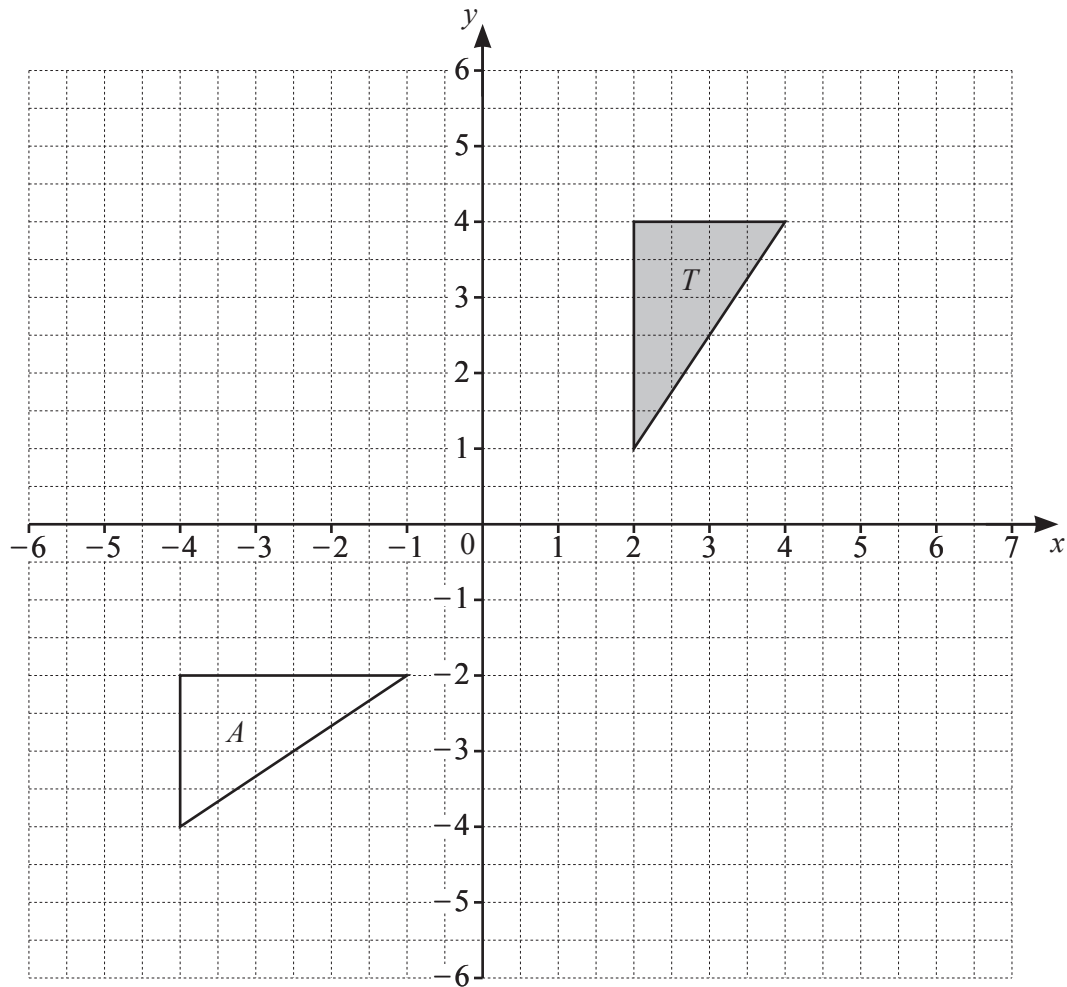
(c) Find the area of the quadrilateral $ABCD$.

$\dots\dots\dots \text{m}^2$ [3]

- (d) Find the shortest distance from B to AD .

..... m [3]

7



- (a) On the grid, draw the image of

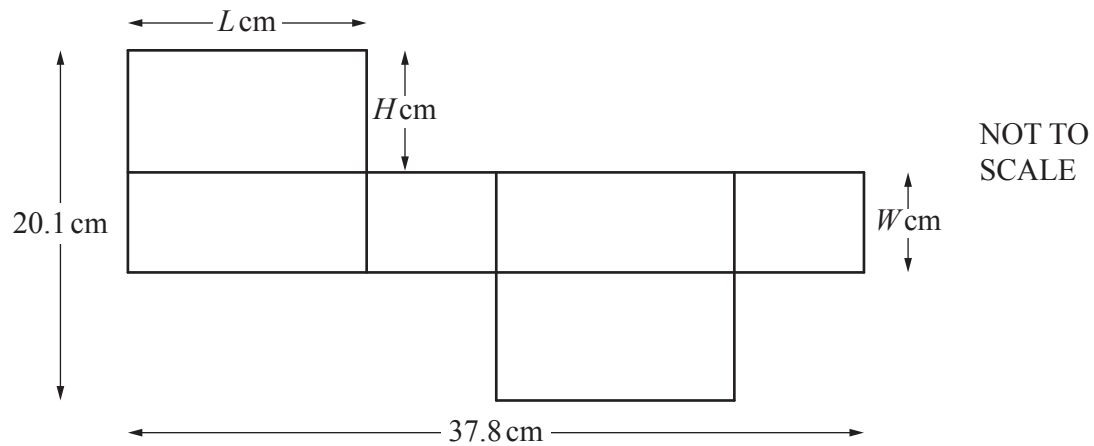
- (i) triangle T after a translation by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$, [2]
 (ii) triangle T after a rotation, 90° clockwise, about the origin, [2]
 (iii) triangle T after an enlargement, scale factor $-\frac{1}{2}$, centre $(-2, 3)$. [2]

- (b) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....

..... [2]

- 8 (a) A cuboid has length L cm, width W cm and height H cm.



The diagram shows the net of this cuboid.

The ratio $W : L = 1 : 2$.

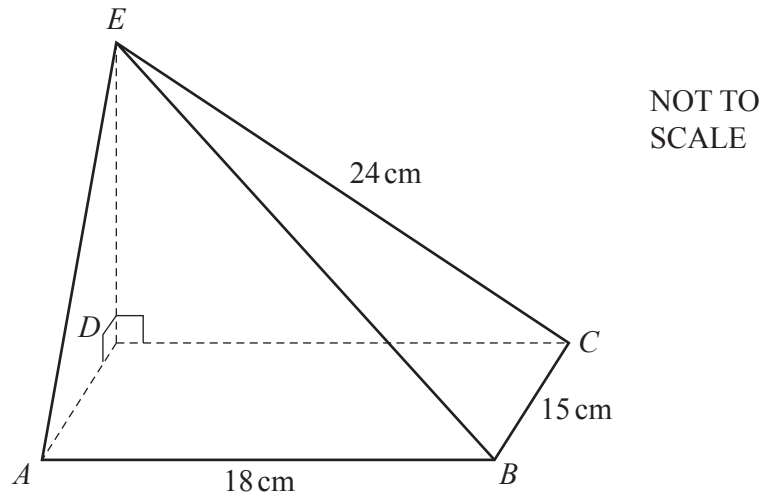
Find the value of L , the value of W and the value of H .

$$L = \dots\dots\dots$$

$$W = \dots\dots\dots$$

$$H = \dots\dots\dots [5]$$

(b)



The diagram shows a solid pyramid with a rectangular base $ABCD$.

E is vertically above D .

Angle $EDC = \text{angle } EDA = 90^\circ$.

$AB = 18 \text{ cm}$, $BC = 15 \text{ cm}$ and $EC = 24 \text{ cm}$.

- (i) The pyramid is made of wood and has a mass of 800 g.

Calculate the density of the wood.

Give the units of your answer.

[The volume, V , of a pyramid is $V = \frac{1}{3} \times \text{area of base} \times \text{height}$.]
[Density = mass $\div$ volume]

..... [5]

- (ii) Calculate the angle between BE and the base of the pyramid.

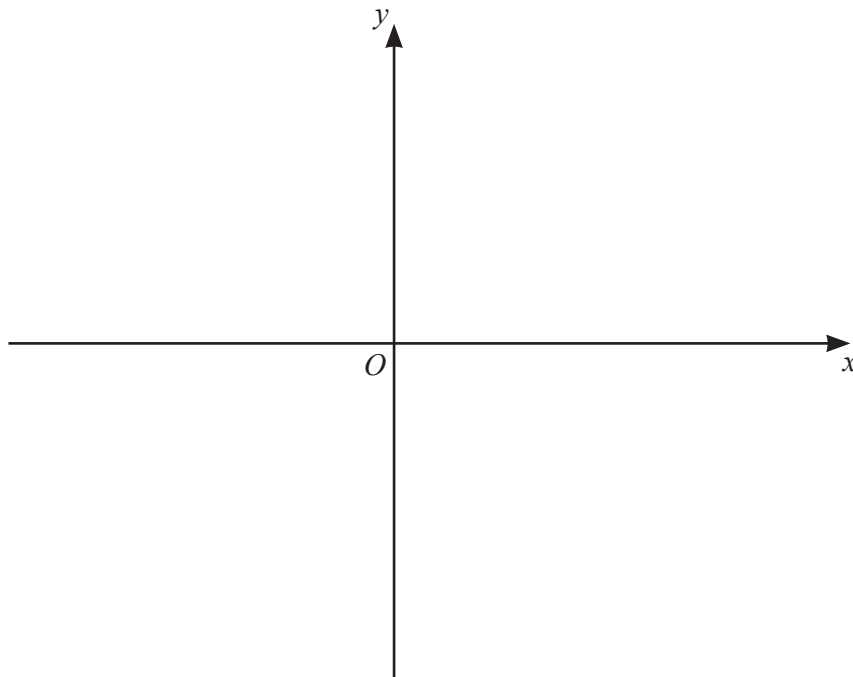
..... [4]
[Turn over]

- 9 (a) (i) The equation $y = x^3 - 4x^2 + 4x$ can be written as $y = x(x-a)^2$.

Find the value of a .

$a = \dots\dots\dots$ [2]

- (ii) On the axes, sketch the graph of $y = x^3 - 4x^2 + 4x$, indicating the values where the graph meets the axes.



[4]

- (b) Find the equation of the tangent to the graph of $y = x^3 - 4x^2 + 4x$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [7]

Question 10 is printed on the next page.

10 The table shows four sequences A , B , C and D .

Sequence	1st term	2nd term	3rd term	4th term	5th term		n th term
A	1	8	27	64			
B	5	11	17	23			
C	0.25	0.5	1	2	4		
D	4.75	10.5	16	21			

Complete the table.

[9]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	11.61 final answer	2	M1 for $13.5[0] \times \left(1 - \frac{14}{100}\right)$ oe or B1 for 1.89
1(a)(ii)	197.37 final answer	2	FT $17 \times$ <i>their</i> (a)(i) exact or correct to nearest cent M1 for $42.5 \div 2.5$
1(b)(i)	53.3 or 53.33...	1	
1(b)(ii)	7.5	2	M1 for $22.5 \div (2 + 8 + 5)$ oe soi
1(c)	20.55×2.45 oe	M2	M1 for $20.5 + 0.05$ oe seen or $2.4 + 0.05$ oe seen If 0 scored, SC1 here for 20.45×2.35 oe
	3 nfw	A2	M1 for <i>their</i> area $\div 10 \div 2.5$ oe
2(a)(i)	1, -0.5 oe	2	B1 for each
2(a)(ii)	Correct curve	4	B3FT for 6 or 7 correct plots or B2FT for 4 or 5 correct plots or B1FT for 2 or 3 correct plots
2(b)	$y = 2.5 - 2x$ ruled	B2	B1 for $y = k - 2x$ or $y = px + 2.5$ ruled ($p \neq 0$) or for $[y =] 2.5 - 2x$ oe identified
	1.3 to 1.4	B1	
2(c)	-1	B1	
	$y = -1$	B1	FT <i>their</i> k (must be negative)
3(a)(i)	7^{11} cao	1	
3(a)(ii)	7^{10} cao	1	
3(a)(iii)	7^2 cao	1	If answers 11, 10 and 2 in (a) then allow SC1 in this part
3(b)	$1000x^9y^{12}$ final answer	3	B2 for correct answer seen or answer of the form $1000x^9y^k$ or $1000x^ky^{12}$ or kx^9y^{12} or B1 for answer with one correct element in product or $(10x^3y^4)^{[3]}$ seen
3(c)(i)	108	2	M1 for $[540 =] 2^2 [\times] 3^3 [\times] 5$ or B1 for 108 oe not in prime factor form e.g. $2^2 \times 3 \times 9$

Question	Answer	Marks	Partial Marks
3(c)(ii)	30 240	2	M1 for $(540 \times 2^5 \times 3^3 \times 7) \div \text{their (c)(i)}$ oe or B1 for answer 30 240 oe not in prime factor form e.g. $2^5 \times 3^3 \times 35$
3(c)(iii)	98	2	B1 for 592 704 seen or $2^6 \times 3^3 \times 7^3$ seen or 2×7^2 oe seen
3(d)(i)	$(x - 7)(x + 4)$ final answer	2	M1 for $x(x - 7) + 4(x - 7)$ or $x(x + 4) - 7(x + 4)$ or better or for $(x + a)(x + b)$ where $ab = -28$ or $a + b = -3$
3(d)(ii)	$(a + 2b)(11a + 14b)$ final answer	2	M1 for $(a + 2b)(7(a + 2b) + 4a)$ or $(a + pb)(11a + qb)$ where $pq = 28$ or $11p + q = 36$ If 0 scored, SC1 for $a + 2b(11a + 14b)$
3(e)	$[y =] \frac{5x - 1}{2}$ oe final answer	4	B2 for $2x - 1 = -2x + 2y - x$ oe or B1 for $9^x = 3^{2x}$ or better M1dep for correct rearrangement of <i>their</i> 5 term 'linear' equation in y and x to make y the subject
4(a)(i)	Correct histogram	3	B1 for each correct block If 0 scored, SC1 for any two of fds 7.5, 3.33..., 0.8 oe soi
4(a)(ii)	3.7875 or 3.79 or 3.787 or 3.788	4	M1 for 0.75, 1.5, 3, 5.5, 9.5 soi M1 for Σfx M1 dep for <i>their</i> $\Sigma fx \div 40$
4(a)(iii)	$\frac{11}{40}$ oe	1	
4(a)(iv)	$\frac{30}{203}$ oe	3	M2 for $[2 \times] \frac{4}{29} \times \frac{15}{28}$ oe or M1 for $\frac{4}{29}$ or $\frac{15}{29}$ oe seen After 0 scored, SC1 for $[2 \times] \left(\frac{4}{40} \times \frac{26}{39} \right)$ oe or for answer $\frac{120}{841}$ oe
4(b)(i)	4.6	1	
4(b)(ii)	3.2	1	

Question	Answer	Marks	Partial Marks
4(b)(iii)	[median] remains the same oe and one is below [the median/middle] and one is above oe	2	B1 for each statement
5(a)(i)(a)	$\begin{pmatrix} 5 \\ -13 \end{pmatrix}$ final answer	1	
5(a)(i)(b)	$\begin{pmatrix} -4 \\ 11 \end{pmatrix}$ final answer	2	B1 for answer $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 11 \end{pmatrix}$ or $\begin{pmatrix} -6 \\ 16 \end{pmatrix}$ seen
5(a)(i)(c)	5.39 or 5.385...	2	M1 for $2^2 + ([-]5)^2$
5(a)(ii)	$[k =] 8$ $[m =] -32$	3	B2 for $k = 8$ or $m = -32$ or M1 for $-3 + 2k = 13$ oe or for $m = -5 \times \text{their } k + 8$ correctly evaluated
5(b)(i)(a)	$\mathbf{p} + \mathbf{q}$ final answer	1	
5(b)(i)(b)	$\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{q}$ or $\frac{1}{2}(\mathbf{p} - \mathbf{q})$ or $\frac{\mathbf{p} - \mathbf{q}}{2}$ final answer	2	M1 for unsimplified answer or any correct vector route for $\overrightarrow{CM}$, e.g. $-\mathbf{q} + \frac{1}{2}\text{their } (\mathbf{b})(\mathbf{i})(\mathbf{a})$
5(b)(i)(c)	$\frac{1}{2}\mathbf{p} + \frac{1}{10}\mathbf{q}$ or $\frac{5\mathbf{p} + \mathbf{q}}{10}$ final answer	2	M1 for unsimplified answer or any correct vector route for $\overrightarrow{MN}$
5(b)(ii)	$\frac{5}{3}\mathbf{p} + \mathbf{q}$ or $\frac{5\mathbf{p} + 3\mathbf{q}}{3}$ final answer	3	B2 for unsimplified correct answer OR M1 for $\mathbf{p} + \frac{3}{5}\mathbf{q}$ seen B1 for final answer of form $k\mathbf{p} + \mathbf{q}$ ($k > 1$) or final answer $\frac{5}{3}\mathbf{p} + j\mathbf{q}$ oe (any j)
6(a)	$\sqrt{16^2 + 19^2 - 2 \times 16 \times 19 \cos 57}$ oe	M2	or M1 for $16^2 + 19^2 - 2 \times 16 \times 19 \cos 57$ A1 for 285.8 to 285.9
	16.90 to 16.91	A1	

Question	Answer	Marks	Partial Marks
6(b)	74.3 or 74.30 to 74.33	4	M2 for $[\sin \dots =] \frac{16.9 \times \sin 75}{32}$ oe or M1 for $\frac{16.9}{\sin C} = \frac{32}{\sin 75}$ oe B1 for $[\text{angle } BCD =] 30.7 \text{ or } 30.67 \text{ to } 30.69\dots$ or M1dep for $105 - \text{their angle } BCD$
6(c)	388 or 387.7 to 387.9... nfw	3	M1 for $\frac{1}{2} \times 16 \times 19 \times \sin 57$ oe M1 for $\frac{1}{2} \times 16.9 \times 32 \times \sin \text{their (b)}$ oe
6(d)	13.4 or 13.41 to 13.42 nfw	3	M2 for $\frac{x}{16} = \sin 57$ oe or M1 for distance required is perpendicular to AD soi
7(a)(i)	Triangle at (4, 0) (4, 3) (6, 3)	2	B1 for translation by $\begin{pmatrix} 2 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -1 \end{pmatrix}$ If 0 scored SC1 for triangle at (3, 0.5) (3, 3.5) (5, 3.5)
7(a)(ii)	Triangle at (1, -2) (4, -4) (4, -2)	2	B1 for rotation 90 clockwise wrong centre or for rotation 90 anticlockwise about the origin
7(a)(iii)	Triangle at (-4, 4) (-4, 2.5) (-5, 2.5)	2	B1 for enlargement SF $-\frac{1}{2}$ with wrong centre or for enlargement SF $\frac{1}{2}$ with centre (-2, 3)
7(b)	Reflection $y = -x$ oe	2	B1 for each
8(a)	$[L =] 11.8$ $[W =] 5.9$ $[H =] 7.1$	5	M1 for $L = 2W$ oe soi M1 for $W + 2H = 20.1$ oe M1 for $2L + 2H = 37.8$ oe B1 for at least one correct answer
8(b)(i)	0.559 to 0.56[0...]	B4	M2 for $\frac{1}{3} \times 18 \times 15 \times \sqrt{24^2 - 18^2}$ isw conversion or M1 for $h^2 + 18^2 = 24^2$ oe or better M1 for figs $800 \div$ figs <i>their</i> volume isw
	g/cm^3 or g cm^{-3} final answer	B1	

Question	Answer	Marks	Partial Marks
8(b)(ii)	34.1 or 34.11 to 34.12	4	M3 for $\tan [] = \frac{\sqrt{24^2 - 18^2}}{\sqrt{18^2 + 15^2}}$ oe or M2 for $\sqrt{18^2 + 15^2}$ isw or $\sqrt{24^2 + 15^2}$ isw or M1 for $18^2 + 15^2$ isw or $24^2 + 15^2$ isw or M1 for indicating required angle is <i>EBD</i>
9(a)(i)	2	2	M1 for $x(x^2 - 4x + 4)$ or $x(x - 2)^2$ or $(x^2 - 2x)(x - 2)$ or $x^3 - 2ax^2 + a^2x$
9(a)(ii)	Correct sketch with curve passing through <i>O</i> and touching (2, 0) 	4	B1 for any positive cubic B1 for sketch through or touching <i>O</i> B1 for sketch with min or max touching <i>x</i> -axis once only but not at (0, 0) B1FT <i>their (a)(i)</i> for sketch with min or max touching <i>x</i> -axis at (<i>their</i> 2, 0) and <i>their</i> 2 is labelled or clearly indicated
9(b)	$y = 20x - 64$ final answer nfw	7	B6 for equivalent correct equation OR B2 for $3x^2 - 8x + 4$ isw or B1 for $3x^2$ or $-8x$ seen M2dep for [grad =] 20 soi nfw or M1dep for substituting 4 into <i>their</i> derivative isw B1 for (4, 16) soi M1dep for $16 = \text{their } 20 \times 4 + c$ oe
10	125 n^3 oe final ans	B2	B1 for 125 B1 for n^3
	29 $6n - 1$ oe final ans	B3	B1 for 29 B2 for $6n - 1$ oe or B1 for $6n + k$ or $an - 1$ ($a \neq 0$)
	2^{n-3} oe final ans	B2	B1 for $2^{n[+k]}$ oe
	25 $6n - 1 - 2^{n-3}$ oe final ans OR 25.25 $-\frac{1}{24}n^3 + \frac{1}{8}n^2 + \frac{17}{3}n - 1$ oe final ans	B2	FT <i>their</i> 29 – 4 and <i>their</i> $6n - 1 - \text{their } 2^{n-3}$ B1FT for each OR B1 for each



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MATHEMATICS**0580/43**

Paper 4 (Extended)

May/June 2021**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

- 1 (a) (i) Yasmin and Zak share an amount of money in the ratio 21 : 19.
Yasmin receives \$6 more than Zak.

Calculate the total amount of money shared by Yasmin and Zak.

\$ [2]

- (ii) In a sale, all prices are reduced by 15%.

- (a) Yasmin buys a blouse with an original price of \$40.

Calculate the sale price of the blouse.

\$ [2]

- (b) Zak buys a shirt with a sale price of \$29.75 .

Calculate the original price of the shirt.

\$ [2]

- (b) Xavier's salary increases by 2% each year.
In 2010, his salary was \$40 100.

- (i) Calculate his salary in 2015.
Give your answer correct to the nearest dollar.

\$ [3]

- (ii) In which year is Xavier's salary first greater than \$47 500?

..... [3]

- (c) In January 2020, the population of a town was 5% **more** than its population in January 2018.
In January 2021, the population of this town was 2% **less** than its population in January 2020.

Calculate the overall percentage increase in the population from January 2018 to January 2021.

..... % [2]

2 (a) $y = px^2 + t$

(i) Find the value of y when $p = 3$, $x = 2$ and $t = -13$.

$$y = \dots\dots\dots [2]$$

(ii) Rearrange the formula to write x in terms of p , t and y .

$$x = \dots\dots\dots [3]$$

(b) (i) Factorise.

$$15x^2 - 2x - 8$$

$$\dots\dots\dots [2]$$

(ii) Solve the equation.

$$15x^2 - 2x - 8 = 0$$

$$x = \dots\dots\dots \text{ or } x = \dots\dots\dots [1]$$

(c) Factorise completely.

$$x^3 - 16xy^2$$

$$\dots\dots\dots [3]$$

(d) Simplify.

$$\frac{2x - 1 - 4ax + 2a}{2x^2 - x}$$

..... [4]

6

- 3 (a) Zoe's test scores last term were 6 7 7 7 8 9 9 10 10.

Find

- (i) the range,

..... [1]

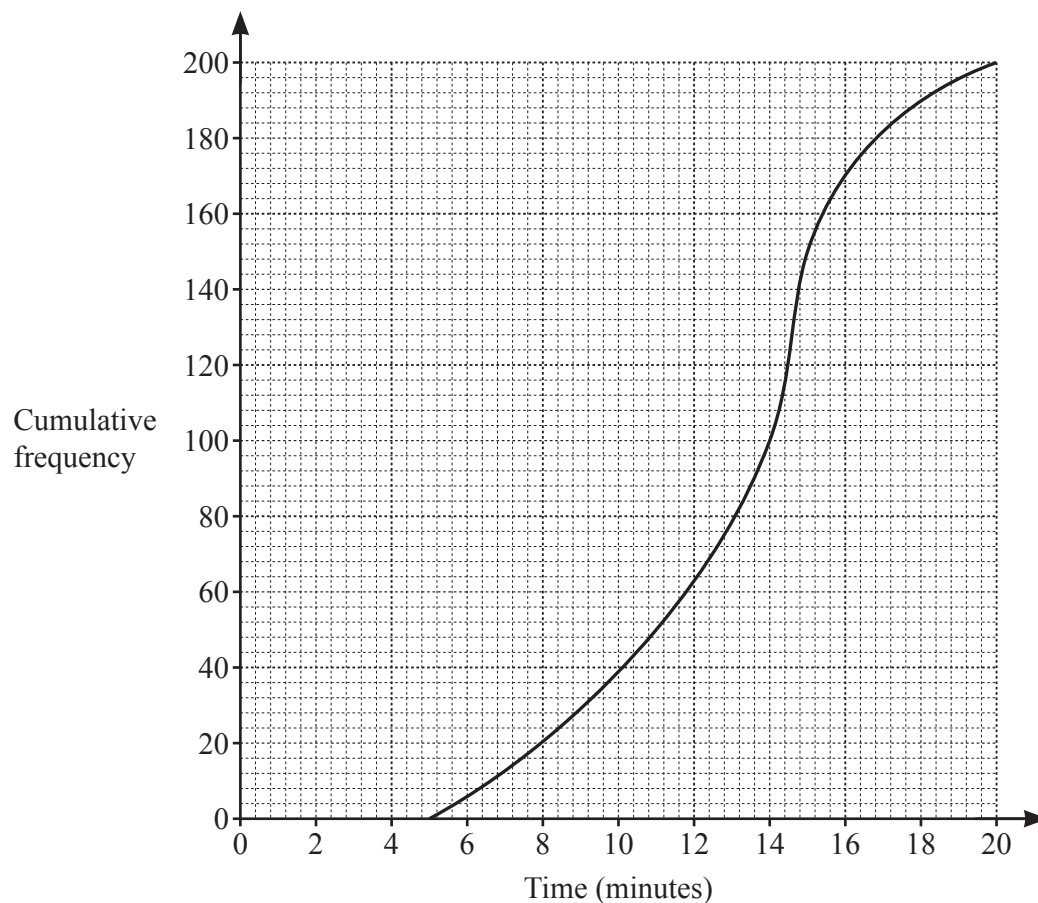
- (ii) the mode,

..... [1]

- (iii) the median.

..... [1]

- (b) The cumulative frequency diagram shows information about the time taken by each of 200 students to solve a problem.



Use the diagram to find an estimate of

- (i) the median,

..... min [1]

- (ii) the interquartile range.

..... min [2]

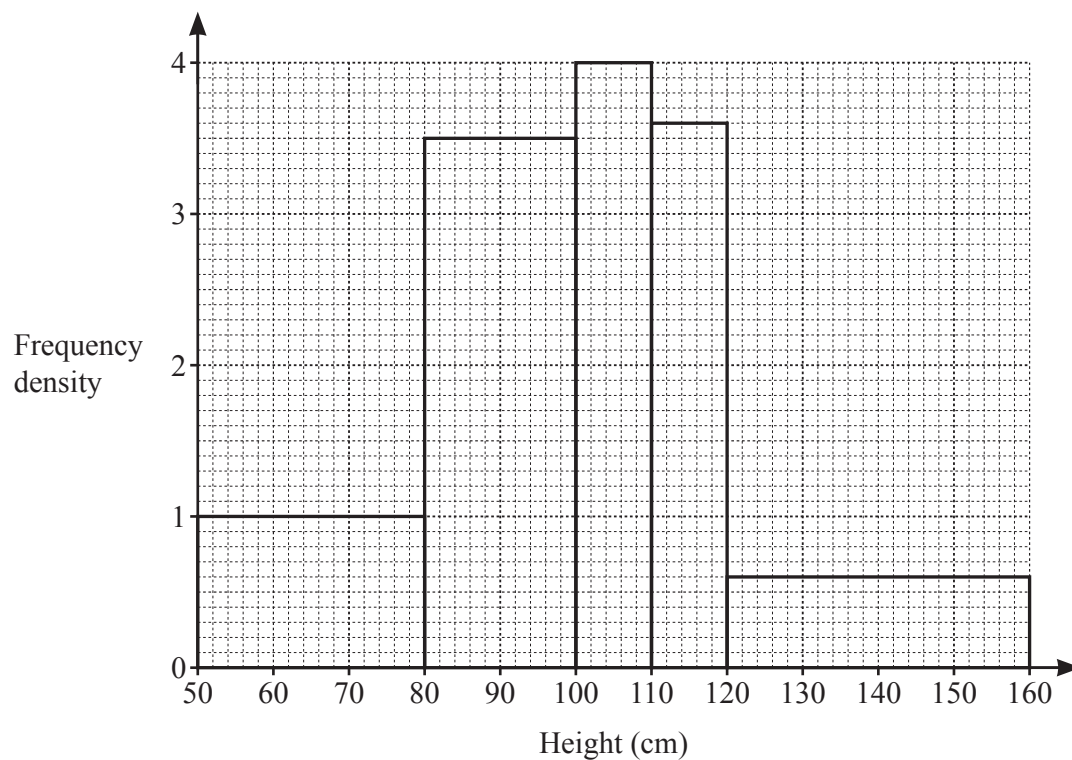
- (c) The test scores of 200 students are shown in the table.

Score	5	6	7	8	9	10
Frequency	3	10	43	75	48	21

Calculate the mean.

..... [3]

- (d) The height, in cm, of each of 200 plants is measured.
The histogram shows the results.



Calculate an estimate of the mean height.
You must show all your working.

..... cm [6]

- 4 (a) A is the point $(1, 5)$ and B is the point $(3, 9)$.
 M is the midpoint of AB .

(i) Find the coordinates of M .

(....., ...) [2]

(ii) Find the equation of the line that is perpendicular to AB and passes through M .
 Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [4]

- (b) The position vector of P is $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and the position vector of Q is $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$.

(i) Find the vector $\overrightarrow{PQ}$.

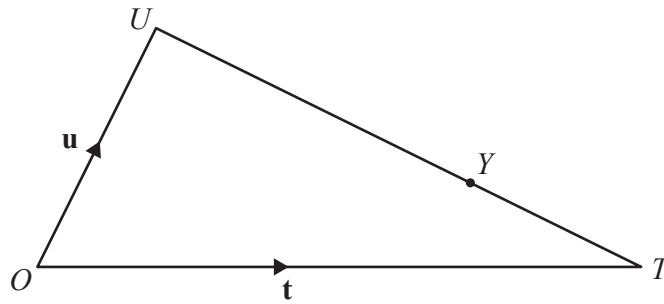
$\begin{pmatrix} \\ \end{pmatrix}$ [2]

(ii) R is the point such that $\overrightarrow{PR} = 3\overrightarrow{PQ}$.

Find the position vector of R .

$\begin{pmatrix} \\ \end{pmatrix}$ [2]

(c)

NOT TO
SCALE

$$\overrightarrow{OT} = \mathbf{t}, \overrightarrow{OU} = \mathbf{u} \text{ and } UY = 2YT.$$

- (i) Find $\overrightarrow{OY}$ in terms of $\mathbf{t}$ and $\mathbf{u}$.
Give your answer in its simplest form.

$$\overrightarrow{OY} = \dots\dots\dots [2]$$

- (ii) Z is on OT and YZ is parallel to UO.

Find $\overrightarrow{OZ}$ in terms of $\mathbf{t}$ and/or $\mathbf{u}$.
Give your answer in its simplest form.

$$\overrightarrow{OZ} = \dots\dots\dots [1]$$

5 Solve the simultaneous equations.

(a) $x + 2y = 13$
 $x + 5y = 22$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [2]$$

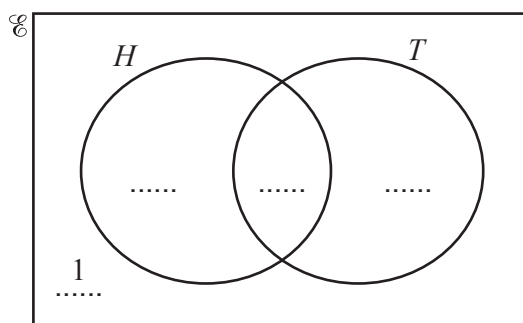
(b) $y = 2 - x$
 $y = x^2 + 2x + 2$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [4]$$

- 6 In a class of 24 students, 18 students like homework (H), 15 students like tests (T) and 1 student does not like homework and does not like tests.

(a) Complete the Venn diagram to show this information.



[2]

(b) Write down the number of students who like both homework and tests.

..... [1]

(c) Find $n(H' \cap T)$.

..... [1]

(d) A student is picked at random from the class.

Write down the probability that this student likes tests but does not like homework.

..... [1]

(e) Two students are picked at random from the class.

Find the probability that both students do not like homework and do not like tests.

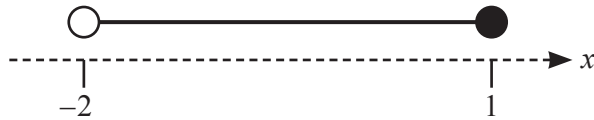
..... [1]

(f) Two of the students who like homework are picked at random.

Find the probability that both students also like tests.

..... [3]

7 (a)



Write down the inequality in x shown by the number line.

..... [2]

(b) (i) Write $x^2 + 4x + 1$ in the form $(x + p)^2 + q$.

..... [2]

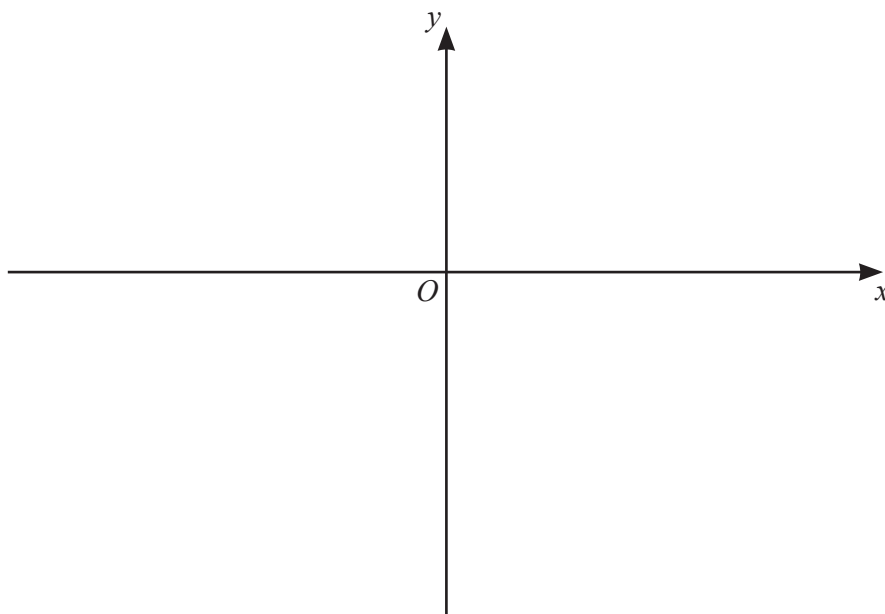
(ii) Use your answer to **part (b)(i)** to solve the equation $x^2 + 4x + 1 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

- (iii) Use your answer to **part (b)(i)** to write down the coordinates of the minimum point on the graph of $y = x^2 + 4x + 1$.

(..... , ...) [2]

- (iv) On the diagram, sketch the graph of $y = x^2 + 4x + 1$.



[2]

- 8 (a) A solid cuboid measures 20 cm by 12 cm by 5 cm.

(i) Calculate the volume of the cuboid.

..... cm^3 [1]

(ii) (a) Calculate the total surface area of the cuboid.

..... cm^2 [3]

- (b) The surface of the cuboid is painted.
The cost of the paint used is \$1.52 .

Find the cost to paint 1 cm^2 of the cuboid.
Give your answer in cents.

..... cents [1]

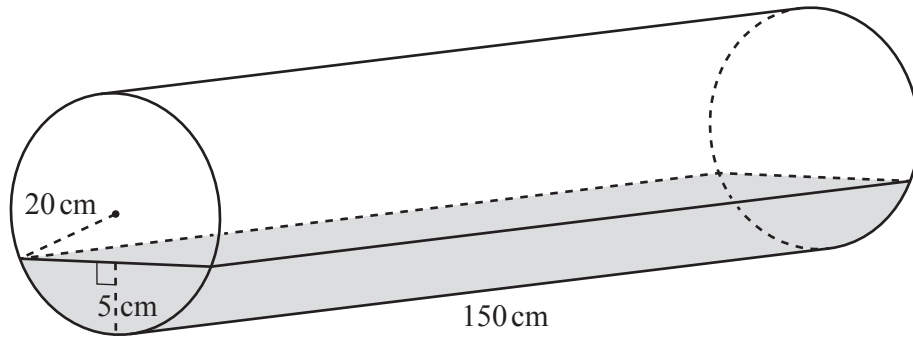
- (b) A solid metal cylinder with radius x and height $\frac{9x}{2}$ is melted.
All the metal is used to make a sphere with radius r .

Find r in terms of x .

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$r =$ [3]

(c)

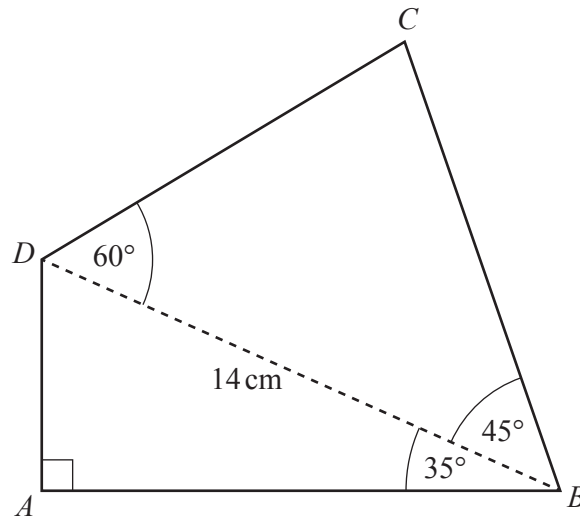
NOT TO
SCALE

The diagram shows a cylinder of length 150 cm on horizontal ground.
 The cylinder has radius 20 cm.
 The cylinder contains water to a depth of 5 cm, as shown in the diagram.

Calculate the volume of water in the cylinder.
 Give your answer in litres.

..... litres [7]

9 (a)

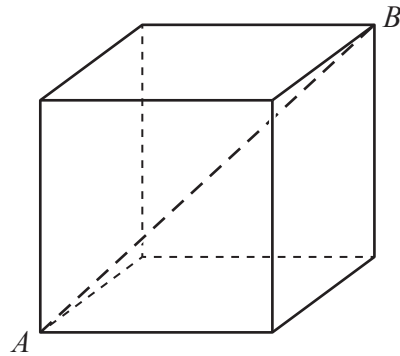


NOT TO
SCALE

Calculate the perimeter of the quadrilateral $ABCD$.

..... cm [7]

(b)



NOT TO
SCALE

The diagram shows a cube.
The length of the diagonal AB is 8.5 cm.

(i) Calculate the length of an edge of the cube.

..... cm [3]

(ii) Calculate the angle between AB and the base of the cube.

..... [3]

10 $f(x) = 3x - 2$ $g(x) = 5x - 7$ $h(x) = x^2 + x$ $j(x) = 3^x$

(a) Find

(i) $f(2)$,

..... [1]

(ii) $g(2)$,

..... [1]

(iii) $gf(2)$.

..... [1]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ [2]

(c) Find $hf(x)$, giving your answer in the form $ax^2 + bx + c$.

..... [3]

(d) Find the derivative of $h(x)$.

..... [1]

(e) (i) Find x when $j^{-1}(x) = 4$.

$x =$ [1]

(ii) Simplify $j^{-1}j(x)$.

..... [1]

- 11 (a) These are the first four terms of a sequence.

11 7 3 -1

- (i) Write down the next term.

..... [1]

- (ii) Write down the term to term rule for this sequence.

..... [1]

- (iii) Find the n th term of this sequence.

..... [2]

- (b) The n th term of a different sequence is $\frac{2n}{n+1}$.

- (i) Find the difference between the 5th term and the 6th term of this sequence.
Give your answer as a fraction.

..... [2]

- (ii) Is $\frac{3}{4}$ a term in this sequence?
Show how you decide.

[3]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

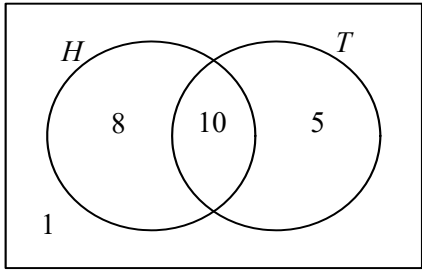
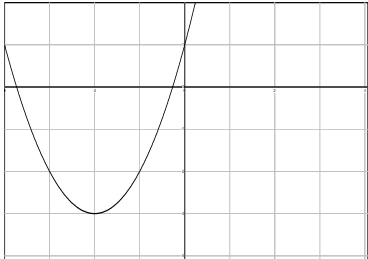
Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	120	2	M1 for $6 \div (21 - 19)$ oe soi or for $\frac{2x}{40} = 6$
1(a)(ii)(a)	34	2	M1 for $40 - \frac{15}{100} \times 40$ oe or better or B1 for 6
1(a)(ii)(b)	35	2	M1 for $\left(1 - \frac{15}{100}\right) \times p = 29.75$ or better
1(b)(i)	44 274 cao	3	B2 for 44273 to 44274 or 44270 or M1 for $40100 \times \left(1 + \frac{2}{100}\right)^5$ oe
1(b)(ii)	2019 nfw	3	M2 for one correct trial of $n = 8$ or $n = 9$ either to find a salary or, if working with 1.02 ⁿ and $47\,500 \div 40\,100 [= 1.1845]$, to find a value of 1.02 ⁿ or B2 for final answer 9 or 4 nfw or M1 for <i>their</i> $44\,274 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or $40\,100 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or for at least one trial giving a value greater than <i>their</i> 44 274
1(c)	2.9 [increase]	2	M1 for $\left(1 + \frac{5}{100}\right) \times \left(1 - \frac{2}{100}\right)$ oe implied by 1.029 or 102.9[%]
2(a)(i)	-1	2	M1 for $3 \times 2^2 - 13$ oe
2(a)(ii)	$[\pm] \sqrt{\frac{y-t}{p}}$ oe final answer	3	M1 for correct rearrangement to isolate x^2 term M1 for correct division by p M1 for correct square root Incorrect answer scores a maximum of M2 If 0 scored, SC1 for a correctly rearranged formula with $p = 3$ and $t = -13$ substituted

Question	Answer	Marks	Partial Marks
2(b)(i)	$(5x - 4)(3x + 2)$ oe final answer	2	B1 for $(ax + b)(cx + d)$ where either $ac = 15$ <u>and</u> $bd = -8$ or $ad + bc = -2$ or $5x(3x + 2) - 4(3x + 2)$ or $3x(5x - 4) + 2(5x - 4)$ or correct factors seen and spoiled
2(b)(ii)	$\frac{4}{5}$ oe and $-\frac{2}{3}$ oe	1	FT a factorised quadratic
2(c)	$x(x + 4y)(x - 4y)$ final answer	3	B2 for $(x^2 + 4xy)(x - 4y)$ or $(x + 4y)(x^2 - 4xy)$ or answer in the form $x(a + b)(a - b)$ or correct answer seen and spoiled or B1 for $x(x^2 - 16y^2)$ oe or $(x + 4y)(x - 4y)$
2(d)	$\frac{1 - 2a}{x}$ oe final answer	4	B2 for $(2x - 1)(1 - 2a)$ oe or B1 for $2x - 1 - 2a(2x - 1)$ or $2x(1 - 2a) - (1 - 2a)$ B1 for $x(2x - 1)$
3(a)(i)	4	1	
3(a)(ii)	7	1	
3(a)(iii)	8	1	
3(b)(i)	14	1	
3(b)(ii)	4	2	B1 for [l.q. =] 11 or [u.q =] 15
3(c)	8.09	3	M1 for $5 \times 3 + 10 \times 6 + 43 \times 7 + 75 \times 8 + 48 \times 9 + 21 \times 10$ M1 dep $\div 200$
3(d)	30, 70, 40, 36, 24 seen	B2	B1 for 3 or 4 correct or M1 for $1 \times (80 - 50)$, $3.5 \times (100 - 80)$, $4 \times (110 - 100)$, $3.6 \times (120 - 110)$ and $0.6 \times (160 - 120)$ oe
	$(\text{their } 30 \times 65 + \text{their } 70 \times 90 + \text{their } 40 \times 105 + \text{their } 36 \times 115 + \text{their } 24 \times 140) \div 200$	M3	M1 for midpoints soi M1 for Σfx , x in interval or boundary of interval M1 dep on second M1 for $\div 200$
	99.75	A1	
4(a)(i)	(2, 7)	2	B1 for each coordinate

Question	Answer	Marks	Partial Marks
4(a)(ii)	$-\frac{1}{2}x + 8$ oe	4	Correct equivalent in different form scores 3 marks. M1 for gradient of $AB = \frac{9-5}{3-1}$ or $\frac{4}{2}$ or 2 M1 dep for gradient $p = -\frac{1}{\text{their grad of } AB}$ M1 (dep on previous M1) for substitution of <i>their</i> midpoint into $y = (\text{their } p)x + c$ oe where <i>their</i> $p \neq 0$
4(b)(i)	$\begin{pmatrix} 0 \\ 2 \end{pmatrix}$	2	B1 for $\begin{pmatrix} 0 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 2 \end{pmatrix}$
4(b)(ii)	$\begin{pmatrix} -2 \\ 9 \end{pmatrix}$	2	FT <i>their</i> $\overrightarrow{PQ}$ B1FT for $\begin{pmatrix} 0 \\ 6 \end{pmatrix}$
4(c)(i)	$\frac{2}{3}\mathbf{t} + \frac{1}{3}\mathbf{u}$ or $\frac{1}{3}(2\mathbf{t} + \mathbf{u})$ final answer	2	M1 for $\overrightarrow{UY} = \frac{2}{3}(\mathbf{t} - \mathbf{u})$ oe or $\overrightarrow{TY} = \frac{1}{3}(\mathbf{u} - \mathbf{t})$ oe or correct route soi
4(c)(ii)	$\frac{2}{3}\mathbf{t}$ cao	1	
5(a)	$[x =] 7$ $[y =] 3$	2	B1 for each
5(b)	$[x =] 0, [y =] 2$ $[x =] -3, [y =] 5$	4	B3 for $x = 0$ and $x = -3$ or B2 for $x^2 + 3x = 0$ or M1 for $2 - x = x^2 + 2x + 2$ If 0 scored award B1 for $x = 0, y = 2$ or $x = -3, y = 5$ from no/incorrect working ALTERNATIVE B3 for $y = 2$ and $y = 5$ or B2 for $y^2 - 7y + 10 = 0$ or M1 for $y = (2 - y)^2 + 2(2 - y) + 2$ If 0 scored award B1 for $x = 0, y = 2$ or $x = -3, y = 5$ from no/incorrect working

Question	Answer	Marks	Partial Marks
6(a)		2	i.e. 8, 10 and 5 correctly placed B1 for 10 correctly placed or M1 for $18 - x$, x and $15 - x$ correctly placed on diagram and $x = 10$ seen
6(b)	10	1	FT <i>their</i> Venn diagram
6(c)	5	1	FT <i>their</i> Venn diagram
6(d)	$\frac{5}{24}$ oe	1	FT <i>their</i> 5 on the Venn diagram
6(e)	0	1	
6(f)	$\frac{5}{17}$ oe	3	M2 for $\frac{\text{their}10}{18} \times \frac{\text{their}9}{17}$ or B1FT for $\frac{\text{their}10}{18}$ or $\frac{\text{their}9}{17}$ seen After 0 scored, SC1 for answer $\frac{25}{81}$ oe
7(a)	$-2 < x \leq 1$	2	B1 for $-2 < x$ or $x \leq 1$
7(b)(i)	$(x+2)^2 - 3$	2	M1 for $(x+2)^2 + k$
7(b)(ii)	$(x+2)^2 = 3$	M1	FTdep <i>their</i> (b)(i) for $k < 0$
	-3.73 or -3.732... and -0.268 or -0.2679...	B1	
7(b)(iii)	$(-2, -3)$	2	FT <i>their</i> $(x+2)^2 - 3$ B1 for each coordinate
7(b)(iv)	Correct sketch 	2	Parabola with minimum point in correct quadrant and both x -intercepts negative and positive y -intercept B1 for parabola with minimum point.

Question	Answer	Marks	Partial Marks
8(a)(i)	1200	1	
8(a)(ii)(a)	800	3	M2 for $[2 \times] (20 \times 12 + 20 \times 5 + 12 \times 5)$ or M1 for 20×12 or 20×5 or 12×5
8(a)(ii)(b)	0.19	1	FT $152 \div \text{their } 800$
8(b)	$\frac{3x}{2}$ or $1.5x$	3	B2 for $r^3 = \frac{27x^3[\pi]}{8[\pi]}$ or better or M1 for $\frac{4}{3}\pi r^3 = \pi x^2 \times \frac{9x}{2}$
8(c)	13.6 or 13.59 to 13.61	7	If chord is AB and O is centre of the cross section M2 for $2 \times \cos^{-1}\left(\frac{20-5}{20}\right)$ oe or M1 for $\cos = \frac{20-5}{20}$ oe M1 for $\frac{\text{their } AOB}{360} \times \pi \times 20^2$ or $\frac{1}{2}(20)^2 \left(\frac{82.8\pi}{180}\right)$ M1 for $\frac{1}{2} \times 20^2 \times \sin(\text{their } AOB)$ oe M1 for $\text{their area} \times 150$ M1 for $\text{their volume} \div 1000$
9(a)	42.3 or 42.28 to 42.30...	7	M1 for $\frac{AB}{14} = \cos 35$ oe M1 for $\frac{AD}{14} = \sin 35$ oe B1 for $[C =] 75$ M3 for $[BC =] \frac{14 \sin 60}{\sin \text{their } 75}$ oe and $[DC] \frac{14 \sin 45}{\sin \text{their } 75}$ oe or M2 for $\frac{14 \sin 60}{\sin \text{their } 75}$ or $\frac{14 \sin 45}{\sin \text{their } 75}$ oe or M1 for $\frac{\sin \text{their } 75}{14} = \frac{\sin 60}{BC}$ oe or $\frac{\sin \text{their } 75}{14} = \frac{\sin 45}{CD}$ oe

Question	Answer	Marks	Partial Marks
9(b)(i)	4.91 or 4.907...	3	B2 for $[l^2 =]$ 24.1 or 24.08... or M2 for $\sqrt{3} l = 8.5$ or $[l =] \sqrt{\frac{8.5^2}{3}}$ oe or M1 for $l^2 + l^2 + l^2 = 8.5^2$ oe
9(b)(ii)	35.3 or 35.26 to 35.3 nfw	3	M2dep for $\sin(\text{angle}) = \frac{\text{their (b)(i)}}{8.5}$ oe or M1 for clear recognition of correct angle
10(a)(i)	4	1	
10(a)(ii)	3	1	
10(a)(iii)	13	1	FT $5 \times \text{their (a)(i)} - 7$
10(b)	$\frac{x+2}{3}$ final answer	2	M1 for $y + 2 = 3x$ or for $\frac{y}{3} = x - \frac{2}{3}$ or for $x = 3y - 2$
10(c)	$9x^2 - 9x + 2$ final answer	3	M1 for $(3x-2)^2 + 3x - 2$ B1 for $(3x-2)^2 = 9x^2 - 6x - 6x + 4$
10(d)	$2x + 1$	1	
10(e)(i)	81	1	
10(e)(ii)	x	1	Not $y = x$
11(a)(i)	-5	1	
11(a)(ii)	Subtract 4 oe	1	
11(a)(iii)	$15 - 4n$ oe final answer	2	B1 for $k - 4n$ or $15 - jn$ $j \neq 0$
11(b)(i)	$\frac{1}{21}$ or equivalent fraction	2	B1 for $\frac{12}{7}$ and $\frac{10}{6}$
11(b)(ii)	$n = \frac{3}{5}$ oe or $2n \geq n + 1$ but $3 < 4$.	M2	M1 for $\frac{3}{4} = \frac{2n}{n+1}$ oe or M1 for $2n > n + 1$ but $3 < 4$
	No, n is not an integer oe or No, $\frac{3}{4}$ is less than 1, oe	A1	



Cambridge IGCSE™

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NUMBER

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NUMBER

MATHEMATICS

0580/22

Paper 2 (Extended)

February/March 2021

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

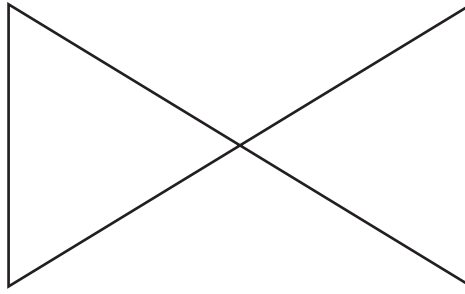
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

1



(a) Complete this statement.

The diagram has rotational symmetry of order [1]

(b) On the diagram, draw all the lines of symmetry. [2]

2 Sahil and Anika share \$78 in the ratio 5 : 8.

Calculate the amount each receives.

Sahil \$

Anika \$ [2]

3 The number of passengers on a bus is recorded each day for 14 days.

15	18	22	17	35	38	24
19	19	24	25	31	36	29

(a) Complete the stem-and-leaf diagram.

1	
2	
3	

Key: 1 | 5 represents 15 passengers

[2]

(b) Find the median.

..... [1]

3

- 4 By writing each number correct to 1 significant figure, find an estimate for the value of

$$\frac{2.8 \times 82.6}{27.8 - 13.9} .$$

..... [2]

- 5 The number of bowls of hot soup sold decreases when the temperature rises.

What type of correlation does this statement describe?

..... [1]

- 6 Joseph spends $\frac{5}{24}$ of one week's earnings to buy a jacket.
The cost of the jacket is \$56.50 .

Calculate the amount Joseph earns in a week.

\$ [2]

- 7 **Without using a calculator**, work out $2\frac{1}{4} \times 3\frac{2}{3}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

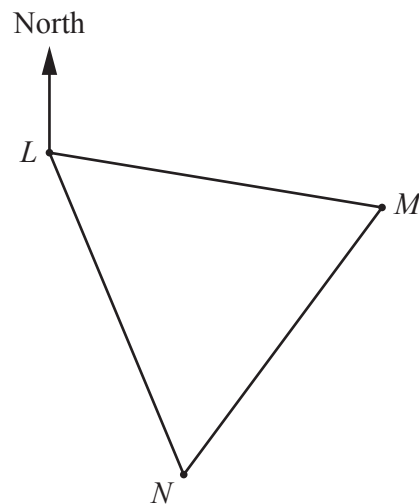
- 8 Write $0.\dot{3}\dot{7}$ as a fraction.

..... [1]

- 9 Calculate $4.8 \times 10^6 + 3.7 \times 10^7$.
Give your answer in standard form.

..... [1]

10



NOT TO
SCALE

On a map, the positions of the towns L , M and N form an equilateral triangle.
The bearing of M from L is 103° .

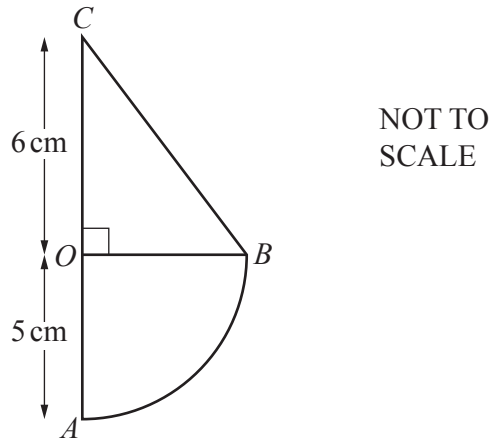
Work out the bearing of L from N .

..... [2]

- 11 Find the highest common factor (HCF) of 36 and 84.

..... [2]

12



The diagram shows a shape made from a quarter-circle, OAB , and a right-angled triangle OBC . The radius of the circle is 5 cm and $OC = 6$ cm.

Calculate the area of the shape.

..... cm^2 [3]

- 13 The population of one variety of butterfly is decreasing exponentially at a rate of 34% per year. At the end of 2014, the population was 125.9 million.

Calculate the population at the end of 2019.

..... million [2]

- 14 (a) These are the first four terms of a sequence.

29 22 15 8

Write down the next two terms.

....., ... [2]

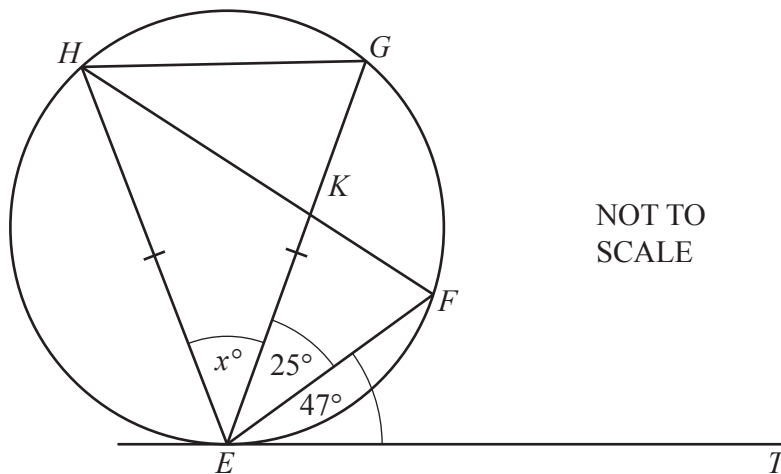
- (b) These are the first five terms of another sequence.

4 7 12 19 28

Find the n th term.

..... [2]

15

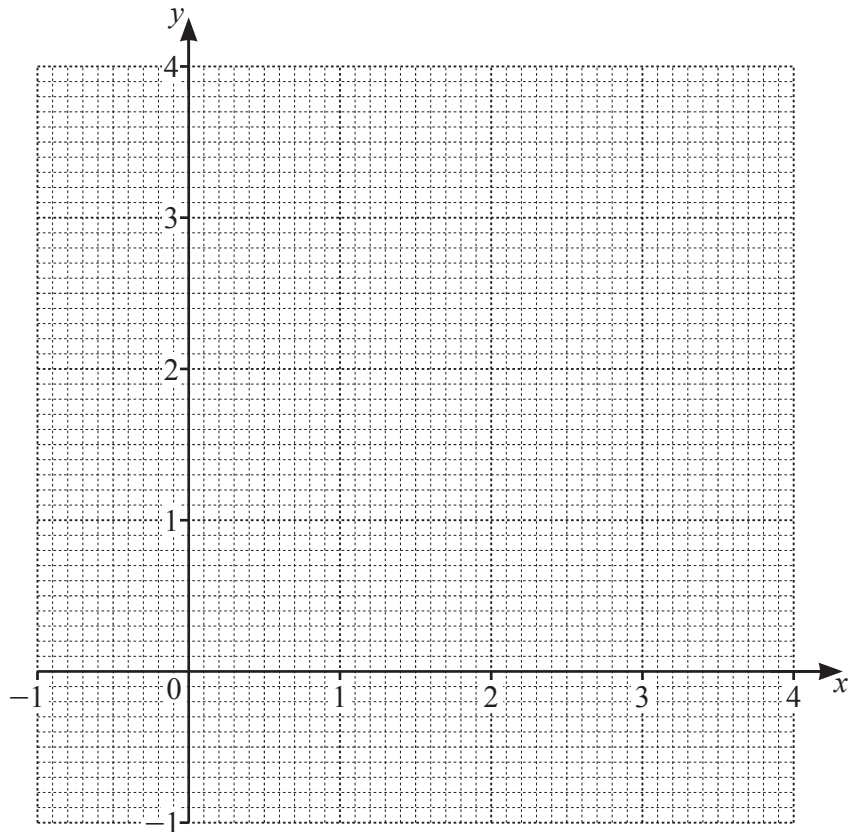


Points E, F, G and H lie on the circle and $EG = EH$.
 HF and EG intersect at K .
 ET is a tangent to the circle at E .
 Angle $FET = 47^\circ$ and angle $FEG = 25^\circ$.

Find the value of x .

$x =$ [2]

16



The region R satisfies these three inequalities.

$$y > 1 \quad y < 2x + 2 \quad x + y \leq 3$$

By drawing three suitable lines, and shading unwanted regions, find and label the region R .

[5]

- 17 Some students were asked how many books they each had in their school bags. The table shows some of this information.

Number of books	5	6	7	8	9	10
Frequency	4	5	x	11	7	5

The mean number of books is 7.6 .

Calculate the value of x .

$x = \dots\dots\dots$ [3]

18 Simplify $(343x^9)^{\frac{2}{3}}$.

..... [2]

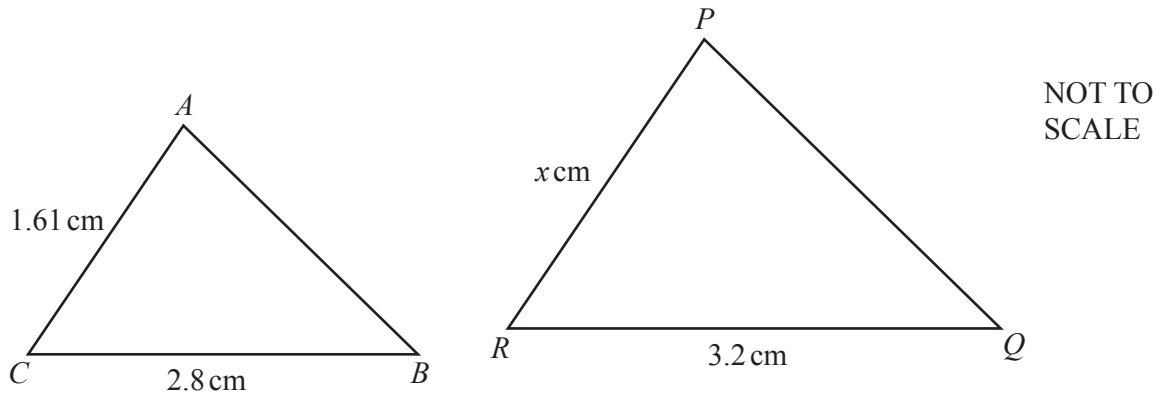
19 Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}x - y &= 7 \\ x^2 + y &= 149\end{aligned}$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [5]$$

20 (a)



Triangle ABC is mathematically similar to triangle PQR .

Find the value of x .

$x = \dots\dots\dots$ [2]

(b)



The diagram shows two mathematically similar bowls.
The larger bowl has capacity 7.8 litres and height 11.5 cm.
The smaller bowl has capacity 4 litres.

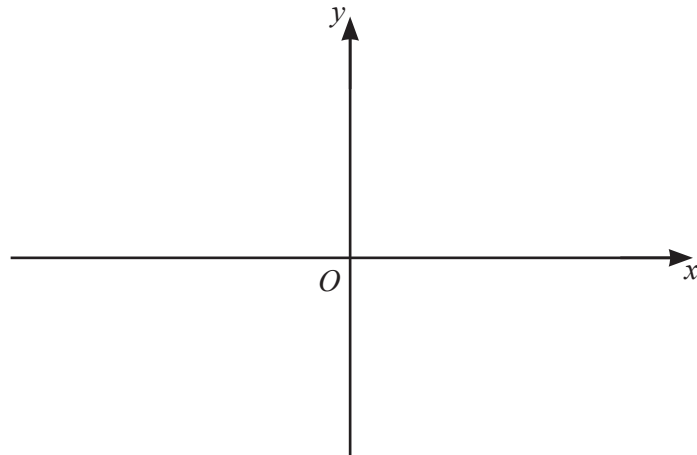
Calculate the height of the smaller bowl.

$\dots\dots\dots \text{ cm}$ [3]

10

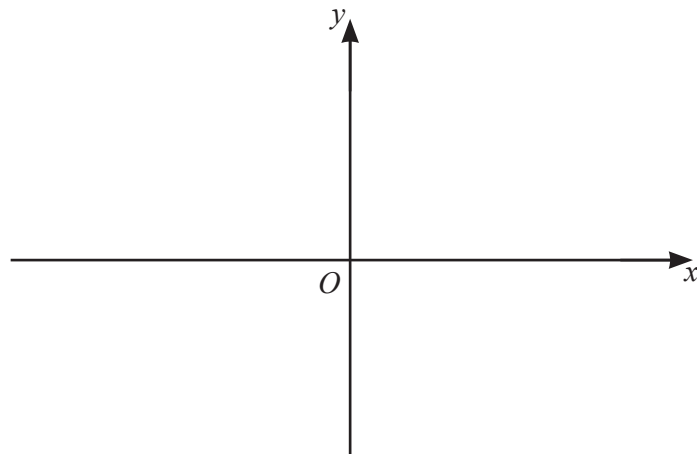
21 On the axes, sketch the graph of each of these functions.

(a) $y = \frac{1}{x}$



[2]

(b) $y = 4^x$



[2]

22 (a) A bag of rice has a mass of 25 kg, correct to the nearest kilogram.

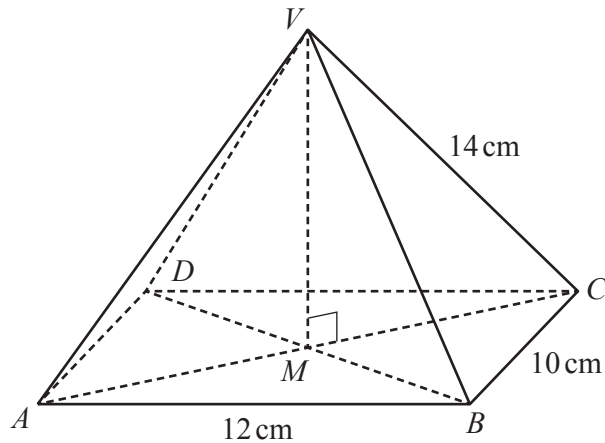
Calculate the lower bound of the total mass of 10 of these bags.

..... kg [1]

(b) Virat has 200 metres of wire, correct to the nearest metre.
He cuts the wire into n pieces of length 3 metres, correct to the nearest 20 centimetres.

Calculate the largest possible value of n .

$n =$ [3]

NOT TO
SCALE

The diagram shows a pyramid $VABCD$ with a rectangular base.
 V is vertically above M , the intersection of the diagonals AC and BD .
 $AB = 12\text{ cm}$, $BC = 10\text{ cm}$ and $VC = 14\text{ cm}$.

Calculate the angle that VC makes with the base $ABCD$.

..... [4]

Question 24 is printed on the next page.

24 A curve has equation $y = x^3 - 2x^2 + 5$.

Find the coordinates of its two stationary points.

(....., ...) and (....., ...) [5]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 22 (Extended)

March 2021

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of 7 printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

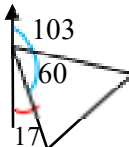
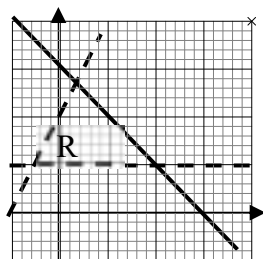
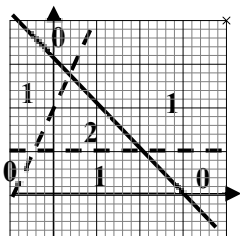
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

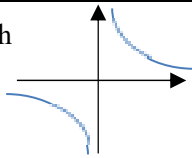
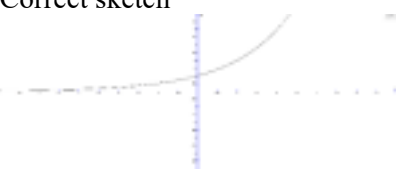
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks						
1(a)	2	1							
1(b)	2 correct lines	2	B1 for each						
2	30 48	2	M1 for $\frac{78}{5+8} \times k$ oe where $k = 1, 5$ or 8						
3(a)	<table border="1"><tr><td>1</td><td>5 7 8 9 9</td></tr><tr><td>2</td><td>2 4 4 5 9</td></tr><tr><td>3</td><td>1 5 6 8</td></tr></table>	1	5 7 8 9 9	2	2 4 4 5 9	3	1 5 6 8	2	B1 for two rows correct or for a fully correct unordered stem-and-leaf diagram or for a correct diagram with one leaf incorrect or omitted
1	5 7 8 9 9								
2	2 4 4 5 9								
3	1 5 6 8								
3(b)	24	1							
4	3, 80, 30 and 10 seen and answer 12	2	M1 for 3 out of 4 correct elements or for all correct but with any trailing zeros If 0 scored SC1 for answer 12						
5	Negative	1							
6	271.2[0]	2	M1 for $56.50 \div 5$ or 56.50×24 oe or better						
7	$\frac{9}{4}$ and $\frac{11}{3}$ oe improper fractions	M1							
	$\frac{99}{12}$ oe improper fraction	A1							
	$8\frac{1}{4}$ cao final answer	A1	dep on 1 st A1 If M0 scored SC1 for $\frac{9}{4}$ or $\frac{11}{3}$ oe improper fraction						
8	$\frac{37}{99}$ oe fraction	1							
9	4.18×10^7 cao	1							

Question	Answer	Marks	Partial Marks
10	343	2	B1 for 103 in correct position and 60 or 17 in correct position 
11	12	2	M1 for $2^2 \times 3^2$ and $2^2 \times 3 \times 7$ or for $2 \times 2 \times 3$ final answer or B1 for 2, 3, 4 or 6 as final answer
12	34.6 or 34.63 to 34.64	3	M2 for $\frac{1}{4} \times \pi \times 5^2 + \frac{1}{2} \times 5 \times 6$ oe or M1 for $\frac{1}{4} \times \pi \times 5^2$ oe or $\frac{1}{2} \times 5 \times 6$ oe
13	15.8 or 15.76 to 15.77	2	M1 for $125.9 \times \left(1 - \frac{34}{100}\right)^5$ oe
14(a)	1 - 6	2	B1 for each If 0 scored, SC1 for two terms with a difference of -7
14(b)	$n^2 + 3$ oe	2	M1 for any quadratic or second differences = 2
15	36	2	M1 for angle $EHG = 72$ or for angle $EHF = 47$ and $GHF = 25$
16	3 correct ruled lines and R clearly indicated 	5	B1 for each line $y = 1$ dashed $y = 2x + 2$ dashed $x + y = 3$ solid B2 for correct region or B1 for region satisfying 2 inequalities  or SC1 for shading of the wanted region only

Question	Answer	Marks	Partial Marks
17	13 nfw	3	M2 for $251 + 7x = 7.6(32 + x)$ or better or M1 for $\frac{5 \times 4 + 6 \times 5 + 7x + 8 \times 11 + 9 \times 7 + 10 \times 5}{32 + x} = 7.6$ oe
18	$49x^6$ final answer	2	B1 for $49x^k$ or nx^6 as final answer
19	$x^2 + x - 156 [=0]$ or $y^2 + 15y - 100 [=0]$	M2	M1 for $x^2 + x = 7 + 149$ or correct substitution
	$(x - 12)(x + 13) [=0]$ or $(y - 5)(y + 20) [=0]$	M1	or for correct factors for <i>their</i> quadratic equation or for correct use of quadratic formula or completing the square for <i>their</i> equation
	$[x =] 12 [y =] 5$ $[x =] -13 [y =] -20$	B2	B1 for $x = 12, x = -13$ or for $y = 5, y = -20$ or for a correct pair of x and y values If B0 scored and at least 2 method marks scored SC1 for correct substitution of both of <i>their</i> x values or <i>their</i> y values into $x - y = 7$ or $x^2 + y = 149$
20(a)	1.84	2	M1 for $\frac{1.61}{x} = \frac{2.8}{3.2}$ oe
20(b)	9.20 or 9.204 to 9.205	3	M2 for $11.5 \times \sqrt[3]{\frac{4}{7.8}}$ oe or M1 for $\sqrt[3]{\frac{4}{7.8}}$ or $\sqrt[3]{\frac{7.8}{4}}$ oe seen or for $\frac{11.5^3}{x^3} = \frac{7.8}{4}$ oe
21(a)	Correct sketch 	2	B1 for one correct branch or attempt at correct shape
21(b)	Correct sketch 	2	B1 for correct shape but crossing x -axis or correct shape but just in one quadrant

PUBLISHED

Question	Answer	Marks	Partial Marks
22(a)	245	1	
22(b)	69 cao nfw	3	M2 for $\frac{200+0.5}{3-0.1}$ oe or M1 for 200 ± 0.5 oe or 3 ± 0.1 oe seen
23	56.1 or 56.09...	4	M3 for $\cos[\dots] = \frac{\frac{1}{2}\sqrt{10^2+12^2}}{14}$ oe or M2 for $[MC =] \frac{1}{2}\sqrt{10^2+12^2}$ oe or M1 for $[AC^2 =] 10^2+12^2$ oe or B1 for indicating required angle
24	(0, 5) $\left(\frac{4}{3}, \frac{103}{27}\right)$ oe	5	B2 for $3x^2 - 4x$ or B1 for $3x^2$ or $-4x$ M1 for <i>their</i> derivative = 0 oe or $\frac{dy}{dx} = 0$ B1 for $[x =] 0$ and $\frac{4}{3}$ or for 1 correct coordinate pair



Cambridge IGCSE™

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CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/42**

Paper 4 (Extended)

February/March 2021**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

1

Painter \$35 per hour

Plumber Fixed charge \$40 plus \$26.50 per hour

Electrician \$48 per hour for the first 2 hours then \$32 per hour

These are the rates charged by a painter, a plumber and an electrician who do some work for Mr Sharma.

- (a) The painter works for 7 hours.

Calculate the amount Mr Sharma pays the painter.

\$ [1]

- (b) Mr Sharma pays the plumber \$252.

Calculate how many hours the plumber works.

..... hours [2]

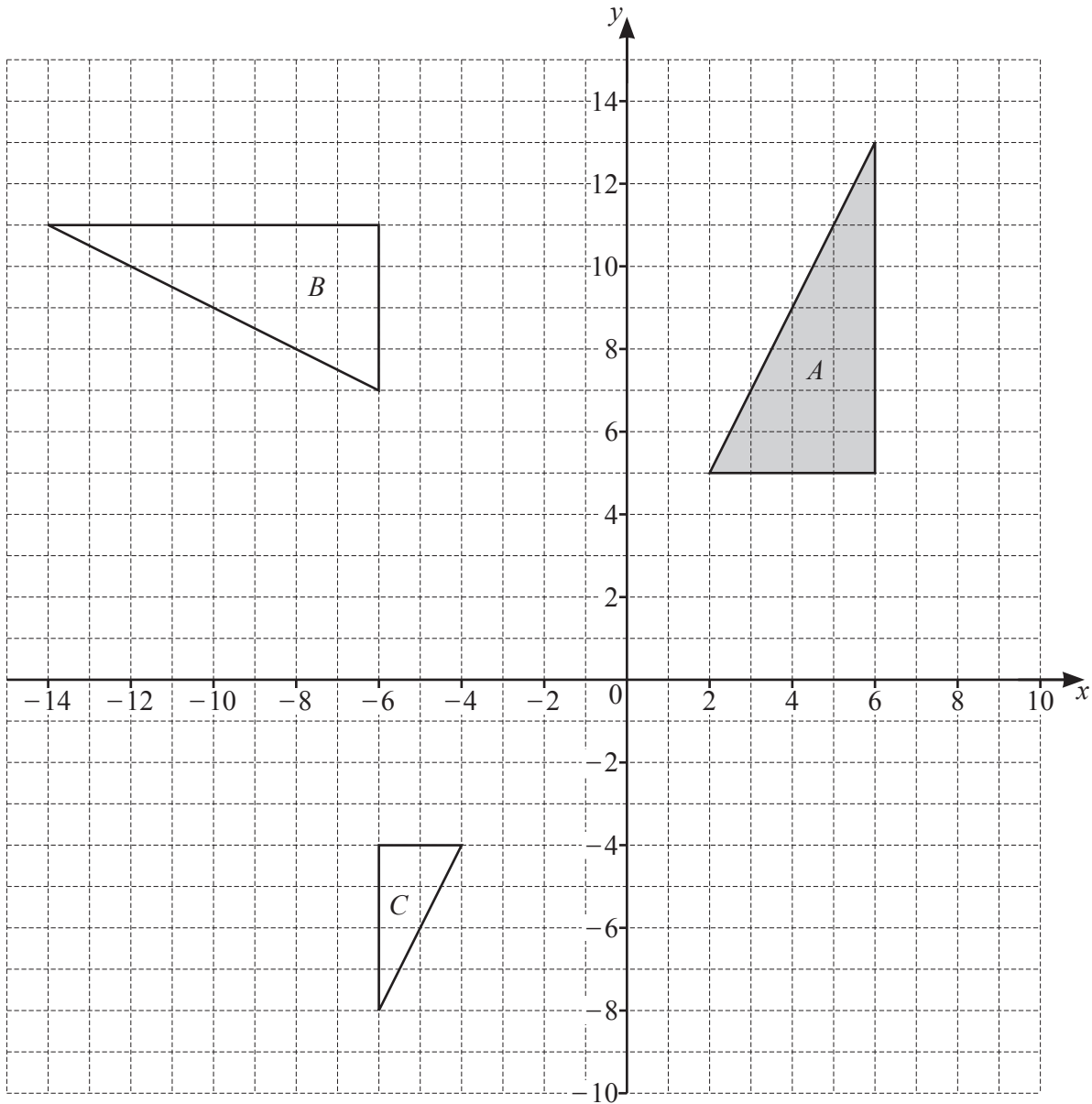
- (c) Mr Sharma pays the electrician \$224.

Calculate how many hours the electrician works.

..... hours [2]

- (d) Write down the ratio of the amount Mr Sharma pays to the painter, the plumber and the electrician.
Give your answer in its lowest terms.

painter : plumber : electrician = ... : : [2]



(a) Describe fully the **single** transformation that maps

(i) triangle *A* onto triangle *B*,

.....
 [3]

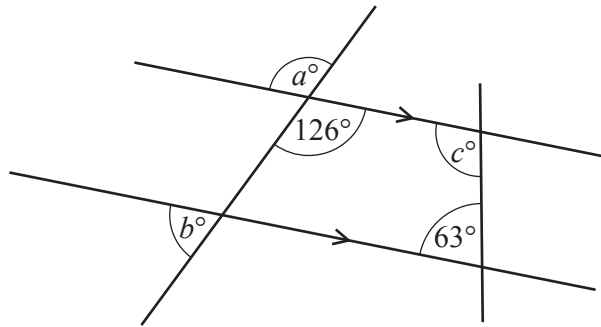
(ii) triangle *A* onto triangle *C*.

.....
 [3]

(b) Draw the image of triangle *A* after a translation by the vector $\begin{pmatrix} -5 \\ -10 \end{pmatrix}$. [2]

(c) Draw the image of triangle *A* after a reflection in the line $y = 4$. [2]

3 (a)



NOT TO
SCALE

The diagram shows two straight lines intersecting two parallel lines.

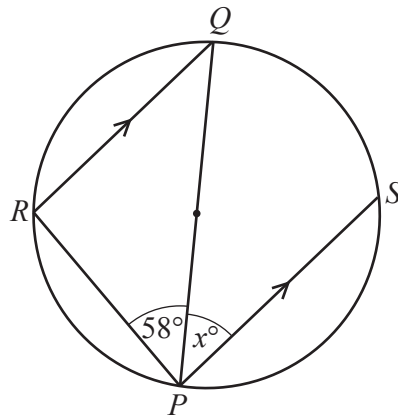
Find the values of a , b and c .

$a =$

$b =$

$c =$ [3]

(b)



NOT TO
SCALE

Points R and S lie on a circle with diameter PQ .

RQ is parallel to PS .

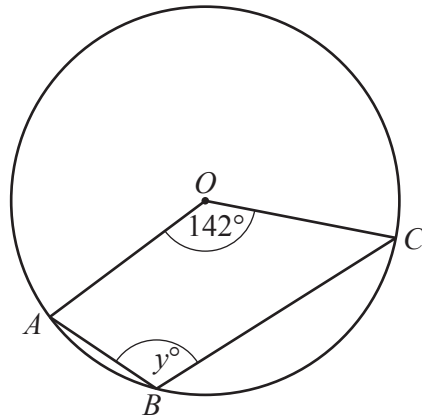
Angle $RPQ = 58^\circ$.

Find the value of x , giving a geometrical reason for each stage of your working.

.....
.....
.....

$x =$ [3]

(c)



NOT TO
SCALE

Points A , B and C lie on a circle, centre O .
Angle $AOC = 142^\circ$.

Find the value of y .

$y = \dots\dots\dots$ [2]

- 4 (a) A shop gives each of 1000 people a voucher.
28 people use their voucher.
The shop now gives each of 16 500 people a voucher.

Calculate how many of these 16 500 people are expected to use their voucher.

..... [1]

- (b) In a class activity, all the 15 students wear hats.
7 students wear red hats, 6 students wear green hats and 2 students wear white hats.

- (i) One of these students is picked at random.

Find the probability that this student wears a red hat.

..... [1]

- (ii) Two of the 15 students are picked at random.

Show that the probability that these two students wear hats of the same colour is $\frac{37}{105}$.

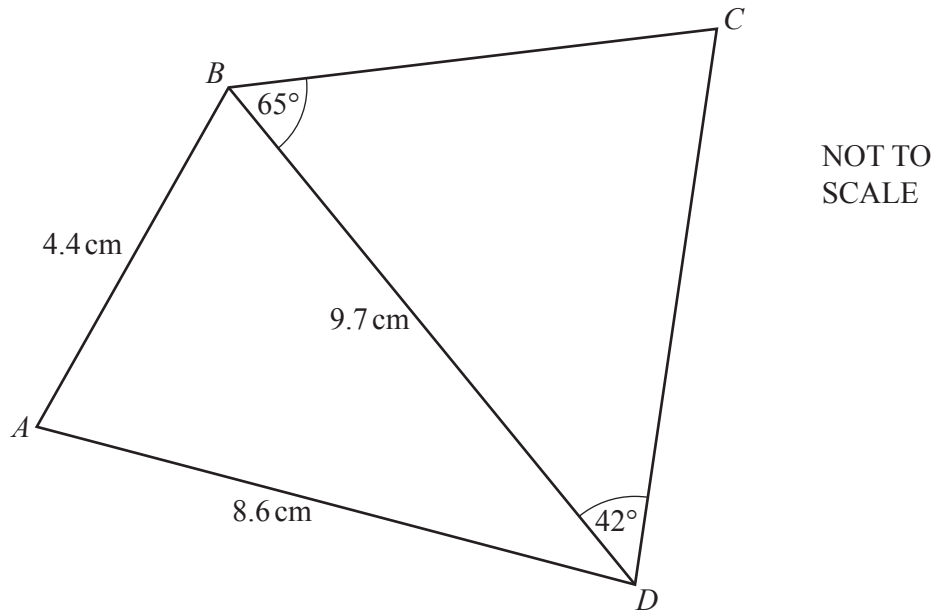
[3]

- (iii) Three of the 15 students are picked at random.

Find the probability that at least two of these three students wear red hats.

..... [4]

5



(a) Calculate angle ADB .

Angle $ADB = \dots\dots\dots [3]$

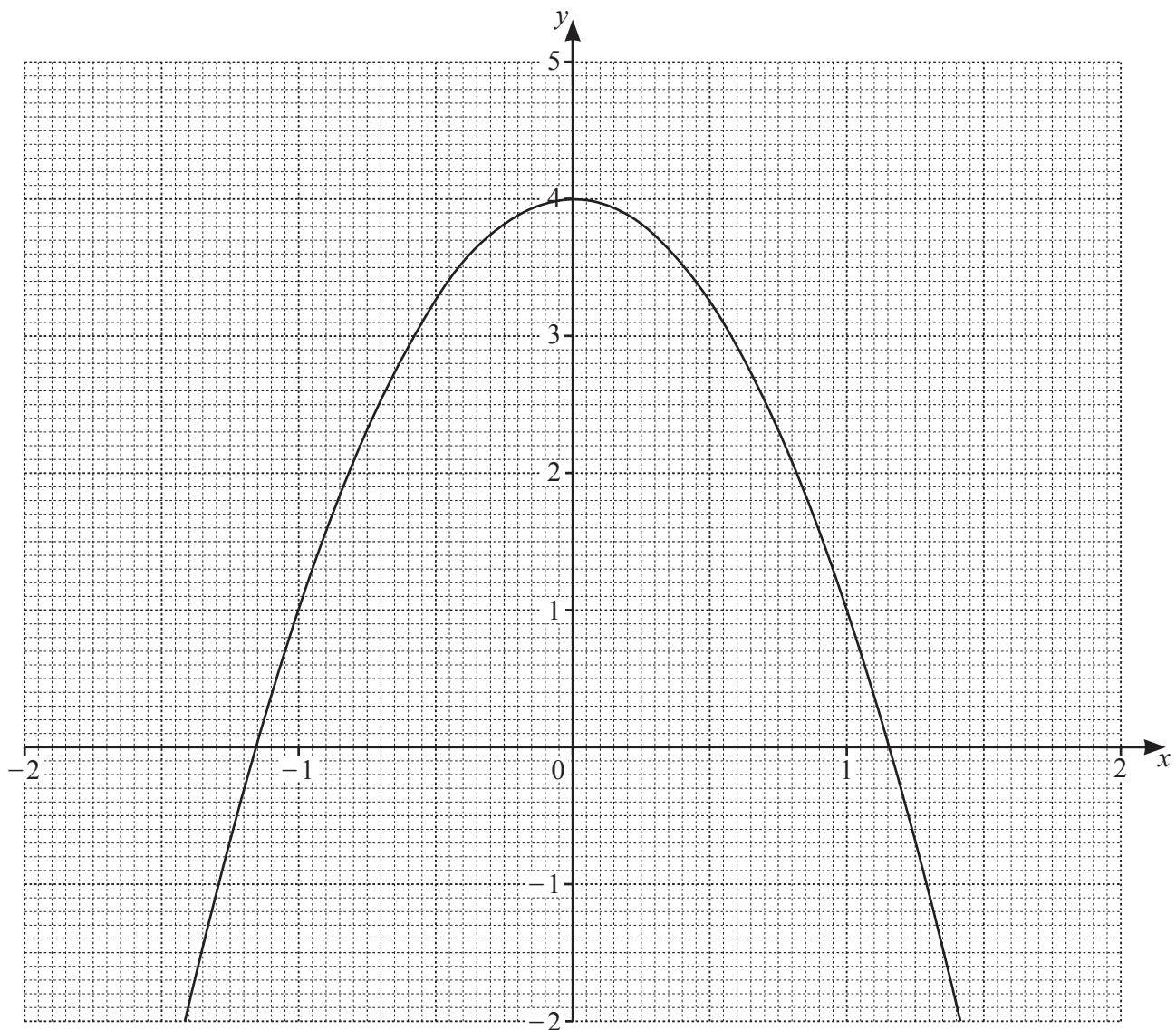
(b) Calculate DC .

$DC = \dots\dots\dots \text{ cm } [4]$

(c) Calculate the shortest distance from C to BD .

$\dots\dots\dots \text{ cm } [3]$

6



(a) The grid shows the graph of $y = a + bx^2$.

The graph passes through the points with coordinates (0, 4) and (1, 1).

(i) Find the value of a and the value of b .

$a =$

$b =$ [2]

- (ii) Write down the equation of the tangent to the graph at $(0, 4)$.

..... [1]

- (iii) The equation of the tangent to the graph at $x = -1$ is $y = 6x + 7$.

Find the equation of the tangent to the graph at $x = 1$.

..... [2]

- (b) The table shows some values for $y = 1 + \frac{5}{3-x}$ for $-2 \leq x \leq 1.5$.

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5
y	2	2.11		2.43		3		4.33

- (i) Complete the table. [3]

- (ii) On the grid, draw the graph of $y = 1 + \frac{5}{3-x}$ for $-2 \leq x \leq 1.5$. [4]

- (c) (i) Write down the values of x where the two graphs intersect.

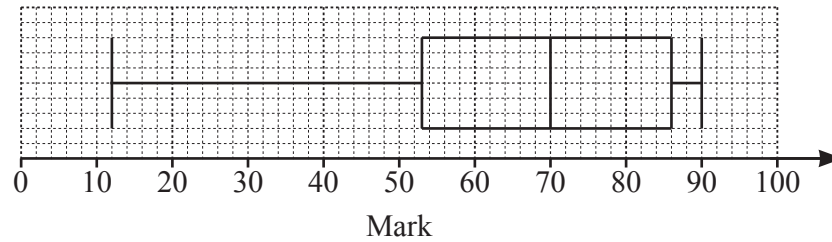
$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

- (ii) The answers to **part(c)(i)** are two solutions of a cubic equation in terms of x .

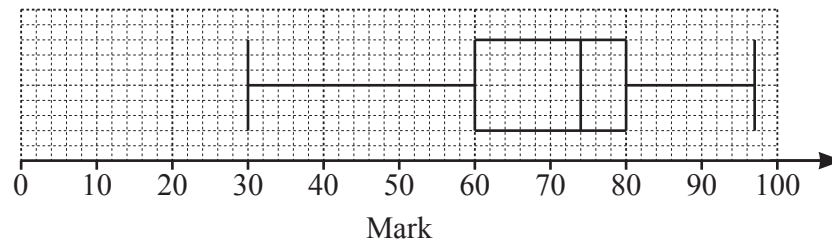
Find this equation in the form $ax^3 + bx^2 + cx + d = 0$, where a, b, c and d are integers.

..... [4]

- 7 (a) The box-and-whisker plot shows information about the marks scored by some students in a test.



- (i) Write down the median mark. [1]
- (ii) Work out the range. [1]
- (iii) Jais scored a mark in the test that was higher than the marks scored by 75% of the students.
Write down a possible mark for Jais. [1]
- (iv) This box-and-whisker plot shows information about the marks scored by the same students in a second test.



Make one comparison between the distributions of marks in the two tests.

..... [1]

- (b) The table shows information about the height, h cm, of each of 50 plants.

Height (h cm)	$0 < h \leq 20$	$20 < h \leq 30$	$30 < h \leq 34$	$34 < h \leq 40$	$40 < h \leq 60$
Frequency	4	9	20	15	2

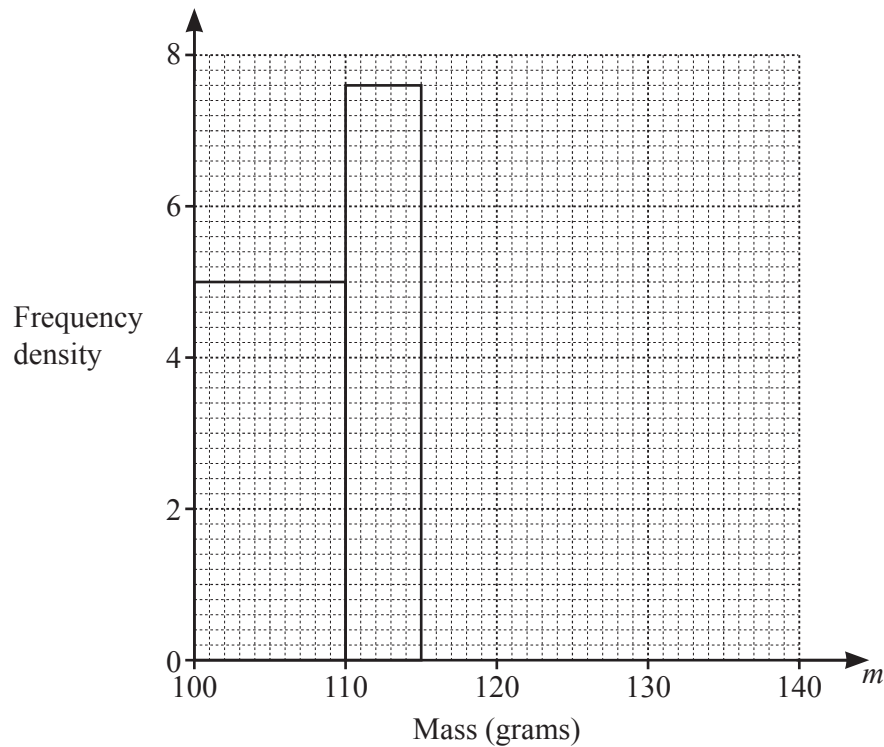
Calculate an estimate of the mean.

..... cm [4]

- (c) Some apples are weighed and the mass, m grams, of each apple is recorded. The table shows the results.

Mass (m grams)	$100 < m \leq 110$	$110 < m \leq 115$	$115 < m \leq 125$	$125 < m \leq 140$
Frequency	50	x	44	51

The histogram shows some of the information from the table.



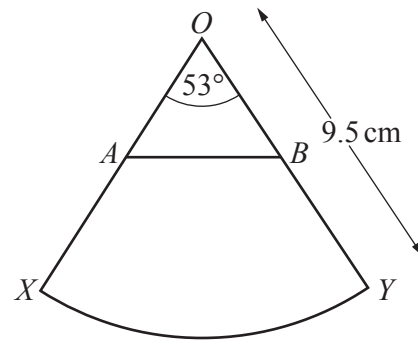
- (i) Work out the value of x .

$x = \dots\dots\dots$ [1]

- (ii) Complete the histogram.

[2]

8 (a)



NOT TO
SCALE

The diagram shows a sector OXY of a circle with centre O and radius 9.5 cm. The sector angle is 53° .

A lies on OX , B lies on OY and $OA = OB$.

- (i) Show that the area of the sector is 41.7 cm^2 , correct to 1 decimal place.

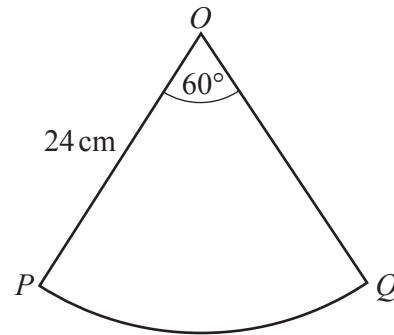
[2]

- (ii) The area of triangle OAB is $\frac{1}{3}$ of the area of sector OXY .

Calculate OA .

$OA = \dots\dots\dots \text{ cm}$ [4]

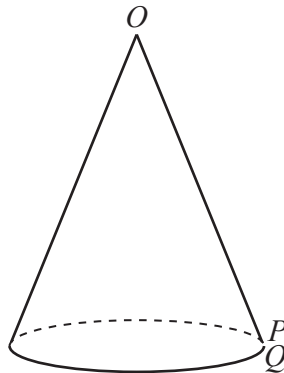
(b)



NOT TO
SCALE

The diagram shows a sector OPQ of a circle with centre O and radius 24 cm.
The sector angle is 60° .

A cone is made from this sector by joining OP to OQ .



NOT TO
SCALE

Calculate the volume of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [6]

9 (a) Factorise.

(i) $5am + 10ap - bm - 2bp$

..... [2]

(ii) $15(k+g)^2 - 20(k+g)$

..... [2]

(iii) $4x^2 - y^4$

..... [2]

(b) Expand and simplify.

$$(x-3)(x+1)(3x-4)$$

..... [3]

(c) $(x+a)^2 = x^2 + 22x + b$

Find the value of a and the value of b .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [2]$$

- 10 (a) A box is a cuboid with length 45 cm, width 30 cm and height 42 cm.
The box is completely filled with 90.72 kg of sand.

Calculate the density of this sand in kg/m^3 .
[Density = mass $\div$ volume]

..... kg/m^3 [3]

- (b) A bag contains 15000cm^3 of sand.
Some of this sand is used to completely fill a hole in the shape of a cylinder.
The hole is 30 cm deep and has radius 10 cm.

Calculate the percentage of the sand from the bag that is used.

..... % [3]

- (c) Sand costs \$98.90 per tonne.
This cost includes a tax of 15%.

Calculate the amount of tax paid per tonne of sand.

\$ [3]

- (d) Raj buys some sand for 3540 rupees.

Calculate the cost in dollars when the exchange rate is \$1 = 70.8 rupees.

\$ [2]

11 Gaya spends \$48 to buy books that cost \$ x each.

(a) Write down an expression, in terms of x , for the number of books Gaya buys.

..... [1]

(b) Myra spends \$60 to buy books that cost \$ $(x + 2)$ each.
Gaya buys 4 more books than Myra.

Show that $x^2 + 5x - 24 = 0$.

(c) Solve by factorisation.

$$x^2 + 5x - 24 = 0$$

[4]

$x =$ or $x =$ [3]

(d) Find the number of books Myra buys.

..... [1]

12 (a) Find the gradient of the curve $y = 2x^3 - 7x + 4$ when $x = -2$.

..... [3]

(b) A is the point $(7, 2)$ and B is the point $(-5, 8)$.

(i) Calculate the length of AB .

..... [3]

(ii) Find the equation of the line that is perpendicular to AB and that passes through the point $(-1, 3)$.
Give your answer in the form $y = mx + c$.

$y =$ [4]

(iii) AB is one side of the parallelogram $ABCD$ and

- $\overrightarrow{BC} = \begin{pmatrix} -a \\ -b \end{pmatrix}$ where $a > 0$ and $b > 0$
- the gradient of BC is 1
- $|\overrightarrow{BC}| = \sqrt{8}$.

Find the coordinates of D .

(..... , ...) [4]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

March 2021

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **10** printed pages.

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

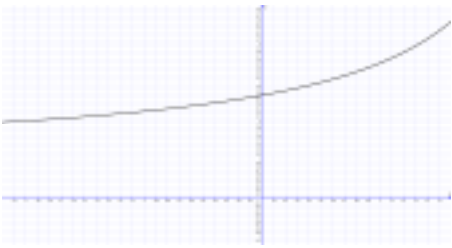
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	245	1	
1(b)	8	2	M1 for $40 + 26.5x = 252$ oe or B1 for 212 seen
1(c)	6	2	M1 for $(224 - 2 \times 48) \div 32$ oe or $2 \times 48 + 32(x - 2) = 224$ soi
1(d)	35 : 36 : 32 final answer	2	B1 for <i>their</i> (a) : 252 : 224 or equivalent ratio
2(a)(i)	rotation 90 anticlockwise oe (-3, 2)	3	B1 for each
2(a)(ii)	enlargement $-\frac{1}{2}$ (-2, -1)	3	B1 for each
2(b)	Image at (-3, -5) (1, -5) (1, 3)	2	B1 for translation by $\begin{pmatrix} -5 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -10 \end{pmatrix}$
2(c)	Image at (2, 3) (6, 3) (6, -5)	2	B1 for reflection in $y = k$ or $x = 4$
3(a)	126 54 117	3	B1 for each
3(b)	angle [in a] semicircle is 90	B1	Do not accept triangle for angle
	Allied, co-interior [add to 180] or Angles in triangle [= 180] and alternate oe	B1	
	32	B1	
3(c)	109	2	B1 for 218 or 71 in correct places or correctly labelled

Question	Answer	Marks	Partial Marks
4(a)	462	1	
4(b)(i)	$\frac{7}{15}$ oe	1	
4(b)(ii)	$\frac{7}{15} \times \frac{6}{14} + \frac{6}{15} \times \frac{5}{14} + \frac{2}{15} \times \frac{1}{14}$ $= \frac{37}{105}$	3	M2 for addition of two of $\frac{7}{15} \times \frac{6}{14} + \frac{6}{15} \times \frac{5}{14} + \frac{2}{15} \times \frac{1}{14}$ or M1 for one of the products seen
4(b)(iii)	$\frac{29}{65}$ oe	4	M3 for $\frac{7}{15} \times \frac{6}{14} \times \frac{5}{13} + 3 \times \frac{7}{15} \times \frac{6}{14} \times \frac{6}{13} + 3 \times \frac{7}{15} \times \frac{6}{14} \times \frac{2}{13}$ oe or $1 - 3 \left(\frac{8}{15} \times \frac{7}{14} \times \frac{7}{13} \right) - \left(\frac{8}{15} \times \frac{7}{14} \times \frac{6}{13} \right)$ oe or M2 for the sum of at least two of $\frac{7}{15} \times \frac{6}{14} \times \frac{5}{13}$, $N \times \frac{7}{15} \times \frac{6}{14} \times \frac{6}{13}$, $N \times \frac{7}{15} \times \frac{6}{14} \times \frac{2}{13}$ seen or for $\frac{7}{15} \times \frac{6}{14} \times \frac{13}{13}$ or $\frac{7}{15} \times \frac{6}{14} + N \times \frac{7}{15} \times \frac{6}{14} \times \frac{k}{13}$ seen or M1 for $\frac{7}{15} \times \frac{6}{14} \times \frac{5}{13}$ or $N \times \frac{7}{15} \times \frac{6}{14} \times \frac{6}{13}$ or $N \times \frac{7}{15} \times \frac{6}{14} \times \frac{2}{13}$ seen If 0 scored SC1 for $\frac{1519}{3375}$ oe
5(a)	27[.0] or 26.97... nfw	3	M2 for $[\cos =] \frac{8.6^2 + 9.7^2 - 4.4^2}{2 \times 8.6 \times 9.7}$ or M1 for implicit form
5(b)	9.19 or 9.192 to 9.193	4	B1 for [angle $BCD =$] 73 seen M2 for $\frac{9.7 \times \sin 65}{\sin (180 - 65 - 42)}$ oe or M1 for $\frac{\sin (180 - 65 - 42)}{9.7} = \frac{\sin 65}{DC}$ oe

Question	Answer	Marks	Partial Marks
5(c)	6.15 or 6.149 to 6.151...	3	M2 for $\frac{d}{\text{their } 9.19} = \sin 42$ oe or M1 for right angle between line from C to BD and BD soi
6(a)(i)	$[a =] 4$ $[b =] - 3$ nfw	2	B1 for $[a =] 4$ B1 for $[b =] - 3$ nfw
6(a)(ii)	$y = 4$ oe	1	
6(a)(iii)	$y = -6x + 7$ oe final answer	2	B1 for answer $-6x + 7$ or answers $y = -6x + c$ or $y = kx + 7$ ($k < 0$)
6(b)(i)	2.25 2.67 3.5	3	B1 for each
6(b)(ii)	correct curve 	4	B3 FT for 7 or 8 points or B2 FT for 5 or 6 points or B1 FT for 3 or 4 points
6(c)(i)	-0.78 to -0.72 and 0.55 to 0.59	2	B1 for each
6(c)(ii)	$3x^3 - 9x^2 - 3x + 4$ [= 0] final answer	4	B3FT for 3 out of 4 correct terms or for $bx^3 - 3bx^2 + (a - 1)x + 8 - 3a$ [= 0] oe or B2FT for 2 out of 4 correct terms or for 3 out of 4 terms from $bx^3 - 3bx^2 + (a - 1)x + 8 - 3a$ [= 0] or M1 for $1 + \frac{5}{3-x} = \text{their } 4 + (\text{their } (-3))x^2$ oe
7(a)(i)	70	1	
7(a)(ii)	78	1	
7(a)(iii)	Value in range $86 < V \leq 90$	1	

PUBLISHED

Question	Answer	Marks	Partial Marks
7(a)(iv)	One <u>general</u> comment <u>interpreting</u> the median comparison nfww e.g. Students did better on second test oe OR One <u>general</u> comment <u>interpreting</u> IQR/range comparison nfww e.g. Students marks were more consistent on the 2nd test oe	1	
7(b)	31.2	4	M1 for mid-values soi M1 for Σfm where m is any value in interval including boundaries M1 (dep on second M1) for <i>their</i> $\Sigma fm \div 50$
7(c)(i)	38	1	
7(c)(ii)	Blocks of heights 4.4 and 3.4 with correct widths	2	B1 for each correct block If B0 scored, SC1 for both correct frequency densities soi

Question	Answer	Marks	Partial Marks
8(a)(i)	$\frac{53}{360} \times \pi \times 9.5^2$	M1	
	41.74 to 41.75	A1	
8(a)(ii)	5.9[0] or 5.899 to 5.903..	4	M3 for $[OA^2 =] \frac{\frac{1}{3} \times 41.7}{\frac{1}{2} \sin 53}$ oe M2 for $\frac{1}{2} \times OA^2 \times \sin 53 = \frac{1}{3} \times 41.7$ oe M1 for $\frac{1}{2} \times OA \times OB \times \sin 53 = \frac{1}{3} \times 41.7$ seen or better
8(b)	396 or 397 or 396.4 to 396.6	6	M2 for $[r =] \left(\frac{60}{360} \times 2 \times \pi \times 24 \right) \div 2\pi$ oe or better or M1 for $2\pi r = \frac{60}{360} \times 2 \times \pi \times 24$ oe M2 for $\sqrt{24^2 - a^2}$ or M1 for $h^2 + a^2 = 24^2$ M1 for $\frac{1}{3} \pi \times \text{their } r^2 \times \text{their } h$
9(a)(i)	$(5a - b)(m + 2p)$ final answer	2	M1 for $5a(m + 2p) - b(m + 2p)$ or $m(5a - b) + 2p(5a - b)$ or B1 for correct answer seen
9(a)(ii)	$5(k + g)(3k + 3g - 4)$ final answer	2	M1 for correct partial factorisation by 5 or $(k + g)$ isw eg $5(3k^2 + 6kg + 3g^2 - 4k - 4g)$ or $5(3(k + g)^2 - 4(k + g))$ or $(k + g)(15(k + g) - 20)$ or $(5k + 5g)(3k + 3g - 4)$ or B1 for correct answer seen
9(a)(iii)	$(2x - y^2)(2x + y^2)$ final answer	2	M1 for answer in form $(a + b)(a - b)$ or B1 for correct answer seen
9(b)	$3x^3 - 10x^2 - x + 12$ final answer	3	B2 for correct unsimplified expansion or simplified expression with 3 terms correct in a 4-term expression of required form or B1 for correct expansion of two of the brackets with at least 3 terms correct
9(c)	$[a =] 11$ $[b =] 121$	2	B1 for each

Question	Answer	Marks	Partial Marks
10(a)	1600	3	B2 for answer figs 16 or M2 for $90.72 \div (\text{figs}45 \times \text{figs}3 \times \text{figs}42)$ or M1 for volume = figs 45 $\times$ figs 3 $\times$ figs 42 isw
10(b)	62.8 or 62.83 to 62.84	3	M2 for $\frac{\pi \times 10^2 \times 30}{15000} \times 100$ or M1 for $\pi \times 10^2 \times 30$
10(c)	12.9[0]	3	B2 for 86 OR M2 for $\frac{98.9}{1 + \frac{15}{100}} \times 0.15$ oe or $98.9 - \frac{98.9}{1 + \frac{15}{100}}$ oe or M1 for $\left(1 + \frac{15}{100}\right)a = 98.9$ oe isw
10(d)	50	2	M1 for $3540 \div 70.8$
11(a)	$\frac{48}{x}$ final answer	1	Accept $48 \div x$
11(b)	$their(a) - \frac{60}{x+2} = 4$ oe	M1	FT <i>their</i> (a) provided expression in x
	$48(x+2) - 60x = 4x(x+2)$ oe	M2	FT <i>their</i> 3 term eqn with algebraic denominators, x and $x+2$, for M2 or M1 M1 for common denominator $x(x+2)$ oe seen or any two terms in a 3 term equation from $\pm 48(x+2)$, $\pm 60x$, $\pm 4x(x+2)$ oe seen
	$48x + 96 - 60x = 4x^2 + 8x$ oe leading to $x^2 + 5x - 24 = 0$	A1	With brackets expanded and no errors or omissions seen
11(c)	$(x-3)(x+8)$	B2	B1 for $x(x+8) - 3(x+8)$ or $x(x-3) + 8(x-3)$ or $(x+a)(x+b) [= 0]$ where $ab = -24$ or $a+b = 5$ [a, b integers]
	3 and -8	B1	
11(d)	12	1	
12(a)	17	3	M2 for $3 \times 2x^2 - 7$ or better isw or M1 for $3 \times 2x^2$ oe or $kx^2 - 7$ seen

Question	Answer	Marks	Partial Marks
12(b)(i)	13.4 or 13.41 to 13.42	3	M2 for $\sqrt{(-5-7)^2 + (8-2)^2}$ oe or M1 for $(-5-7)^2 + (8-2)^2$ oe
12(b)(ii)	$[y =] 2x + 5$ final answer	4	M1 for [gradient of $AB = \frac{8-2}{-5-7}$ oe M1dep for gradient $p = -1 \div \text{their} - \frac{1}{2}$ oe M1dep on previous M1 for substituting $(-1, 3)$ into $y = \text{their } px + c$ oe where $\text{their } p \neq 0$
12(b)(iii)	(5, 0)	4	B3 for $\overrightarrow{AD} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$ or $\overrightarrow{DA} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ or coordinates of C $(-7, 6)$ and $[\overrightarrow{CD} =] \begin{pmatrix} 12 \\ -6 \end{pmatrix}$ oe seen or B2 for $a = b = 2$ soi or coordinates of C $(-7, 6)$ or M1 for $a = b$ oe soi or for $a^2 + b^2 = (\sqrt{8})^2$ oe or $\cos 45 = \frac{a}{\sqrt{8}}$ oe or for $[\overrightarrow{DC} =] \begin{pmatrix} -12 \\ 6 \end{pmatrix}$ or $[\overrightarrow{CD} =] \begin{pmatrix} 12 \\ -6 \end{pmatrix}$ seen or $\frac{y-8}{x-5} = 1$ oe or $\frac{y-2}{x-7} = 1$



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NUMBER

MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2020

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

1 Simplify.

$$3a + 7b - 4a + b$$

..... [2]

2 A field, ABC , is in the shape of a triangle.
 $AC = 500$ m and $BC = 650$ m.

Using a ruler and compasses only, complete the scale drawing of the field ABC .

Leave in your construction arcs.

Use a scale of 1 cm to represent 100 m.

The side AB has been drawn for you.



Scale: 1 cm to 100 m

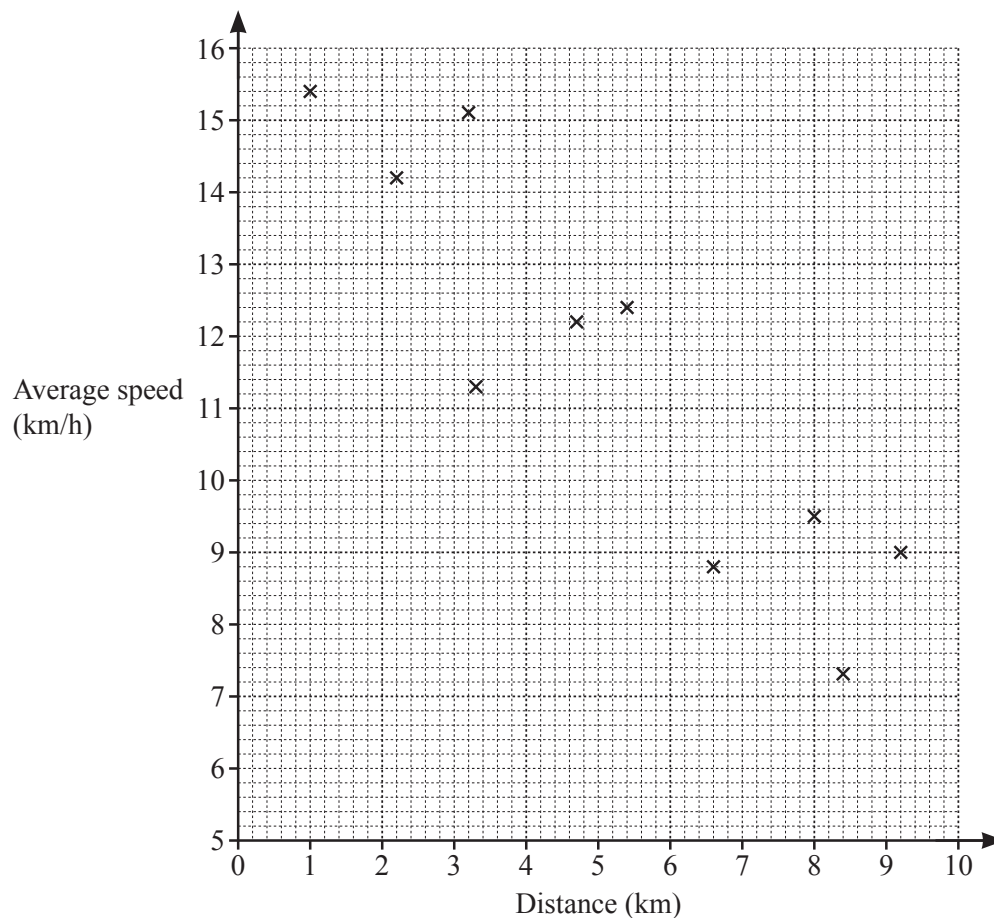
[3]

3 Rangan buys 3.6 kg of potatoes and 2.8 kg of leeks.
The total cost is \$13.72 .
Leeks cost \$2.65 per kilogram.

Find the cost of 1 kg of potatoes.

\$ [3]

- 4 Aisha records the distance she runs and her average speed. The results are shown in the scatter diagram.



- (a) The table shows the results of four more runs.

Distance (km)	4.2	5.7	7.1	8.8
Average speed (km/h)	13.4	11.8	9.8	8.3

On the scatter diagram, plot these points.

[2]

- (b) What type of correlation is shown in the scatter diagram?

..... [1]

- (c) On the scatter diagram, draw a line of best fit.

[1]

- (d) Use your line of best fit to estimate her average speed when she runs a distance of 6 km.

..... km/h [1]

5 $T = \frac{49.2 - 9.59}{4.085 \times 2.35}$

By writing each number correct to 1 significant figure, work out an estimate for T .
You must show all your working.

..... [2]

6 **Without using a calculator**, work out $2\frac{2}{3} \times 2\frac{3}{4}$.

You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

7 Make x the subject of this formula.

$$2y = 5x - 7$$

$x =$ [2]

- 8 (a) 1, 2, 3, 5 and 7 are all common factors of two numbers.

Write down the digit that the two numbers must end in.

..... [1]

- (b) Write 84 as a product of its prime factors.

..... [2]

- 9 (a) Ahmed increases 40 by 300%.

From this list, put a ring around the correct calculation.

40×1.300

40×3

40×400

40×4

40×300

[1]

- (b) Ahmed finds the magnitude of the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$.

From this list, put a ring around the correct calculation.

$\sqrt{2^2 + -3^2}$

$2^2 - 3^2$

$\sqrt{2^2 - 3^2}$

$2^2 + (-3)^2$

$\sqrt{2^2 + (-3)^2}$

[1]

- 10 A town has a population of 45 000.

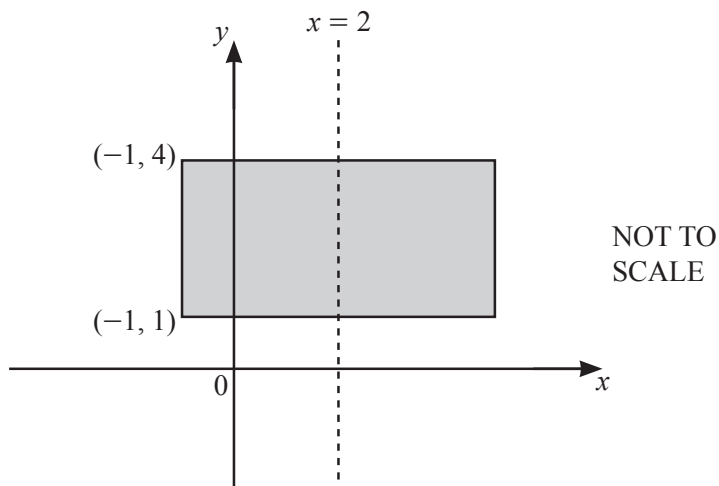
This population increases exponentially at a rate of 1.6% per year.

Find the population of the town at the end of 5 years.

Give your answer correct to the nearest hundred.

..... [3]

11



The diagram shows a rectangle with a line of symmetry at $x = 2$.
Two vertices of the rectangle are at $(-1, 1)$ and $(-1, 4)$.

The shaded region is defined by the inequalities $a \leq x \leq b$ and $c \leq y \leq d$.

Find the values of a , b , c and d .

$a =$
 $b =$
 $c =$
 $d =$ [2]

12 The interior angle of a regular polygon with n sides is 156° .

Work out the value of n .

$n =$ [2]

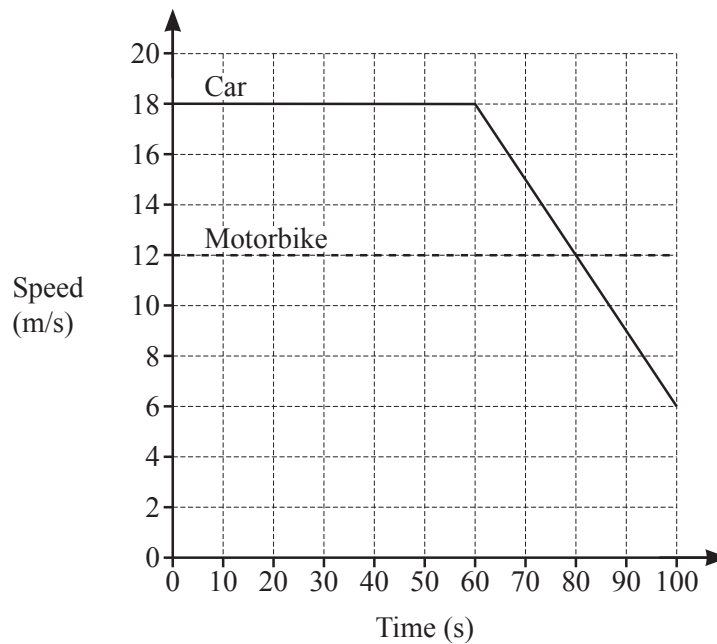
13 Write the recurring decimal $0.1\dot{7}$ as a fraction in its simplest form.
You must show all your working.

..... [3]

- 14 Find the gradient of a line that is perpendicular to $8y + 4x = 5$.

..... [2]

15



The diagram shows the speed–time graph for 100 seconds of the journey of a car and of a motorbike.

- (a) Find the deceleration of the car between 60 and 100 seconds.

..... m/s^2 [1]

- (b) Calculate how much further the car travelled than the motorbike during the 100 seconds.

..... m [3]

16 Factorise $6x^2 + 7x - 20$.

..... [2]

17 (a) $f(x) = 3x^2 + a$ where a is an integer.
 $f(-2) = 19$

Find the value of a .

$a =$ [2]

(b) $g(x) = 2x + 7$ $h(x) = 3x - 8$

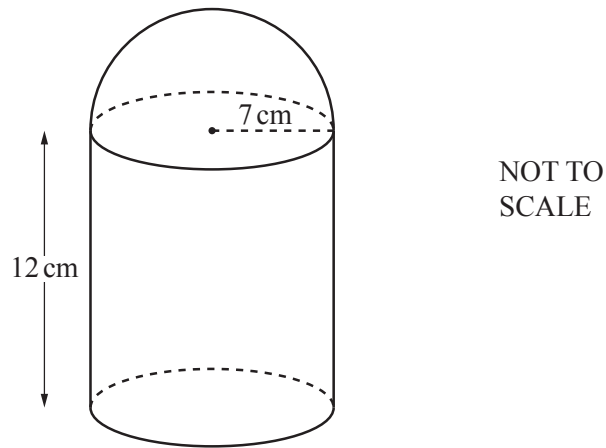
(i) Find $gh(x)$ in its simplest form.

..... [2]

(ii) Find $g^{-1}(x)$.

$g^{-1}(x) =$ [2]

18



The diagram shows a solid made from a cylinder and a hemisphere, both of radius 7 cm. The cylinder has length 12 cm.

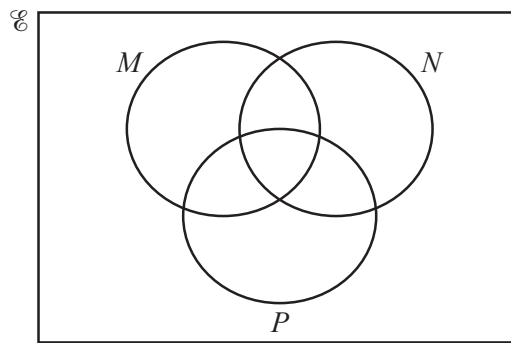
Work out the total surface area of the solid.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

..... cm² [4]

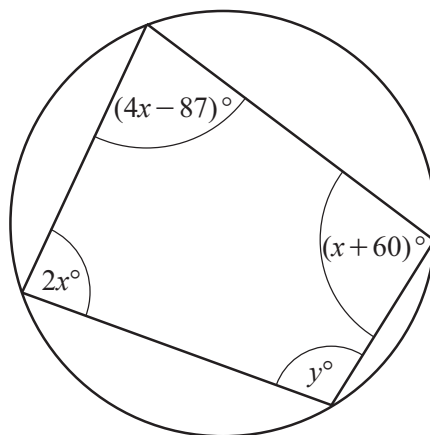
10

- 19 In this Venn diagram, shade the region $M' \cup N \cup P$.



[1]

20



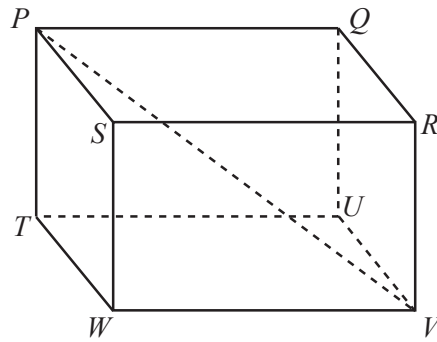
NOT TO
SCALE

The diagram shows a cyclic quadrilateral.

Find the value of y .

$y = \dots\dots\dots$ [4]

21



NOT TO
SCALE

The diagram shows a cuboid $PQRSTUW$.

$PV = 17.2$ cm

The angle between the line PV and the base $TUVW$ of the cuboid is 43° .

Calculate PT .

$PT = \dots\dots\dots$ cm [3]

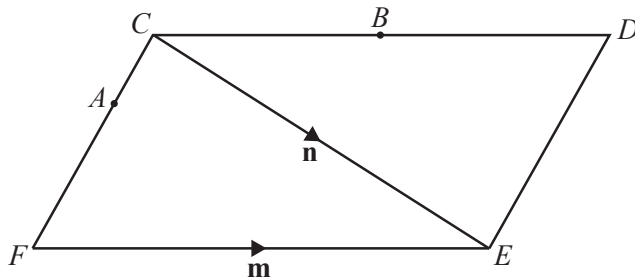
22 Simplify.

$$\frac{x^2 - 5x}{2x^2 - 50}$$

$\dots\dots\dots$ [4]

Question 23 is printed on the next page.

23 (a)



NOT TO
SCALE

The diagram shows a parallelogram $CDEF$.

$\overrightarrow{FE} = \mathbf{m}$ and $\overrightarrow{CE} = \mathbf{n}$.

B is the midpoint of CD .

$FA = 2AC$

Find an expression, in terms of $\mathbf{m}$ and $\mathbf{n}$, for $\overrightarrow{AB}$.

Give your answer in its simplest form.

$\overrightarrow{AB} = \dots\dots\dots$ [3]

(b) $\overrightarrow{GH} = \frac{5}{6}(2\mathbf{p} + \mathbf{q})$ $\overrightarrow{JK} = \frac{5}{18}(2\mathbf{p} + \mathbf{q})$

Write down **two** facts about vectors $\overrightarrow{GH}$ and $\overrightarrow{JK}$.

.....
..... [2]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 70

Published

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These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

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- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
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GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

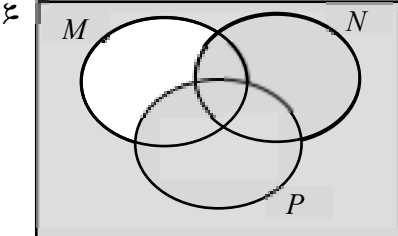
Maths-Specific Marking Principles	
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2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	$-a + 8b$ final answer	2	B1 for $-a$ or $[+]$ $8b$ in final answer or for $-a + 8b$ spoilt
2	Correct triangle constructed with $AC = 5$ cm and $BC = 6.5$ cm and intersecting arcs	3	B2 for correct triangle with no/incorrect arcs or SC2 for accurate triangle with arcs but sides interchanged or B1 for 6.5 [cm] or 5 [cm] soi
3	1.75	3	M2 for $(13.72 - 2.8 \times 2.65) \div 3.6$ oe or M1 for 2.8×2.65
4(a)	4 points correctly plotted	2	B1 for 2 or 3 points correctly plotted
4(b)	Negative	1	
4(c)	Correct ruled line of best fit	1	
4(d)	10 to 12	1	FT <i>their</i> straight line of best fit
5	$\frac{50 - 10}{4 \times 2}$	M1	Allow M1 for 3 out of 4 values correctly rounded or for all correct but with any trailing zeros
	5	A1	dep on $\frac{50 - 10}{4 \times 2}$
6	$\frac{8}{3}$ and $\frac{11}{4}$ oe improper fractions	M1	
	$\frac{88}{12}$ oe improper fraction	A1	
	$7\frac{1}{3}$ cao final answer	A1	dep on 1 st A1 If M0 scored SC1 for $\frac{8}{3}$ or $\frac{11}{4}$ oe improper fraction
7	$[x =] \frac{2y+7}{5}$ oe or $[x =] \frac{2y}{5} + \frac{7}{5}$ oe final answer	2	M1 for $2y + 7 = 5x$ oe or $\frac{2y}{5} = x - \frac{7}{5}$ oe
8(a)	0	1	
8(b)	$2^2 \times 3 \times 7$ or $2 \times 2 \times 3 \times 7$	2	B1 for 2, 2, 3, 7
9(a)	40×4	1	
9(b)	$\sqrt{2^2 + (-3)^2}$	1	

Question	Answer	Marks	Partial Marks
10	48 700 cao	3	M1 for $45000 \times \left(1 + \frac{1.6}{100}\right)^5$ oe A1 for 48 710 to 48 720 If A0 scored B1 for <i>their</i> more accurate value correctly rounded to the nearest 100
11	$[a =] -1$ $[b =] 5$ $[c =] 1$ $[d =] 4$	2	B1 for two or three correct or SC1 for $[a =] x \geq -1$ $[b =] x \leq 5$ $[c =] y \geq 1$ $[d =] y \leq 4$
12	15	2	M1 for $\frac{360}{180-156}$ or $\frac{180(n-2)}{n} = 156$ oe
13	17.77... – 1.77... oe	M1	M1 for correct working shown
	$\frac{8}{45}$ cao	A2	B1 for $\frac{16}{90}$ oe seen
14	2	2	M1 for $y = \frac{5-4x}{8}$ oe or better
15(a)	0.3	1	
15(b)	360	3	M2 for correct complete area statement e.g. $18 \times 60 + \frac{1}{2} \times 40 \times (18 + 6) - 12 \times 100$ or $\frac{1}{2} \times 6 \times (60 + 80) - \frac{1}{2} \times 6 \times 20$ or for answer 420 or M1 for one area calculation
16	$(3x - 4)(2x + 5)$ final answer	2	B1 for $(ax + b)(cx + d)$ where $ac = 6$ and $ad + bc = 7$ or $bd = -20$
17(a)	$[a =] 7$	2	M1 for $3(-2)^2 + a = 19$ or better
17(b)(i)	$6x - 9$ or $3(2x - 3)$ final answer	2	M1 for $2(3x - 8) + 7$ or better
17(b)(ii)	$\frac{x-7}{2}$ final answer	2	M1 for a correct first step $x = 2y + 7$ or $y - 7 = 2x$ or $\frac{y}{2} = x + \frac{7}{2}$

Question	Answer	Marks	Partial Marks
18	990 or 989.58 to 989.73	4	M1 for $4 \times \pi \times 7^2 [\div 2]$ M1 for $\pi \times 7^2$ M1 for $\pi \times 7 \times 2 \times 12$
19		1	
20	107	4	B2 for $x = 40$ or M1 for $2x + x + 60 = 180$ oe M1 for correctly substituting <i>their</i> x into $4x - 87 + y = 180$ oe or $4x - 87 + x + 60 + y + 2x = 360$ oe
21	11.7 or 11.73...	3	M2 for $\sin 43 = \frac{PT}{17.2}$ oe or M1 for identifying angle PVT
22	$\frac{x}{2(x+5)}$ or $\frac{x}{2x+10}$ final answer	4	B1 for $x(x-5)$ B2 for $2(x-5)(x+5)$ or $(x-5)(2x+10)$ or $(2x-10)(x+5)$ or B1 for $2(x^2-25)$ or $(x-5)(x+5)$
23(a)	$\frac{5}{6} \mathbf{m} - \frac{1}{3} \mathbf{n}$	3	B2 for correct unsimplified answer in terms of m and n e.g. $\frac{1}{3} (\mathbf{m} - \mathbf{n}) + \frac{1}{2} \mathbf{m}$ or M1 for a correct route or for $\overrightarrow{FC} = \mathbf{m} - \mathbf{n}$ or $\overrightarrow{CF} = \mathbf{n} - \mathbf{m}$ or better e.g. $\overrightarrow{AC} = \frac{1}{3} (\mathbf{m} - \mathbf{n})$
23(b)	$\overrightarrow{GH} = 3 \overrightarrow{JK}$ oe or $\overrightarrow{GH}$ has a greater magnitude $\overrightarrow{GH}$ and $\overrightarrow{JK}$ are parallel	2	B1 for each



Cambridge IGCSE™

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NUMBER

MATHEMATICS**0580/22**

Paper 2 (Extended)

October/November 2020**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

- 1 Write two hundred thousand and seventeen in figures.

..... [1]

- 2 Insert one pair of brackets to make this calculation correct.

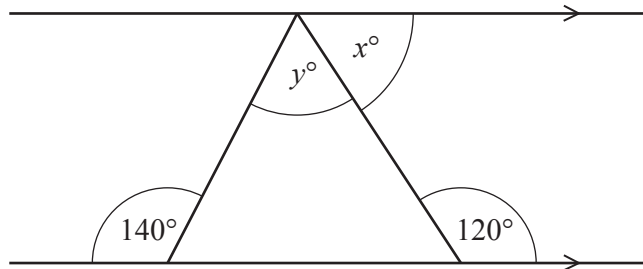
$$7 - 5 - 3 + 4 = 9 \quad [1]$$

- 3 Solve the equation.

$$6 - 2x = 3x$$

$x =$ [2]

4



NOT TO
SCALE

The diagram shows a triangle drawn between a pair of parallel lines.

Find the value of x and the value of y .

$x =$

$y =$ [3]

- 5 Increase 42 by 16%.

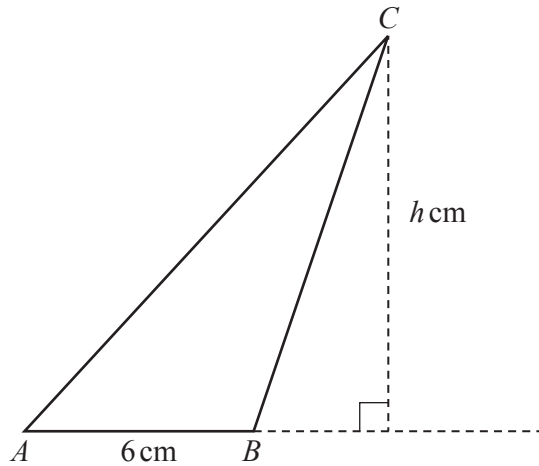
..... [2]

- 6 Factorise completely.

$$4 - 8x$$

..... [1]

7



NOT TO
SCALE

The area of triangle ABC is 27 cm^2 and $AB = 6 \text{ cm}$.

Calculate the value of h .

$h =$ [2]

- 8 Calculate the size of one interior angle of a regular polygon with 40 sides.

..... [2]

- 9 Solve the simultaneous equations.

$$2x + y = 7$$

$$3x - y = 8$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [2]$$

- 10 **Without using a calculator**, work out $\frac{5}{6} \div 1\frac{1}{3}$.

You must show all your working and give your answer as a fraction in its simplest form.

$$\dots\dots\dots [3]$$

- 11 Simplify.

$$2x^2 \times 5x^5$$

$$\dots\dots\dots [2]$$

- 12** Alex and Chris share sweets in the ratio Alex : Chris = 7 : 3.
Alex receives 20 more sweets than Chris.

Work out the number of sweets Chris receives.

..... [2]

- 13** The length of one side of a rectangle is 12 cm.
The length of the diagonal of the rectangle is 13 cm.

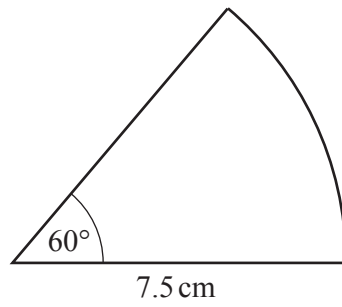
Calculate the area of the rectangle.

..... cm² [3]

- 14** Work out $(3 \times 10^{199}) + (2 \times 10^{201})$.
Give your answer in standard form.

..... [2]

15



NOT TO
SCALE

Calculate the area of this sector of a circle.

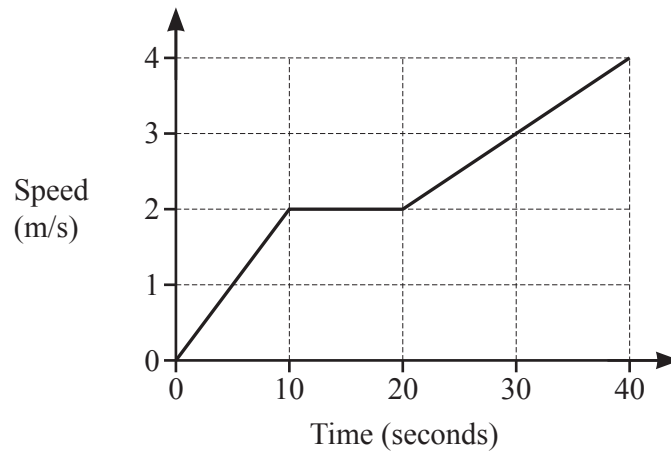
..... cm^2 [2]

- 16** The selling price of a shirt is \$26.50 .
This includes a tax of 6%.

Calculate the price of the shirt before the tax was added.

\$ [2]

17



The diagram shows the speed–time graph for the first 40 seconds of a cycle ride.

(a) Find the acceleration between 20 and 40 seconds.

..... m/s^2 [1]

(b) Find the total distance travelled.

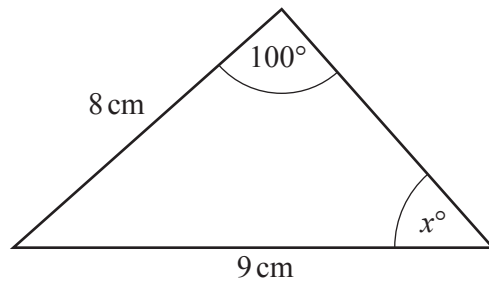
..... m [3]

- 18** The sides of an isosceles triangle are measured correct to the nearest millimetre. One side has a length of 8.2 cm and another has a length of 9.4 cm.

Find the largest possible value of the perimeter of this triangle.

..... cm [3]

19

NOT TO
SCALE

- (a) Calculate the value of x .

$x = \dots\dots\dots$ [3]

- (b) Calculate the area of the triangle.

$\dots\dots\dots \text{ cm}^2$ [3]

- 20 A model of a statue has a height of 4 cm .
The volume of the model is 12 cm^3 .
The volume of the statue is $40\,500\text{ cm}^3$.

Calculate the height of the statue.

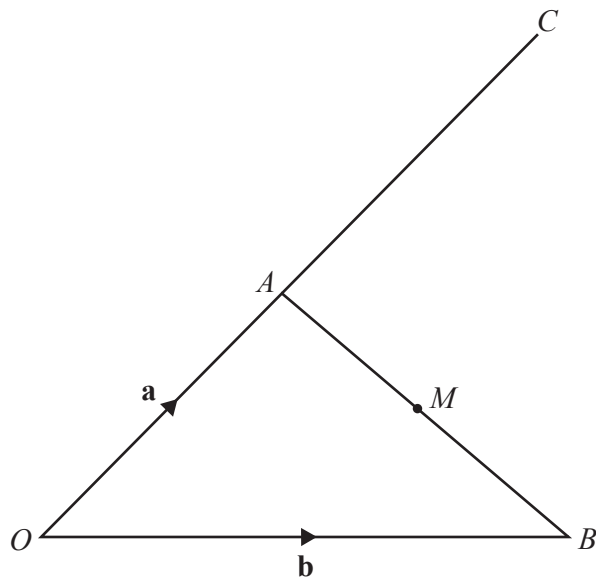
$\dots\dots\dots \text{ cm}$ [3]

21 (a) Differentiate $6 + 4x - x^2$.

..... [2]

(b) Find the coordinates of the turning point of the graph of $y = 6 + 4x - x^2$.

(..... , ...) [2]

NOT TO
SCALE

The diagram shows a triangle OAB and a straight line OAC .

$OA : OC = 2 : 5$ and M is the midpoint of AB .

$\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

(a) $\vec{AB}$,

$\vec{AB} = \dots\dots\dots$ [1]

(b) $\vec{MC}$.

$\vec{MC} = \dots\dots\dots$ [3]

- 23 Write as a single fraction in its simplest form.

$$2 - \frac{2x-1}{x+1}$$

..... [3]

- 24 A line from the point $(2, 3)$ is perpendicular to the line $y = \frac{1}{3}x + 1$.
The two lines meet at the point P .

Find the coordinates of P .

(..... , ...) [5]

Questions 25 and 26 are printed on the next page.

25 Solve the equation $\tan x = 2$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

26 Simplify.

$$\frac{ux - 2u - x + 2}{u^2 - 1}$$

$\dots\dots\dots$ [4]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

October/November 2020

MARK SCHEME

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FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	200 017	1	
2	$7 - (5 - 3) + 4$	1	
3	1.2 or $1\frac{1}{5}$ or $\frac{6}{5}$	2	M1 for $6 = 2x + 3x$ or better
4	$[x =] 60$ $[y =] 80$	3	B1 for $[x =] 60$ B2 for $[y =] 80$ or B1 for 40 in a correct place on diagram If 0 scored SC1 for <i>their</i> $x + \text{their } y = 140$
5	48.72	2	M1 for $\frac{16}{100} \times 42$ oe or better
6	$4(1 - 2x)$	1	
7	9	2	M1 for $\frac{1}{2} \times 6 \times h = 27$ oe
8	171	2	M1 for $180 - (360 \div 40)$ oe or $\frac{(40 - 2) \times 180}{40}$ oe
9	$[x =] 3$ $[y =] 1$	2	B1 for each
10	$\frac{5}{6} \times \frac{3}{4}$ or $\frac{5}{6} \div \frac{8}{6}$ oe	M2	M1 for $\frac{4}{3}$ seen or for $\frac{5}{6} \times \text{their } \frac{3}{4}$ or for $\frac{5}{6} \div \frac{\text{their } 8}{6}$
	$\frac{5}{8}$ cao	A1	dep on M2
11	$10x^7$ final answer	2	B1 for kx^7 or $10x^k$ final answer or for correct answer then spoilt
12	15	2	M1 for $4 [\text{parts}] = 20$ soi or a correct equation e.g. $\frac{x+20}{7} = \frac{x}{3}$ oe
13	60	3	M2 for $12 \times \sqrt{13^2 - 12^2}$ or M1 for $13^2 - 12^2$ or for $12 \times \text{their } 5$ from Pythagoras or trig
14	2.03×10^{201}	2	B1 for figs 203 or $[0].03 \times 10^{201}$ or 200×10^{199}

Question	Answer	Marks	Partial Marks
15	29.5 or 29.45 to 29.46	2	M1 for $\frac{60}{360} \times \pi \times 7.5^2$ oe
16	25	2	M1 for $x \times \left(1 + \frac{6}{100}\right) = 26.50$ oe or better
17(a)	0.1 or $\frac{1}{10}$	1	
17(b)	90	3	M2 for $\frac{1}{2} \times 10 \times 2 + 10 \times 2 + \frac{1}{2} (2 + 4) \times 20$ oe or M1 for one area calculation or indicated on diagram
18	27.15 cao	3	M2 for $(9.4 + 0.05) \times 2 + 8.2 + 0.05$ or better or M1 for $8.2 + 0.05$ or $9.4 + 0.05$ or better seen OR SC2 for answer 25.95 or SC1 for answer 26.85
19(a)	61.1 or 61.08 to 61.09...	3	M2 for $[\sin x =] \frac{8 \sin 100}{9}$ oe or better or M1 for $\frac{9}{\sin 100} = \frac{8}{\sin x}$ oe
19(b)	11.7 or 11.66 to 11.67	3	M2 for $\frac{1}{2} \times 9 \times 8 \times \sin(180 - 100 - \text{their (a)})$ oe or M1 for $180 - 100 - \text{their (a)}$
20	60	3	M2 for $4 \times \sqrt[3]{\frac{40500}{12}}$ oe or M1 for $\left(\frac{4}{l}\right)^3 = \frac{12}{40500}$ oe or $\sqrt[3]{\frac{40500}{12}}$ oe or $\sqrt[3]{\frac{12}{40500}}$ oe
21(a)	$4 - 2x$	2	B1 for 4 or $-2x$
21(b)	(2, 10)	2	B1 for x-coordinate of 2 or M1 for <i>their</i> $4 - 2x = 0$
22(a)	$-a + b$	1	

Question	Answer	Marks	Partial Marks
22(b)	$2a - \frac{1}{2}b$	3	B2 for answer $2a + pb$ or $qa - \frac{1}{2}b$ $q \neq \frac{1}{2}$ or correct unsimplified answer in terms of a and b or M1 for $\overrightarrow{AC} = \frac{3}{2}a$ or $\overrightarrow{OC} = \frac{5}{2}a$ or correct route If 0 scored SC1 for answer $a + \frac{1}{2}b$
23	$\frac{3}{x+1}$ final answer	3	B1 for $2(x+1) - (2x-1)$ oe B1 for common denominator $x+1$
24	(2.4, 1.8) oe	5	M1 for [gradient =] $-1 \div \frac{1}{3}$ oe M1 for substituting (2, 3) into $y = (\text{their } m)x + c$ oe M1 for $\frac{1}{3}x + 1 = \text{their}(mx + c)$ with $\text{their } m \neq \frac{1}{3}$ M1 for substituting <i>their</i> x-coord into either equation to find y or for substituting <i>their</i> y-coord into either equation to find x
25	63.4 or 63.43... 243.4 or 243.4...	2	B1 for each If 0 scored SC1 for two answers with a difference of 180
26	$\frac{x-2}{u+1}$ oe final answer	4	B2 for $(x-2)(u-1)$ or B1 for $u(x-2) - (x-2)$ or $x(u-1) - 2(u-1)$ B1 for $(u-1)(u+1)$



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MATHEMATICS

0580/23

Paper 2 (Extended)

October/November 2020

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

- 1 Write down the cube number that is greater than 50 but less than 100.

..... [1]

- 2 Calculate.

$$\frac{4}{\sqrt{0.0025}}$$

..... [1]

- 3 In triangle ABC , $BC = 7.6$ cm and $AC = 6.2$ cm.

Using a ruler and compasses only, construct triangle ABC .

Leave in your construction arcs.

The side AB has been drawn for you.



[2]

- 4 Simplify.

$$a^2 \div a^6$$

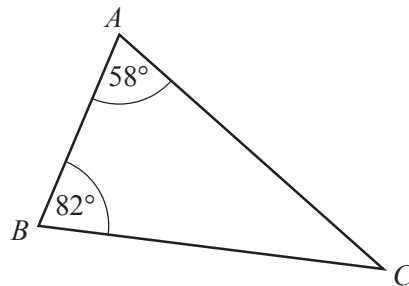
..... [1]

- 5 Thor changes 40 000 Icelandic Krona into dollars when the exchange rate is 1 krona = \$0.0099 .

Work out how many dollars he receives.

\$ [1]

6



NOT TO
SCALE

The diagram shows triangle ABC .

The triangle is reflected in the line BC to give a quadrilateral $ABDC$.

- (a) Write down the mathematical name of the quadrilateral $ABDC$.

..... [1]

- (b) Find angle ACD .

Angle ACD = ... [2]

- 7 Change $457\,000\text{ cm}^2$ into m^2 .

..... m^2 [1]

- 8 The length, l cm, of a line is 18.3 cm, correct to the nearest millimetre.

Complete this statement about the value of l .

$$\dots\dots\dots \leq l < \dots\dots\dots [2]$$

- 9 **Without using a calculator**, work out $1\frac{1}{7} \times 2\frac{1}{10}$.

You must show all your working and give your answer as a mixed number in its simplest form.

$$\dots\dots\dots [3]$$

- 10 Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned} 3x - 8y &= 22 \\ x + 4y &= 4 \end{aligned}$$

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots [3]$$

11 A bag contains 7 red discs, 5 green discs and 2 pink discs.

- (a) Helen takes one disc at random, records the colour and replaces it in the bag. She does this 140 times.

Find how many times she expects to take a green disc.

..... [2]

- (b) Helen adds 9 green discs and some pink discs to the discs already in the bag. The probability of taking a green disc is now $\frac{2}{7}$.

Find the number of pink discs that Helen added to the bag.

..... [2]

12 A straight line, l , has equation $y = 5x + 12$.

- (a) Write down the gradient of line l .

..... [1]

- (b) Find the coordinates of the point where line l crosses the x -axis.

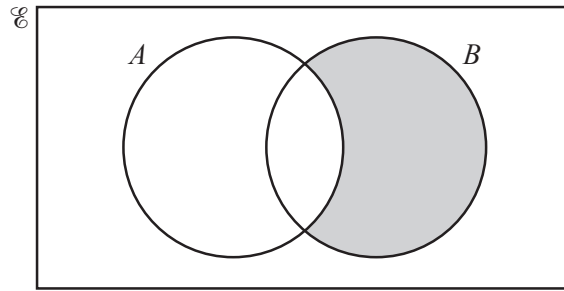
(..... , ...) [2]

- (c) A line perpendicular to line l has gradient k .

Find the value of k .

$k =$ [1]

13



Use set notation to describe the shaded region.

..... [1]

14 $N = 2^4 \times 3 \times 7^5$

$PN = K$, where P is an integer and K is a square number.

Find the smallest value of P .

$P =$ [2]

15 $m = 2p + \sqrt{\frac{x}{y}}$

Make x the subject of this formula.

$x =$ [3]

- 16** A paperweight has height 4 cm and volume 38.4 cm^3 .
A mathematically similar paperweight has height 7 cm.

Calculate the volume of this paperweight.

..... cm^3 [3]

- 17** Adil and Brian are paid the same wage.
Adil is given a 7% pay decrease and his new wage is \$427.80 .
Brian is given a 7% pay increase.

Work out Brian's new wage.

\$ [3]

- 18 (a)** Simplify. $(4xy^2)^3$

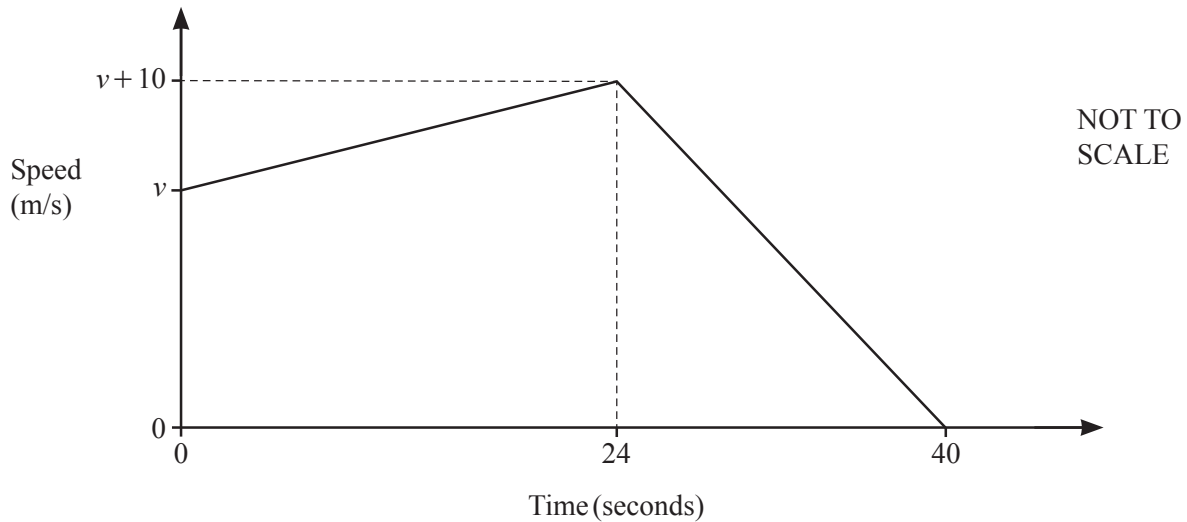
..... [2]

- (b)** $25 = 125^k$

Find the value of k .

$k =$ [1]

19



The diagram shows the speed–time graph for the final 40 seconds of a car journey.
At the start of the 40 seconds the speed is v m/s.

- (a) Find the acceleration of the car during the first 24 seconds.

..... m/s^2 [1]

- (b) The total distance travelled during the 40 seconds is 1.24 **kilometres**.

Find the value of v .

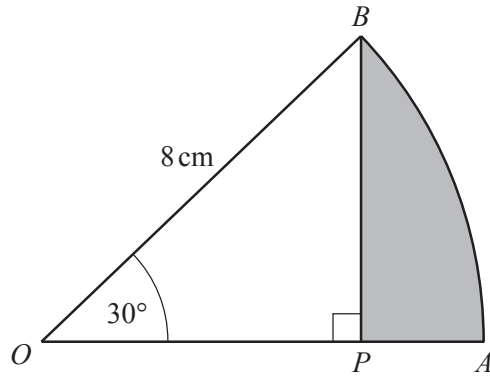
$v =$ [4]

20 Factorise.

$$3x + 8y - 6ax - 16ay$$

..... [2]

21

NOT TO
SCALE

OAB is the sector of a circle, centre O .
 $OB = 8$ cm and angle $AOB = 30^\circ$.
 BP is perpendicular to OA .

(a) Calculate AP .

$AP = \dots\dots\dots$ cm [3]

(b) Work out the area of the shaded region APB .

$\dots\dots\dots$ cm² [3]

- 22 The table shows information about the times, t seconds, taken by each of 100 students to solve a puzzle.

Time (t seconds)	$0 < t \leq 10$	$10 < t \leq 15$	$15 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 75$
Frequency	9	18	22	30	21

- (a) Calculate an estimate of the mean time.

..... s [4]

- (b) Emmanuel draws a histogram to show this information.
The table shows the heights, in cm, of some of the bars for this histogram.

Complete the table.

Time (t seconds)	$0 < t \leq 10$	$10 < t \leq 15$	$15 < t \leq 20$	$20 < t \leq 40$	$40 < t \leq 75$
Height of bar (cm)	3.6	14.4	17.6		

[3]

- 23 y is inversely proportional to the square root of x .
When $y = 7$, $x = 2.25$.

Write y in terms of x .

$$y = \dots\dots\dots [2]$$

- 24 Simplify.

$$\frac{x^2 - 25}{x^2 - 17x + 60}$$

$$\dots\dots\dots [4]$$

Question 25 is printed on the next page.

25 Solve $3 \tan x = -4$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/23

Paper 2 (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of 7 printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	64	1	
2	80	1	
3	Accurate triangle with correct construction arcs	2	B1 for accurate triangle with no/incorrect arcs or SC1 for accurate triangle with arcs with sides interchanged
4	a^{-4} or $\frac{1}{a^4}$ final answer	1	
5	396	1	
6(a)	Kite	1	
6(b)	80	2	M1 for $(180 - 82 - 58)$ or better
7	45.7	1	
8	18.25, 18.35	2	B1 for each or SC1 for both values correct but reversed
9	$\frac{8}{7}$ and $\frac{21}{10}$ oe improper fractions	M1	
	$\frac{168}{70}$ oe improper fractions	A1	
	$2\frac{2}{5}$ cao final answer	A1	Dep. on first A1 If M0 scored SC1 for $\frac{8}{7}$ or $\frac{21}{10}$ oe improper fractions
10	Correctly eliminates one variable	M1	
	$[x =] 6$ $[y =] -0.5$ oe	A2	A1 for either correct If M0 scored, SC1 for 2 values satisfying one of the original equations
11(a)	50	2	M1 for $\frac{5}{7+5+2} [\times 140]$ or $\frac{140}{7+5+2} [\times 5]$
11(b)	26	2	M1 for $\frac{5+9}{n} = \frac{2}{7}$ oe or $\frac{5+9}{p+7+5+2+9} = \frac{2}{7}$ oe

Question	Answer	Marks	Partial Marks
12(a)	5	1	
12(b)	$(-\frac{12}{5} \text{ oe}, 0)$	2	M1 for $5x + 12 = 0$
12(c)	$-\frac{1}{5} \text{ oe}$	1	FT $-\frac{1}{\text{their}(a)}$
13	$A' \cap B$	1	
14	21	2	B1 for 3×7 soi or $2^4 \times 3^2 \times 7^6$ oe or answer of $21 \times k^2$
15	$[x =] y(m - 2p)^2$ nfww or $[x =] y(m^2 - 4mp + 4p^2)$ final answer	3	M1 for subtract $2p$ or <i>their</i> term in p to isolate a term in x M1 for squaring M1 for multiplying by <i>their</i> term in y Maximum of 2 marks for an incorrect answer
16	205.8	3	M2 for $38.4 \times \left(\frac{7}{4}\right)^3$ oe or M1 for $\left(\frac{7}{4}\right)^3$ or $\left(\frac{4}{7}\right)^3$ oe or $\frac{7}{4} = \sqrt[3]{\frac{v}{38.4}}$ oe
17	492.2[0]	3	B2 for 32.2[0] OR M1 for $x \times \left(1 - \frac{7}{100}\right) = 427.8[0]$ oe or better M1 for <i>their</i> $460 \times \left(1 + \frac{7}{100}\right)$ oe or <i>their</i> $460 \times \frac{7}{100}$ correctly evaluated

Question	Answer	Marks	Partial Marks
18(a)	$64x^3y^6$ final answer	2	B1 for kx^3y^6 or $64x^ky^6$ or $64x^3y^k$ final answer or correct answer then spoilt
18(b)	$\frac{2}{3}$	1	
19(a)	$\frac{5}{12}$ or 0.417 or 0.4166 to 0.4167	1	
19(b)	32.5	4	M3 for $\frac{1}{2}(v+v+10) \times 24 + \frac{1}{2} \times 16(v+10) = 1240$ oe OR M2 for $\frac{1}{2}(v+v+10) \times 24$ oe and $\frac{1}{2} \times 16(v+10)$ oe or M1 for one area expression M1 for correctly solving <i>their</i> ($av + b = 1240$) oe ($a \neq 0, b \neq 0$)
20	$(3x + 8y)(1 - 2a)$	2	M1 for $3x(1 - 2a) + 8y(1 - 2a)$ or $3x + 8y - 2a(3x + 8y)$ or better
21(a)	1.07 or 1.071 to 1.072	3	M2 for $[8 -] 8 \cos 30$ oe or M1 for $\frac{OP}{8} = \cos 30$ oe
21(b)	2.9[0] or 2.895 to 2.901	3	M1 for $\frac{30}{360} \times \pi \times 8^2$ oe M1 for $\frac{1}{2} \times 8 \times \text{their } 6.93 \times \sin 30$ oe or $\frac{1}{2} \times 8 \cos 30 \times 4$ oe

Question	Answer	Marks	Partial Marks
22(a)	27.625	4	M1 for 5, 12.5, 17.5, 30, 57.5 M1 for $\sum fx$ where x is in correct interval including boundaries M1 dep on second M1 for $\frac{\sum fx}{100}$
22(b)	6 and 2.4	3	B2 for either correct or M1 for [fd =] 1.5 or 0.6 oe or B1 for [multiplier] 4
23	$y = \frac{10.5}{\sqrt{x}}$ oe final answer	2	M1 for $y = \frac{k}{\sqrt{x}}$
24	$\frac{x+5}{x-12}$ nfww final answer	4	B1 for $(x+5)(x-5)$ B2 for $(x-12)(x-5)$ or B1 for $x(x-5) - 12(x-5)$ or $x(x-12) - 5(x-12)$ or for $(x+a)(x+b)$ where $ab = -60$ or $a+b = -17$
25	126.9 or 126.86 to 126.87 and 306.9 or 306.86 to 306.87	3	B2 for one correct or M1 for $\tan x = -\frac{4}{3}$ if 0 scored then SC1 for two answers with a difference of 180°



Cambridge IGCSE™

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MATHEMATICS**0580/41**

Paper 4 (Extended)

October/November 2020**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

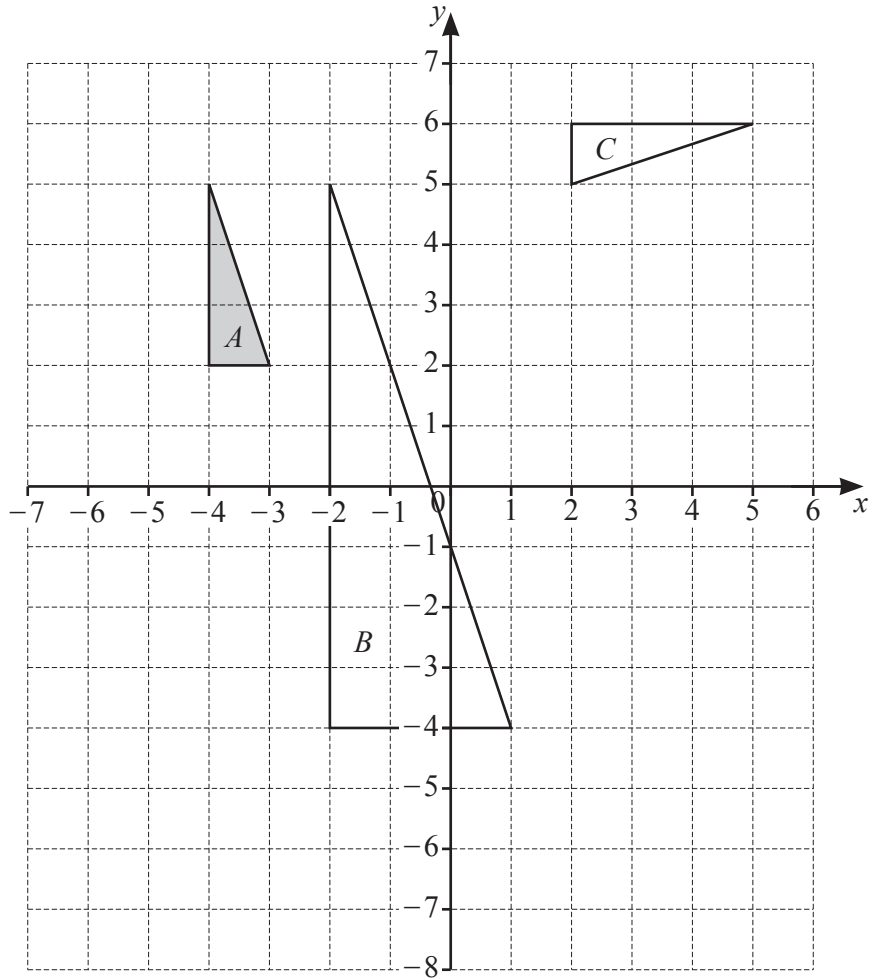
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

1



(a) Draw the image of shape *A* after a translation by the vector $\begin{pmatrix} 8 \\ -6 \end{pmatrix}$. [2]

(b) Draw the image of shape *A* after a reflection in the line $y = -1$. [2]

(c) Describe fully the **single** transformation that maps shape *A* onto shape *B*.

..... [3]

(d) Describe fully the **single** transformation that maps shape *A* onto shape *C*.

..... [3]

- 2 (a) A plane has 14 First Class seats, 70 Premium seats and 168 Economy seats.

Find the ratio First Class seats : Premium seats : Economy seats.
Give your answer in its simplest form.

..... : : [2]

- (b) (i) For a morning flight, the costs of tickets are in the ratio

First Class : Premium : Economy = 14 : 6 : 5.

The cost of a Premium ticket is \$114.

Calculate the cost of a First Class ticket and the cost of an Economy ticket.

First Class \$

Economy \$ [3]

- (ii) For an afternoon flight, the cost of a Premium ticket is reduced from \$114 to \$96.90 .

Calculate the percentage reduction in the cost of a ticket.

..... % [2]

- (c) When the local time in Athens is 09 00, the local time in Berlin is 08 00.

A plane leaves Athens at 13 15.

It arrives in Berlin at 15 05 local time.

- (i) Find the flight time from Athens to Berlin.

..... h min [1]

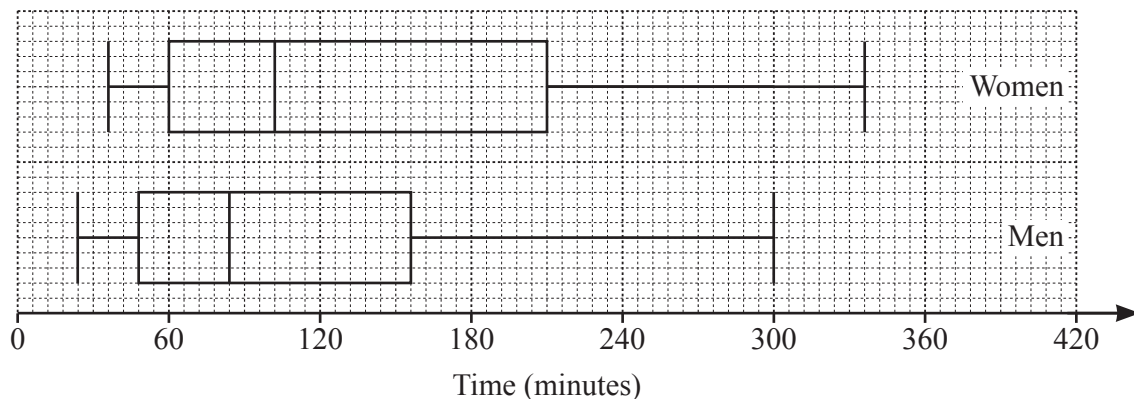
- (ii) The distance the plane flies from Athens to Berlin is 1802 km.

Calculate the average speed of the plane.

Give your answer in kilometres per hour.

..... km/h [2]

3 (a)



The box-and-whisker plots show the times spent exercising in one week by a group of women and a group of men.

Below are two statements comparing these times.

For each one, write down whether you agree or disagree, giving a reason for your answer.

Statement	Agree or disagree	Reason
On average, the women spent less time exercising than the men.		
The times for the women show less variation than the times for the men.		

[2]

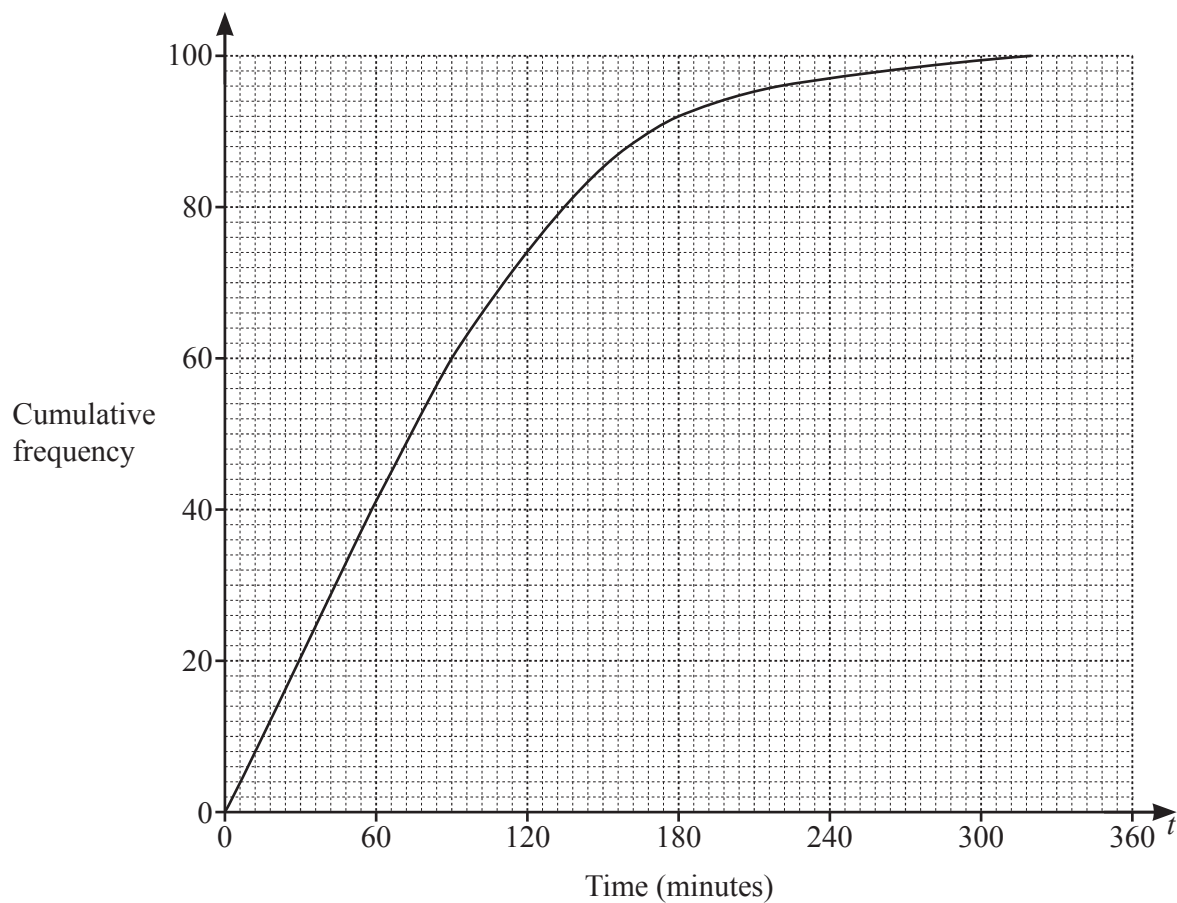
(b) The frequency table shows the times, t minutes, each of 100 children spent exercising in one week.

Time (t minutes)	$0 < t \leq 60$	$60 < t \leq 100$	$100 < t \leq 160$	$160 < t \leq 220$	$220 < t \leq 320$
Frequency	41	24	23	8	4

(i) Calculate an estimate of the mean time.

..... min [4]

- (ii) The information in the frequency table is shown in this cumulative frequency diagram.



Use the cumulative frequency diagram to find an estimate of

- (a) the 60th percentile,

..... min [1]

- (b) the number of children who spent more than 3 hours exercising.

..... [2]

- (iii) A histogram is drawn to show the information in the frequency table.
The height of the bar for the interval $60 < t \leq 100$ is 10.8 cm.

Calculate the height of the bar for the interval $160 < t \leq 220$.

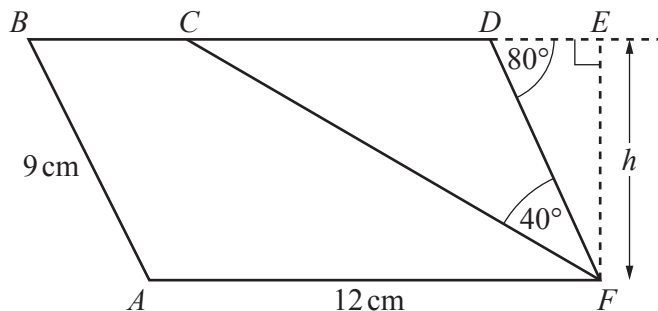
..... cm [2]

- 4 (a) A rectangle measures 8.5 cm by 10.7 cm, both correct to 1 decimal place.

Calculate the upper bound of the perimeter of the rectangle.

..... cm [3]

(b)



NOT TO
SCALE

$ABDF$ is a parallelogram and $BCDE$ is a straight line.

$AF = 12$ cm, $AB = 9$ cm, angle $CFD = 40^\circ$ and angle $FDE = 80^\circ$.

- (i) Calculate the height, h , of the parallelogram.

$h =$ cm [2]

- (ii) Explain why triangle CDF is isosceles.

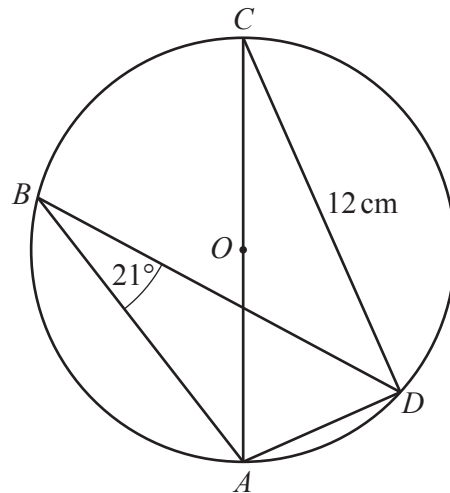
.....

..... [2]

- (iii) Calculate the area of the **trapezium** $ABCF$.

..... cm^2 [3]

(c)

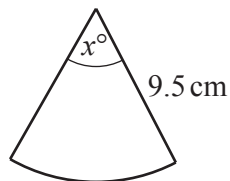
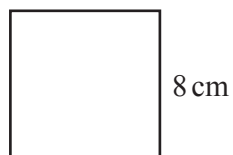
NOT TO
SCALE

A , B , C and D are points on the circle, centre O .
Angle $ABD = 21^\circ$ and $CD = 12$ cm.

Calculate the area of the circle.

..... cm^2 [5]

(d)

NOT TO
SCALE

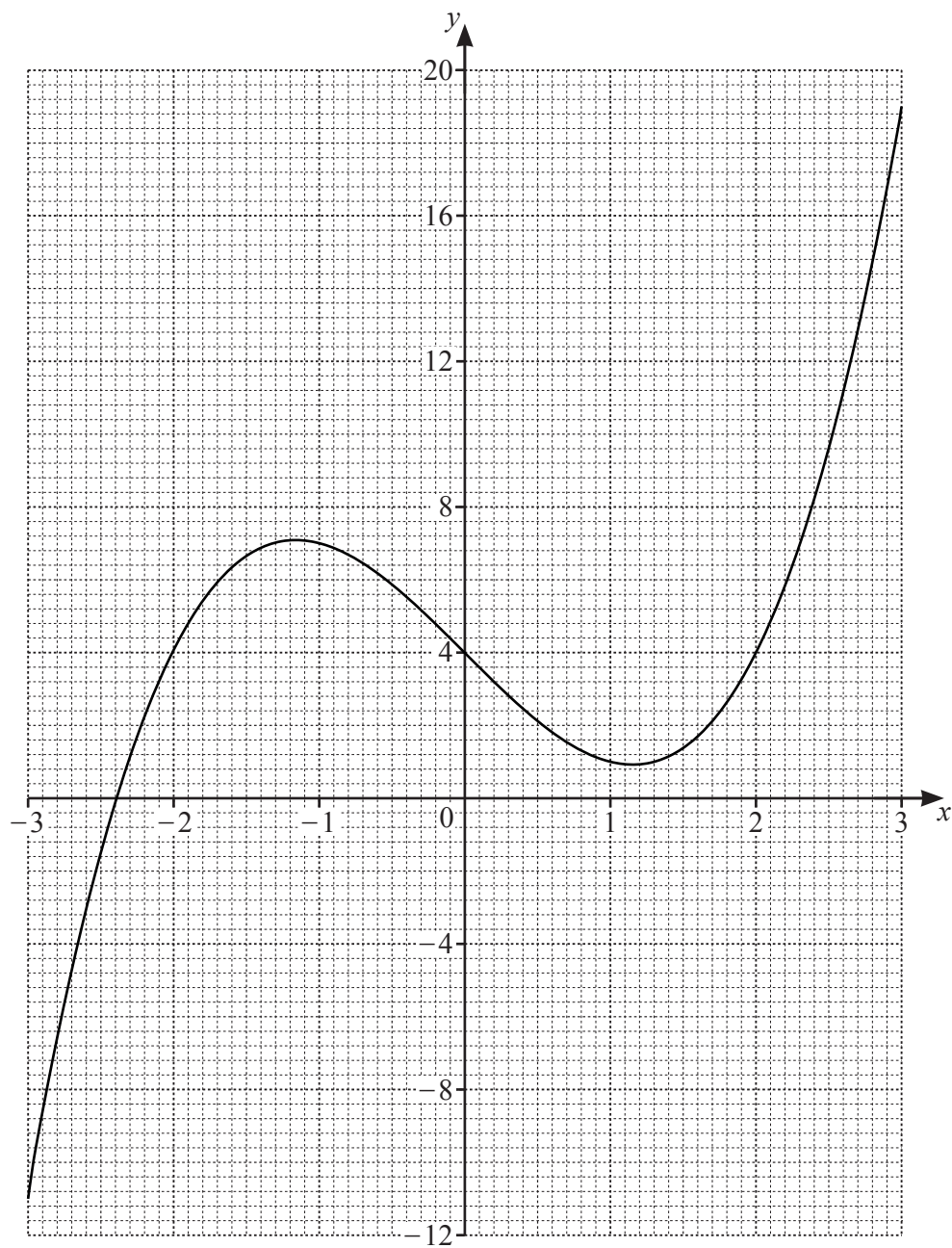
The diagram shows a square with side length 8 cm and a sector of a circle with radius 9.5 cm and sector angle x° .

The perimeter of the square is equal to the perimeter of the sector.

Calculate the value of x .

$x =$ [3]

- 5 (a) The diagram shows the graph of $y = f(x)$ for $-3 \leq x \leq 3$.



- (i) Solve $f(x) = 14$.

$x = \dots\dots\dots$ [1]

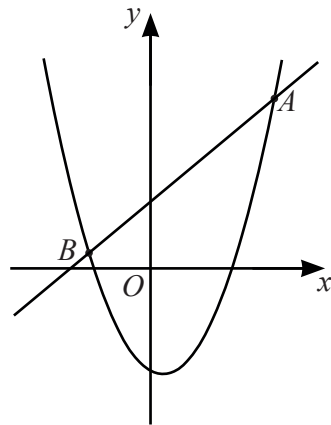
- (ii) By drawing a suitable tangent, find an estimate of the gradient of the graph at the point $(-2, 4)$.

$\dots\dots\dots$ [3]

- (iii) By drawing a suitable straight line on the grid, solve $f(x) = 2x - 2$ for $-3 \leq x \leq 3$.

$x = \dots\dots\dots$ [3]

(b)



NOT TO
SCALE

The diagram shows a curve with equation $y = 2x^2 - 2x - 7$.

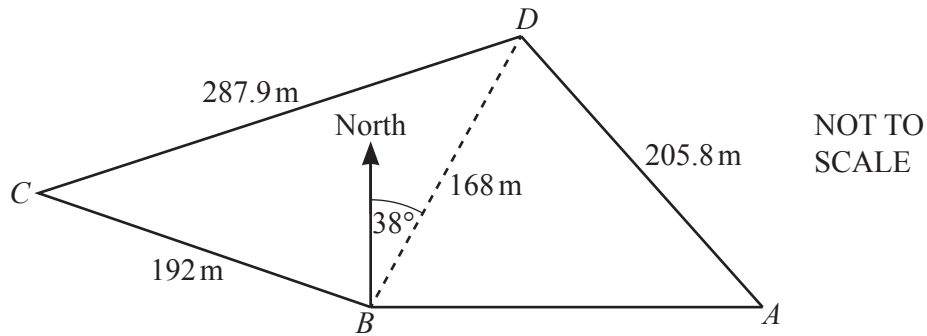
The straight line with equation $y = 3x + 5$ intersects the curve at the points A and B .

Find the coordinates of the points A and B .

A (..... , ...)

B (..... , ...) [5]

6



The diagram shows a field, $ABCD$, on horizontal ground.
 $BC = 192$ m, $CD = 287.9$ m, $BD = 168$ m and $AD = 205.8$ m.

- (a) (i) Calculate angle CBD and show that it rounds to 106.0° , correct to 1 decimal place.

[4]

- (ii) The bearing of D from B is 038° .

Find the bearing of C from B .

..... [1]

- (iii) A is **due east** of B .

Calculate the bearing of D from A .

..... [5]

- (b) (i) Calculate the area of triangle BCD .

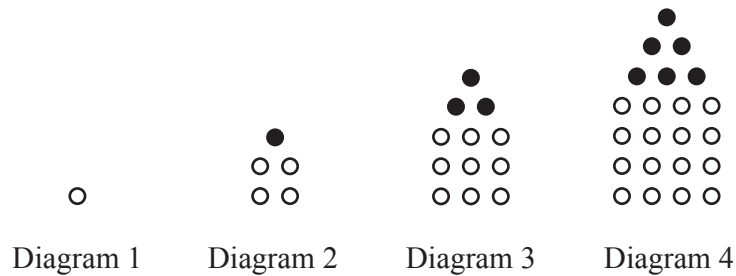
..... m^2 [2]

- (ii) Tomas buys the triangular part of the field, BCD .
The cost is \$35 750 per hectare.

Calculate the amount he pays.
Give your answer correct to the nearest \$100.
[1 hectare = 10 000 m^2]

\$ [2]

7



These are the first four diagrams of a sequence.
The diagrams are made from white dots and black dots.

(a) Complete the table for Diagram 5 and Diagram 6.

Diagram	1	2	3	4	5	6
Number of white dots	1	4	9	16		
Number of black dots	0	1	3	6		
Total number of dots	1	5	12	22		

[2]

(b) Write an expression, in terms of n , for the number of white dots in Diagram n .

..... [1]

(c) The expression for the total number of dots in Diagram n is $\frac{1}{2}(3n^2 - n)$.

(i) Find the total number of dots in Diagram 8.

..... [1]

(ii) Find an expression for the number of black dots in Diagram n .
Give your answer in its simplest form.

..... [2]

- (d) T is the total number of dots used to make **all** of the first n diagrams.

$$T = an^3 + bn^2$$

Find the value of a and the value of b .
You must show all your working.

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [5]$$

- 8 (a) Factorise completely.

$$3a^2b - ab^2$$

..... [2]

- (b) Solve the inequality.

$$3x + 12 < 5x - 3$$

..... [2]

- (c) Simplify.

$$(3x^2y^4)^3$$

..... [2]

- (d) Solve.

$$\frac{2}{x} = \frac{6}{2-x}$$

$x =$ [3]

- (e) Expand and simplify.

$$(x-2)(x+5)(2x-1)$$

..... [3]

- (f) Alan invests \$200 at a rate of $r\%$ per year compound interest.
After 2 years the value of his investment is \$206.46 .

(i) Show that $r^2 + 200r - 323 = 0$.

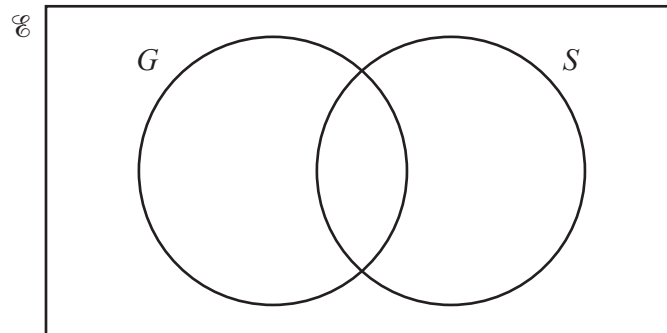
[3]

- (ii) Solve the equation $r^2 + 200r - 323 = 0$ to find the rate of interest.
Show all your working and give your answer correct to 2 decimal places.

$r = \dots\dots\dots$ [3]

- 9 (a) There are 32 students in a class.

5 do not study any languages.
 15 study German (G).
 18 study Spanish (S).



- (i) Complete the Venn diagram to show this information. [2]

- (ii) A student is chosen at random.

Find the probability that the student studies Spanish but not German.

..... [1]

- (iii) A student who studies German is chosen at random.

Find the probability that this student also studies Spanish.

..... [1]

- (b) A bag contains 54 red marbles and some blue marbles.
36% of the marbles in the bag are red.

Find the number of blue marbles in the bag.

..... [2]

- (c) Another bag contains 15 red beads and 10 yellow beads.
Ariana picks a bead at random, records its colour and replaces it in the bag.
She then picks another bead at random.

- (i) Find the probability that she picks two red beads.

..... [2]

- (ii) Find the probability that she does not pick two red beads.

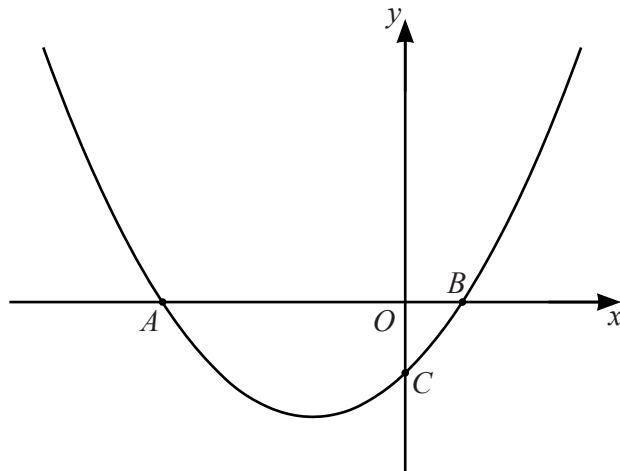
..... [1]

- (d) A box contains 15 red pencils, 8 yellow pencils and 2 green pencils.
Two pencils are picked at random without replacement.

Find the probability that at least one pencil is red.

..... [3]

10 (a)

NOT TO
SCALE

The diagram shows a sketch of the curve $y = x^2 + 3x - 4$.

(i) Find the coordinates of the points A , B and C .

A (....., ...)

B (....., ...)

C (....., ...) [4]

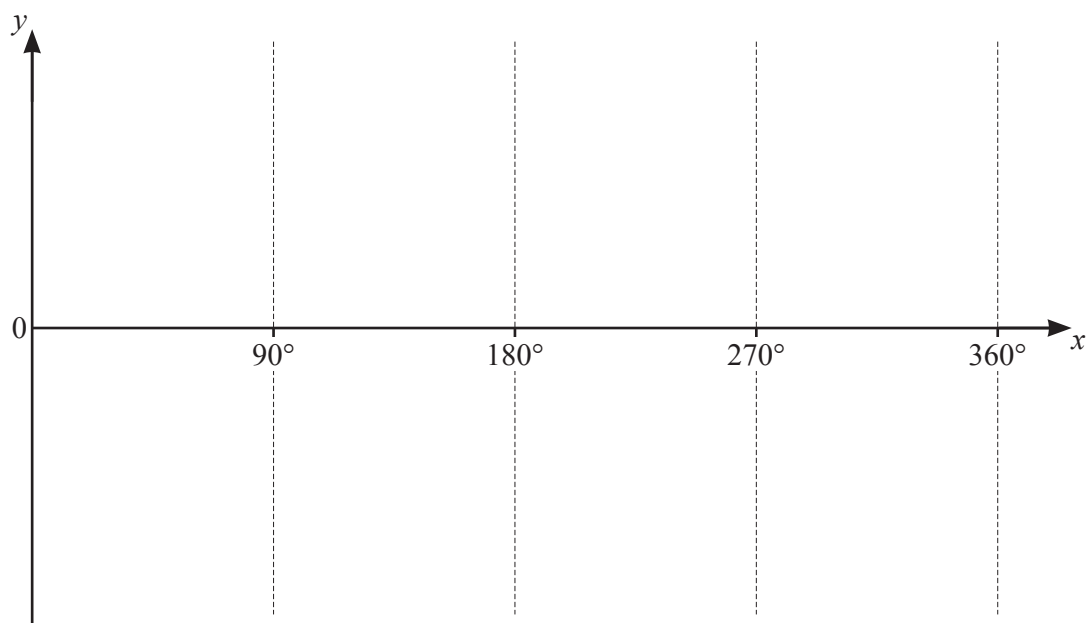
(ii) Differentiate $x^2 + 3x - 4$.

..... [2]

(iii) Find the equation of the tangent to the curve at the point $(2, 6)$.

..... [3]

(b)



(i) On the diagram, sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$. [2]

(ii) Solve the equation $5 \tan x = -7$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **11** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	Image at (4, -1) (4, -4) (5, -4)	2	B1 for translation by $\begin{pmatrix} 8 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -6 \end{pmatrix}$ or for correct vertices not joined
1(b)	Image at (-4, -4) (-4, -7) (-3, -4)	2	B1 for reflection in $x = -1$ or $y = k$ or for correct vertices not joined
1(c)	Enlargement 3 (-5, 5)	3	B1 for each
1(d)	Rotation 90° clockwise oe (1, 1)	3	B1 for each
2(a)	1 : 5 : 12	2	M1 for 2 : 10 : 24 or 7 : 35 : 84 or $\frac{1}{18} : \frac{5}{18} : \frac{12}{18}$
2(b)(i)	266 and 95	3	B2 for 266 or 95 or 266 and 95 reversed or M1 for $\frac{114}{6}$
2(b)(ii)	15	2	M1 for $\frac{114 - 96.9}{114} [\times 100]$ oe or $\frac{96.9}{114} \times 100$
2(c)(i)	2h 50min	1	
2(c)(ii)	636	2	M1 for $1802 \div \text{their } 2\text{h } 50\text{min}$
3(a)	Disagree: the median for the women is greater (than the median for the men) oe Disagree: the men have a smaller [interquartile] range of times oe	2	B1 for each correct statement oe
3(b)(i)	87.4 nfw	4	M1 for mid-points soi (30, 80, 130, 190, 270) M1 for use of Σfm with m in correct interval including both boundaries M1 (dep on 2 nd M1) for $\Sigma fm \div (41 + 24 + 23 + 8 + 4)$
3(b)(ii)(a)	90	1	
3(b)(ii)(b)	8	2	B1 for 92 seen

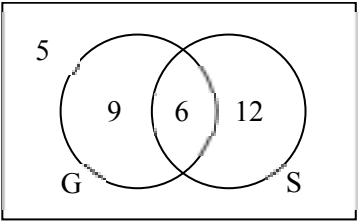
Question	Answer	Marks	Partial Marks
3(b)(iii)	2.4	2	M1 for $\frac{24}{40}$ or $\frac{8}{60}$ Or B1 for [multiplier] 18 or $\frac{1}{18}$
4(a)	38.6	3	M2 for $[2 \times] (8.5 + 0.05 + 10.7 + 0.05)$ or M1 for $8.5 + 0.05$ or $10.7 + 0.05$
4(b)(i)	8.86 or 8.863...	2	M1 for $\frac{h}{9} = \sin 80$ or better oe
4(b)(ii)	$\angle CDF = 100$ leading to $\angle DCF = 40$ Or $\angle EDF = 80$ leading to $\angle DCF = 40$	M1	Implied by $180 - (100 + 40) = 40$ or $80 - 40$
	‘two equal angles’	A1	With no incorrect work seen
4(b)(iii)	66.5 or 66.45 to 66.47...	3	M2 for $0.5(3 + 12) \times \text{their (b)(i)}$ or $12 \times \text{their (b)(i)} - 0.5 \times 9 \times 9 \times \sin 100$ oe or B1 for $DC = 9$ or $BC = 3$

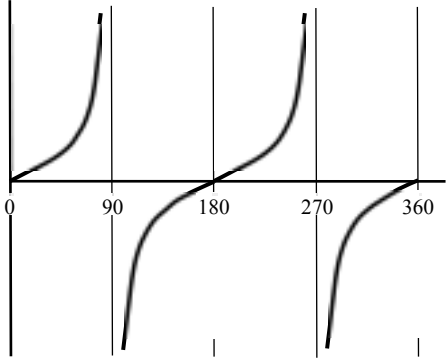
Question	Answer	Marks	Partial Marks
4(c)	130 nfww or 129.6 to 129.8	5	B1 for $\angle ACD = 21^\circ$ or $\angle CAD = 69^\circ$ Method 1 M2 for $\cos 21 = \frac{12}{AC}$ oe or M1 for $\angle ADC = 90$ soi M1 for $\pi(\text{their } AC/2)^2$ OR Method 2 M2 for $\frac{12}{\sin 138} = \frac{r}{\sin 21}$ oe or M1 for $\angle COD = 138$ soi M1 for $\pi(\text{their } r)^2$ OR Method 3 M2 for $\cos 21 = \frac{6}{OC}$ oe or M1 for $\angle CXO = 90$ soi where X is the point where the perpendicular from O meets the chord CD M1 for $\pi(\text{their } OC)^2$
4(d)	78.4 or 78.37 to 78.41	3	M2 for $\frac{x}{360} \times 2 \times \pi \times 9.5 + 2 \times 9.5 = 4 \times 8 \quad \text{oe}$ or M1 for $\frac{x}{360} \times 2 \times \pi \times 9.5$ After M0, SC1 for $9.5x + 19 = 32$ oe
5(a)(i)	2.7 to 2.8	1	

Question	Answer	Marks	Partial Marks
5(a)(ii)	tangent ruled at $x = -2$	B1	
	6 to 10	2	dep on B1 or a close attempt at tangent at $x = -2$ or M1 for rise/run for <i>their</i> tangent, or close attempt, at any point Must see correct or implied calculation from a drawn tangent After M0, SC1 for gradient of tangent (or close attempt) in range embedded in $y = mx + c$
5(a)(iii)	$y = 2x - 2$ ruled and $x = -2.9$ to -2.8 cao	3	B2 for correct ruled line or B1 for short line or for freehand line or broken line or ruled line with gradient 2 or with y-intercept at -2 (but not $y = -2$)
5(b)	$A(4, 17) B(-1.5, 0.5)$	5	B4 for $(-1.5, 0.5)$ and $(4, 17)$, or for $x = 4$ and $x = -1.5$ OR B3 for $A(4, 17)$ or $B(-1.5, 0.5)$ OR M1 for $2x^2 - 2x - 7 = 3x + 5$ oe AND either M2 for $(2x + 3)(x - 4)$ or M1 for $2x(x - 4) + 3(x - 4)$ or $x(2x + 3) - 4(2x + 3)$ or $(2x + c)(x + d)$ where $cd = -12$ or $c + 2d = -5$ [c and d are integers] OR M2 for $\frac{-\text{their } b \pm \sqrt{(\text{their } b)^2 - 4(\text{their } a)(\text{their } c)}}{2(\text{their } a)}$ or M1 for $\sqrt{(\text{their } b)^2 - 4(\text{their } a)(\text{their } c)}$ or for $p = -\text{their } b$, $r = 2(\text{their } a)$ if in the form $\frac{p + \sqrt{q}}{r}$ or $\frac{p - \sqrt{q}}{r}$

Question	Answer	Marks	Partial Marks
6(a)(i)	106.01 to 106.02	4	M2 for $[\cos[\angle CBD] =] \frac{192^2 + 168^2 - 287.9^2}{2 \times 192 \times 168}$ oe or M1 for the implicit form A1 for -0.276 to -0.275
6(a)(ii)	292.0 or 291.98 to 291.99	1	
6(a)(iii)	310.0 or 310.03 to 310.04	5	M2 for $[\sin A =] \frac{168 \times \sin(90 - 38)}{205.8}$ or M1 for $\frac{\sin A}{168} = \frac{\sin(90 - 38)}{205.8}$ A1 for $[A =] 40.0$ or 40.03 to 40.04 M1 dep for $270 + \text{their angle } DAB$ oe
6(b)(i)	15 500 or 15 501 to 15 503. ...	2	M1 for $0.5 \times 192 \times 168 \times \sin(106)$ oe
6(b)(ii)	55 400	2	FT $3.575 \times \text{their (b)(i)}$ oe rounded to nearest 100 M1 for figs $35\ 75 \times \text{figs their (b)(i)}$ or figs 554 or figs 5541 to figs 5543
7(a)	25 36 10 15 35 51	2	B1 for 3, 4 or 5 correct
7(b)	n^2	1	
7(c)(i)	92	1	
7(c)(ii)	$\frac{1}{2}(n^2 - n)$ oe	2	M1 for $\frac{1}{2}(3n^2 - n) - n^2$ oe or for final quadratic answer with $\frac{1}{2}n^2$ oe or $-\frac{1}{2}n^2$ oe but not both

Question	Answer	Marks	Partial Marks
7(d)	$a = \frac{1}{2}, b = \frac{1}{2}$	5	B2 for 2 correct equations eg $a + b = 1, 8a + 4b = 6$ or B1 for 1 correct equation B2 for one correct value or M1 (dep on at least B1) for correctly eliminating one variable from two linear equations in a and b OR B2 for $a = \frac{1}{2}$ or B1 for $6a = 3$ or for 3rd difference = 3 B2 for $b = \frac{1}{2}$ or M1 for substituting <i>their</i> a into a correct equation of first differences
8(a)	$ab(3a - b)$ final answer	2	B1 for $a(3ab - b^2)$ or $b(3a^2 - ab)$ or $ab(3a - b)$ seen
8(b)	$x > 7.5$ final answer	2	B1 for $12 + 3 < 5x - 3x$ oe
8(c)	$27x^6y^{12}$	2	B1 for two of 27, x^6 and y^{12} correct
8(d)	0.5 or $\frac{1}{2}$	3	M2 for $4 = 6x + 2x$ or better or M1 for $2(2 - x) = 6x$ oe
8(e)	$2x^3 + 5x^2 - 23x + 10$ final answer	3	B2 for correct expansion of three brackets unsimplified B1 for correct expansion of two brackets with at least 3 terms correct
8(f)(i)	$200\left(1 + \frac{r}{100}\right)^2 = 206.46$ oe	M1	
	$1 + \frac{2r}{100} + \frac{r^2}{100^2}$ oe	M1	
	$r^2 + 200r - 323 = 0$	A1	Correct solution reached with no errors or omissions seen If 0 scored, SC1 for $200(n)^2 = 206.46$

Question	Answer	Marks	Partial Marks
8(f)(ii)	$\frac{-200 + \sqrt{200^2 - 4(1)(-323)}}{2 \times 1}$	B2	B1 for $\sqrt{200^2 - 4(1)(-323)}$ or $(r + 100)^2$ B1 for $\frac{-200 + \sqrt{q}}{2 \times 1}$ or $r = \sqrt{323 + 100^2} - 100$ OR B2 for $100 \left(\sqrt{\frac{206.46}{200}} - 1 \right)$ or B1 for $\sqrt{\frac{206.46}{200}}$
	1.60 cao final answer	B1	
9(a)(i)		2	B1 for two correct values Or B1 5 outside and total in G = 15 and total in S = 18
9(a)(ii)	$\frac{3}{8}$ oe	1	FT $\frac{\text{their } 12}{32}$
9(a)(iii)	$\frac{2}{5}$ oe	1	FT $\frac{\text{their } 6}{15}$
9(b)	96	2	M1 for $\frac{36}{64} = \frac{54}{x}$ oe or $36 = \frac{54}{(54+b)} \times 100$ oe If 0 scored SC1 for answer 150
9(c)(i)	$\frac{9}{25}$ oe	2	M1 for $\frac{15}{25} \times \frac{15}{25}$ oe
9(c)(ii)	$\frac{16}{25}$ oe	1	FT 1 – their (c)(i)
9(d)	$\frac{17}{20}$ oe	3	M2 for $1 - \frac{10}{25} \times \frac{9}{24}$ oe or for $\frac{15}{25} \times \frac{14}{24} + \frac{15}{25} \times \frac{8}{24} + \frac{15}{25} \times \frac{2}{24} + \frac{8}{25} \times \frac{15}{24}$ $+ \frac{2}{25} \times \frac{15}{24}$ oe or M1 for one correct relevant product

Question	Answer	Marks	Partial Marks
10(a)(i)	$A(-4, 0)$ $B(1, 0)$ $C(0, -4)$	4	B3 for A and B correct Or B2 for B $(-4, 0)$ and A $(1, 0)$ Or B1 for $(x + 4)(x - 1)$ or for $\frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times -4}}{2}$ oe and B1 for A or B correct B1 for C $(0, -4)$ OR SC2 for -4, 1 and -4 in correct positions on the graph
10(a)(ii)	$2x + 3$ [± 0] final answer	2	B1 for answer $2x + c$ or for $ax + 3$, $a \neq 0$ or for correct answer seen
10(a)(iii)	$y = 7x - 8$ oe	3	B2 for answer $7x - 8$ OR M1 for [gradient =] $2(2) + 3$ FT <i>their</i> part (a)(ii) of the form $ax + b$ M1dep for substitution of $(2, 6)$ into $y = \text{their } mx + c$ oe
10(b)(i)	Correct sketch 	2	B1 for one correct section out of 4 OR B1 for two properties correct from • Crosses x-axis at $(0, 0)$ $(180, 0)$ and $(360, 0)$ only • Correct curvature in each section of 90° • Asymptotes at $x = 90$ and $x = 270$
10(b)(ii)	125.5 or 125.53 to 125.54 and 305.5 or 305.53 to 305.54	3	B2 for one correct angle or B1 for -54.5 or $-54.46\dots$ or for 2 angles with a difference of 180.



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MATHEMATICS**0580/42**

Paper 4 (Extended)

October/November 2020**2 hours 30 minutes**

You must answer on the question paper.

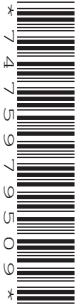
You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

1 Karel travelled from London to Johannesburg and then from Johannesburg to Windhoek.

- (a) The flight from London to Johannesburg took 11 hours 10 minutes.
The average speed was 813 km/h.

Calculate the distance travelled from London to Johannesburg.
Give your answer correct to the nearest 10 km.

..... km [3]

- (b) The total time for Karel's journey from London to Windhoek was 15 hours 42 minutes.
The total distance travelled from London to Windhoek was 10 260 km.

- (i) Calculate the average speed for this journey.

..... km/h [2]

(ii) The cost of Karel's journey from London to Windhoek was \$470.

(a) Calculate the distance travelled per dollar.

..... km per dollar [1]

(b) Calculate the cost per 100 km of this journey.
Give your answer correct to the nearest cent.

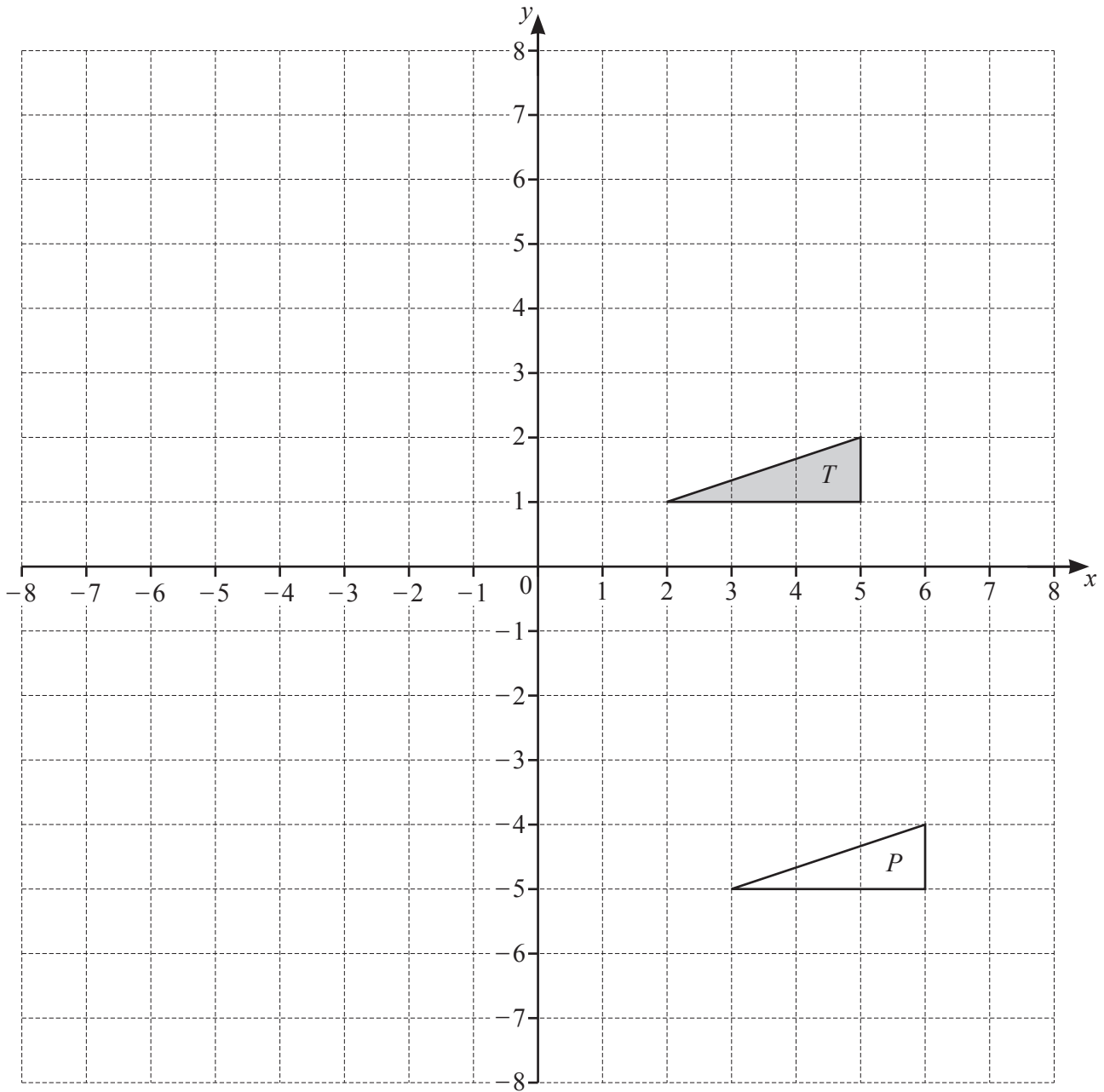
\$ per 100 km [2]

(c) Karel changed \$300 into 3891 Namibian dollars.

Complete the statement.

\$1 = ... Namibian dollars [1]

2



(a) Describe fully the **single** transformation that maps triangle T onto triangle P .

.....
 [2]

(b) (i) Reflect triangle T in the line $x = 1$. [2]

(ii) Rotate triangle T through 90° anticlockwise about $(6, 0)$. [2]

(iii) Enlarge triangle T by a scale factor of -2 , centre $(1, 0)$. [2]

3 (a) Beth invests \$2000 at a rate of 2% per year compound interest.

(i) Calculate the value of this investment at the end of 5 years.

\$ [2]

(ii) Calculate the overall percentage increase in the value of Beth's investment at the end of 5 years.

..... % [2]

(iii) Calculate the minimum number of complete years it takes for the value of Beth's investment to increase from \$2000 to more than \$2500.

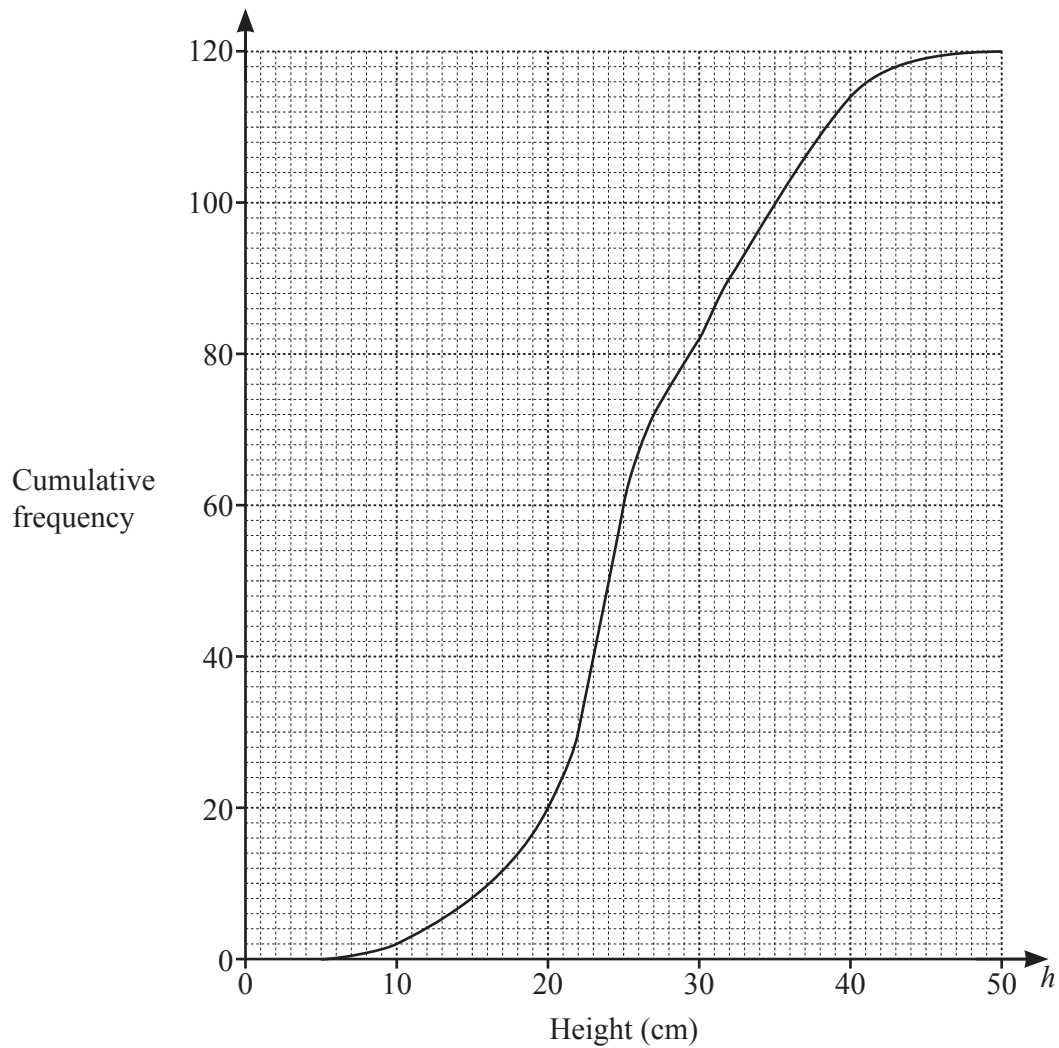
..... [3]

(b) The population of a village decreases exponentially at a rate of 4% each year.
The population is now 255.

Calculate the population 16 years ago.

..... [3]

- 4 The height, h cm, of each of 120 plants is measured.
The cumulative frequency diagram shows this information.



(a) Use the cumulative frequency diagram to find an estimate of

(i) the median,

..... cm [1]

(ii) the interquartile range,

..... cm [2]

(iii) the 60th percentile,

..... cm [1]

(iv) the number of plants with a height greater than 40 cm.

..... [2]

(b) The information in the cumulative frequency diagram is shown in this frequency table.

Height, h cm	$0 < h \leq 10$	$10 < h \leq 20$	$20 < h \leq 30$	$30 < h \leq 50$
Frequency	2	18	62	38

(i) Calculate an estimate of the mean height.

..... cm [4]

(ii) A histogram is drawn to show the information in the frequency table.
The height of the bar representing the interval $10 < h \leq 20$ is 7.2 cm.

Calculate the height of the bar representing the interval $30 < h \leq 50$.

..... cm [2]

- 5 Ahmed sells different types of cake in his shop.
The cost of each cake depends on its type and its size.

Every small cake costs $\$x$ and every large cake costs $\$(2x + 1)$.

- (a) The total cost of 3 small lemon cakes and 2 large lemon cakes is \$12.36 .

Find the cost of a small lemon cake.

\$ [3]

- (b) The cost of 18 small chocolate cakes is the same as the cost of 7 large chocolate cakes.

Find the cost of a small chocolate cake.

\$ [3]

- (c) The number of small cherry cakes that can be bought for \$4 is the same as the number of large cherry cakes that can be bought for \$13.

Find the cost of a small cherry cake.

\$ [3]

- (d) Petra spends \$20 on small coffee cakes and \$10 on large coffee cakes.
The total number of cakes is 45.

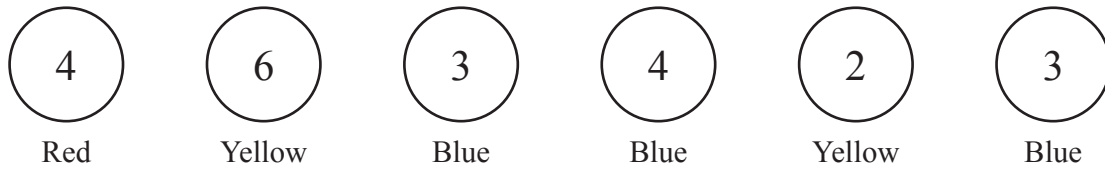
Write an equation in terms of x .

Solve this equation to find the cost of a small coffee cake.

Show all your working.

\$ [7]

6



The diagram shows six discs.
Each disc has a colour and a number.

(a) One disc is picked at random.

Write down the probability that

(i) the disc has the number 4,

..... [1]

(ii) the disc is red and has the number 3,

..... [1]

(iii) the disc is blue and has the number 4.

..... [1]

(b) Two of the six discs are picked at random **without** replacement.

Find the probability that

(i) both discs have the number 3,

..... [2]

(ii) both discs have the same colour.

..... [3]

- (c) Two of the six discs are picked at random **with** replacement.

Find the probability that both discs have the same colour.

..... [3]

7 $y = x^2 + \frac{1}{x}, x \neq 0$

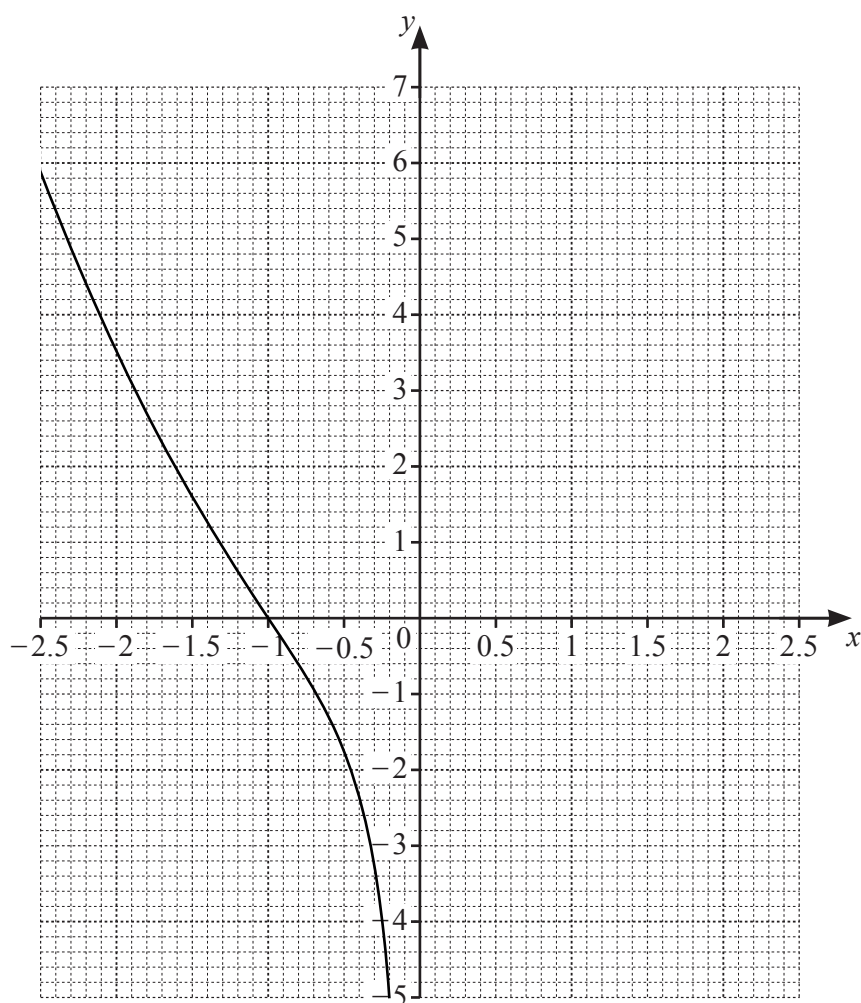
(a) Complete the table.

x	0.2	0.3	0.5	1	1.5	2	2.5
y	5.0	3.4	2.3		2.9		6.7

[2]

(b) On the grid, draw the graph of $y = x^2 + \frac{1}{x}$ for $0.2 \leq x \leq 2.5$.

The graph of $y = x^2 + \frac{1}{x}$ for $-2.5 \leq x \leq -0.2$ has been drawn for you.



[4]

(c) By drawing suitable straight lines on the grid, solve the following equations.

(i) $x^2 + \frac{1}{x} = -2$

$x = \dots\dots\dots$ [1]

(ii) $x^2 + \frac{1}{x} + x - 1 = 0$

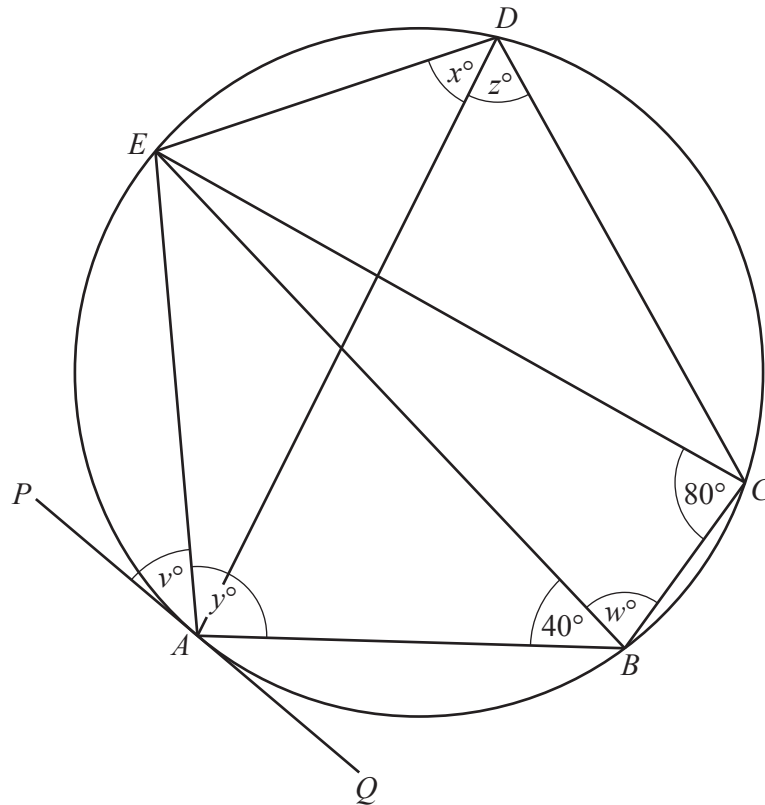
$x = \dots\dots\dots$ [2]

(d) k is an integer and the equation $x^2 + \frac{1}{x} = k$ has three solutions.

Write down a possible value of k .

$k = \dots\dots\dots$ [1]

8 (a)



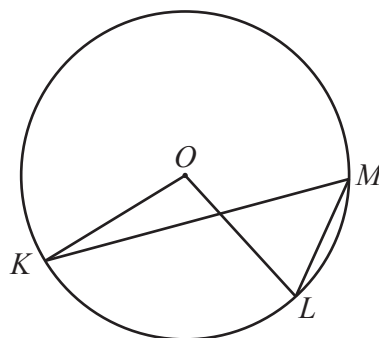
NOT TO
SCALE

The points A, B, C, D and E lie on the circle.
 PAQ is a tangent to the circle at A and $EC = EB$.
 Angle $ECB = 80^\circ$ and angle $ABE = 40^\circ$.

Find the values of v, w, x, y and z .

$v = \dots\dots\dots$ $w = \dots\dots\dots$ $x = \dots\dots\dots$ $y = \dots\dots\dots$ $z = \dots\dots\dots$ [5]

(b)



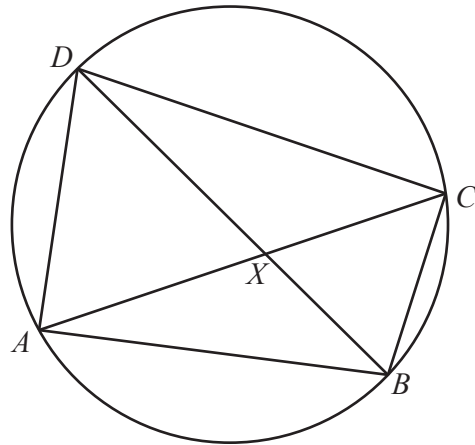
NOT TO
SCALE

In the diagram, K, L and M lie on the circle, centre O .
 Angle $KML = 2x^\circ$ and reflex angle $KOL = 11x^\circ$.

Find the value of x .

$x = \dots\dots\dots$ [3]

(c)

NOT TO
SCALE

The diagonals of the cyclic quadrilateral $ABCD$ intersect at X .

- (i) Explain why triangle ADX is similar to triangle BCX .
Give a reason for each statement you make.

.....

.....

.....

..... [3]

- (ii) $AD = 10$ cm, $BC = 8$ cm, $BX = 5$ cm and $CX = 7$ cm.

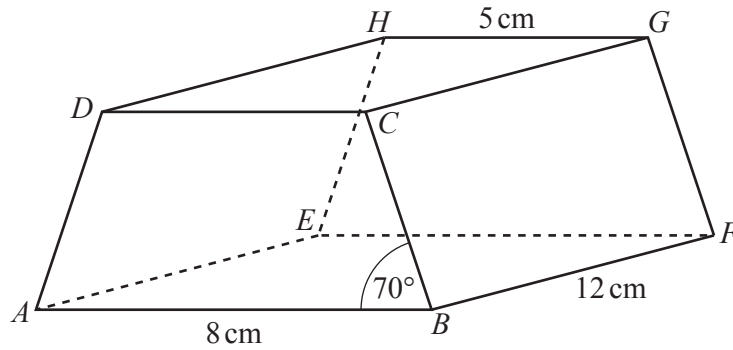
- (a) Calculate DX .

$DX =$ cm [2]

- (b) Calculate angle BXC .

Angle $BXC =$ [4]

9

NOT TO
SCALE

The diagram shows a prism with a rectangular base, $ABFE$.
 The cross-section, $ABCD$, is a trapezium with $AD = BC$.
 $AB = 8$ cm, $GH = 5$ cm, $BF = 12$ cm and angle $ABC = 70^\circ$.

(a) Calculate the total surface area of the prism.

..... cm^2 [6]

(b) The perpendicular from G onto EF meets EF at X .

(i) Show that $EX = 6.5$ cm.

[1]

(ii) Calculate AX .

$AX = \dots\dots\dots$ cm [2]

(iii) Calculate the angle between the diagonal AG and the base $ABFE$.

$\dots\dots\dots$ [2]

10 $f(x) = x^2 + 1$ $g(x) = 1 - 2x$ $h(x) = \frac{1}{x}, x \neq 0$ $j(x) = 5^x$

(a) Find the value of

(i) $f(3)$,

..... [1]

(ii) $gf(3)$.

..... [1]

(b) Find $g^{-1}(x)$.

$g^{-1}(x) =$ [2]

(c) Find x when $h(x) = 2$.

$x =$ [1]

(d) Find $g(x)g(x) - gg(x)$, giving your answer in the form $ax^2 + bx + c$.

..... [4]

(e) Find $hh(x)$, giving your answer in its simplest form.

..... [1]

(f) Find $j(5)$.

..... [1]

(g) Find x when $j^{-1}(x) = 2$.

$x =$ [1]

(h) $j(x) = hg(-12)$

Find the value of x .

$x =$ [2]

Question 11 is printed on the next page.

11

Sequence	1st term	2nd term	3rd term	4th term	5th term		n th term
A	13	9	5	1			
B	0	7	26	63			
C	$\frac{7}{8}$	$\frac{8}{16}$	$\frac{9}{32}$	$\frac{10}{64}$			

(a) Complete the table for the three sequences.

[10]

(b) One term in Sequence C is $\frac{p}{q}$.

Write down the next term in Sequence C in terms of p and q .

..... [2]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

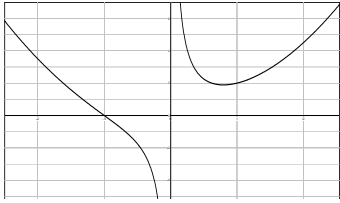
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	9080 cao	3	B2 for 9078 to 9081... or M1 for $813 \times \text{their } 11\text{h } 10\text{min}$
1(b)(i)	654 or 653.5...	2	M1 for $10260 \div 15\text{ h } 42\text{ min}$ oe
1(b)(ii)(a)	21.8 or 21.82 to 21.83	1	
1(b)(ii)(b)	4.58 or 4.59 cao	2	M1 for $470 \div (10260 \div 100)$ oe or $100 \div \text{their } \mathbf{(b)(ii)(a)}$
1(c)	12.97	1	
2(a)	Translation $\begin{pmatrix} 1 \\ -6 \end{pmatrix}$	2	B1 for each
2(b)(i)	Image at (0, 1), (–3, 1), (–3, 2)	2	B1 for reflection in $x = k$ or $y = 1$
2(b)(ii)	Image at (5, –4), (5, –1), (4, –1)	2	B1 for rotation 90° anticlockwise with other centre or for rotation 90° clockwise about (6, 0)
2(b)(iii)	Image at (–1, –2), (–7, –2), (–7, –4)	2	B1 for enlargement, factor –2 with other centre
3(a)(i)	2210 or 2208 or 2208.2, or 2208.16...	2	M1 for $2000 \times \left(1 + \frac{2}{100}\right)^5$ oe
3(a)(ii)	10.4 or 10.5 or 10.40 to 10.41	2	M1 for $\frac{\text{their } \mathbf{(a)(i)} - 2000}{2000} [\times 100]$ or $\frac{\text{their } \mathbf{(a)(i)}}{2000} \times 100$ or $\left(1 + \frac{2}{100}\right)^5 - 1$ or $\left(1 + \frac{2}{100}\right)^5 \times 100$ oe
3(a)(iii)	12	3	B2 for 11.3 or 11.26 to 11.27 OR M2 for $[2000 \times] \left(1 + \frac{2}{100}\right)^{11}$ oe or $[2000 \times] \left(1 + \frac{2}{100}\right)^{12}$ oe seen or M1 for $[2000 \times] \left(1 + \frac{2}{100}\right)^n$ oe, $n > 5$ oe or for $2000 \times \left(1 + \frac{2}{100}\right)^n = \text{or } > \text{or } \geq 2500$ oe

Question	Answer	Marks	Partial Marks
3(b)	490 cao	3	M2 for $p \times \left(1 - \frac{4}{100}\right)^{16} = 255$ oe soi by 490.0... or M1 for $p \times \left(1 - \frac{4}{100}\right)^n = 255$ oe, $n > 1$ oe
4(a)(i)	25	1	
4(a)(ii)	10 nfww	2	B1 for [lq =] 22 or [uq =] 32
4(a)(iii)	27	1	
4(a)(iv)	6	2	B1 for 114 written
4(b)(i)	27.9 or 27.91 to 27.92 nfww	4	M1 for mid-values M1 for $\sum fx$ where x lies within or on boundary of correct interval M1 dep $\sum fx \div 120$ dep on second M1
4(b)(ii)	7.6	2	M1 for $\frac{18}{10}$ oe or $\frac{38}{20}$ oe or B1 for [multiplier] 4 or $\frac{1}{4}$
5(a)	1.48	3	B2 for $7x + 2 = 12.36$ or better or M1 for $3x + 2(2x + 1) [= 12.36]$ or better
5(b)	1.75 or $1\frac{3}{4}$	3	B2 for $18x - 14x = 7$ or better or M1 for $18x = 7(2x + 1)$
5(c)	[0].8 oe	3	B2 for $4(2x + 1) = 13x$ or M1 for $\frac{4}{x} = \frac{13}{2x+1}$ oe or correct equation to find number of cakes

Question	Answer	Marks	Partial Marks
5(d)	$\frac{20}{x} + \frac{10}{2x+1} = 45$ oe	M2	B1 for $\frac{20}{x}$ seen or $\frac{10}{2x+1}$ seen
	$90x^2 - 5x - 20 [= 0]$ oe	B2	B1 for $\frac{20(2x+1)+10x}{x(2x+1)} = 45$ or better
	$(9x+4)(2x-1) [= 0]$ or for $\frac{- -1 \pm \sqrt{(-1)^2 - 4(18)(-4)}}{2(18)}$ oe	M2	FT <i>their</i> 3-term quadratic M1 for factors that give two correct terms when expanded or for correct discriminant or correct $\frac{-b}{2a}$ provided quadratic formula is in correct form
	$[0].5$ or $\frac{1}{2}$ final answer	B1	
6(a)(i)	$\frac{1}{3}$ oe	1	
6(a)(ii)	0	1	
6(a)(iii)	$\frac{1}{6}$ oe	1	
6(b)(i)	$\frac{1}{15}$ oe	2	M1 for $\frac{2}{6} \times \frac{1}{5}$ or equivalent method
6(b)(ii)	$\frac{4}{15}$ oe	3	M2 for $\frac{2}{6} \times \frac{1}{5} + \frac{3}{6} \times \frac{2}{5}$ or equivalent method or M1 for $\frac{2}{6} \times \frac{1}{5}$ oe seen or $\frac{3}{6} \times \frac{2}{5}$ oe seen
6(c)	$\frac{7}{18}$ oe	3	M2 for $\left(\frac{1}{6}\right)^2 + \left(\frac{2}{6}\right)^2 + \left(\frac{3}{6}\right)^2$ oe or M1 for one correct product seen or sample space with 14 correct pairs identified
7(a)	2, 4.5	2	B1 for each
7(b)	Correct graph 	4	B3 FT for 6 or 7 correct points FT <i>their</i> table or B2 FT for 4 or 5 correct points FT <i>their</i> table or B1 FT for 2 or 3 correct points FT <i>their</i> table

Question	Answer	Marks	Partial Marks
7(c)(i)	−0.5 to −0.4	1	
7(c)(ii)	$y = 1 - x$ ruled and −1.9 to −1.75	2	M1 for $[y =] 1 - x$ or $\left[x^2 + \frac{1}{x} =\right] 1 - x$ soi or B1 for −1.9 to −1.75
7(d)	Any integer ≥ 2	1	
8(a)	$[v =] 40$ $[w =] 80$ $[x =] 40$ $[y =] 100$ $[z =] 60$	5	B1 for each FT angle z as $140 - \text{their } w$
8(b)	24	3	M2 for $360 - 11x = 2 \times 2x$ oe or M1 for $360 - 11x$ seen or obtuse angle $KOL = 2 \times 2x$ oe
8(c)(i)	angle $ADX = \text{angle } BCX$ oe same segment oe angle $DAX = \text{angle } CBX$ oe same segment oe angle $AXD = BXC$ oe [vertically] opposite oe	M2	Accept in any order M1 for one correct pair with reason If 0 scored, SC1 for two correct pairs of equal angles identified with incorrect/no reasons
	corresponding angles are equal oe	A1	
8(c)(ii)(a)	8.75 or $8\frac{3}{4}$	2	M1 for $\frac{8}{10} = \frac{7}{DX}$ oe
8(c)(ii)(b)	81.8 or 81.78 to 81.79	4	M2 for $[\cos[BXC] =] \frac{5^2 + 7^2 - 8^2}{2 \times 5 \times 7}$ oe or M1 for $8^2 = 5^2 + 7^2 - 2 \times 5 \times 7 \times \cos(\dots)$ oe A1 for $\frac{10}{70}$ oe

Question	Answer	Marks	Partial Marks
9(a)	315 or 314.5 to 315.0	6	M1 for $\tan 70 = \frac{\text{height}}{\frac{1}{2}(8-5)}$ oe or better seen M1dep for $\frac{1}{2}(8+5) \times \text{their height}$ or better seen dep on trig attempt for height M2 for $12 \times \frac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen or M1 for $\frac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen M1 for 8×12 oe isw and 5×12 oe isw
9(b)(i)	$8 - \frac{1}{2}(8-5)$ or $5 + \frac{1}{2}(8-5)$	M1	
9(b)(ii)	13.6 or 13.64 to 13.65	2	M1 for $12^2 + (6.5)^2$ oe
9(b)(iii)	16.8 or 16.9 or 16.79 to 16.91... nfw	2	M1 for identifying angle GAX from a diagram or from working or better
10(a)(i)	10	1	
10(a)(ii)	-19	1	FT 1 – 2 <i>their (a)(i)</i>
10(b)	$\frac{1-x}{2}$ oe final answer	2	M1 for $x = 1 - 2y$ or $y + 2x = 1$ or $\frac{y}{2} = \frac{1}{2} - x$ or $y - 1 = -2x$ or better
10(c)	$\frac{1}{2}$ oe	1	
10(d)	$4x^2 - 8x + 2$ final answer	4	M1 for $(1-2x)(1-2x) - (1-2(1-2x))$ or better B1 for $1 - 2x - 2x + 4x^2$ B1 for $-(1-2+4x)$ or better or $[+]$ $1 - 4x$ or for correct answer seen then spoiled
10(e)	x final answer	1	
10(f)	3125	1	
10(g)	25	1	
10(h)	-2	2	B1 for $\frac{1}{25}$ or 0.04
11(a)	A : -3 $17 - 4n$ oe	3	B1 for -3 B2 for $17 - 4n$ oe or B1 for $k - 4n$ oe or $17 - pn$ oe, $p \neq 0$

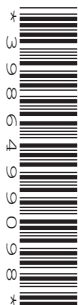
Question	Answer	Marks	Partial Marks
	B : 124 $n^3 - 1$ oe	3	B1 for 124 B2 for $n^3 - 1$ oe or B1 for any cubic
	C : $\frac{11}{128}$ $\frac{n+6}{2^{n+2}}$ oe	4	B1 for $\frac{11}{128}$ B3 for $\frac{n+6}{2^{n+2}}$ oe or B2 for 2^{n+2} oe seen or B1 for 2^k oe or $n + 6$ seen
11(b)	$\frac{p+1}{2q}$ oe	2	B1 for $p + 1$ or $2q$ oe



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**MATHEMATICS****0580/43**

Paper 4 (Extended)

October/November 2020**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

- 1 (a) The Earth has a surface area of approximately $510\,100\,000\text{ km}^2$.
- (i) Write this surface area in standard form.

..... km^2 [1]

- (ii) Water covers 70.8% of the Earth’s surface.
- Work out the area of the Earth’s surface covered by water.

..... km^2 [2]

- (b) The table shows the surface area of some countries and their estimated population in 2017.

Country	Surface area (km^2)	Estimated population in 2017
Brunei	5.77×10^3	433 100
China	9.60×10^6	1 388 000 000
France	6.41×10^5	67 000 000
Maldives	3.00×10^2	374 600

- (i) Find the total surface area of Brunei and the Maldives.

..... km^2 [1]

- (ii) The ratio surface area of the Maldives : surface area of China
can be written in the form $1 : n$.

Find the value of n .

$n =$ [2]

- (iii) Find the surface area of France as a percentage of the surface area of China.

..... % [2]

- (iv) Find the population density of the Maldives.
[Population density = population $\div$ surface area]

.....people/km² [2]

- (c) The population of the Earth in 2017 was estimated to be 7.53×10^9 .

The population of the Earth in 2000 was estimated to be 6.02×10^9 .

- (i) Work out the percentage increase in the Earth's estimated population from 2000 to 2017.

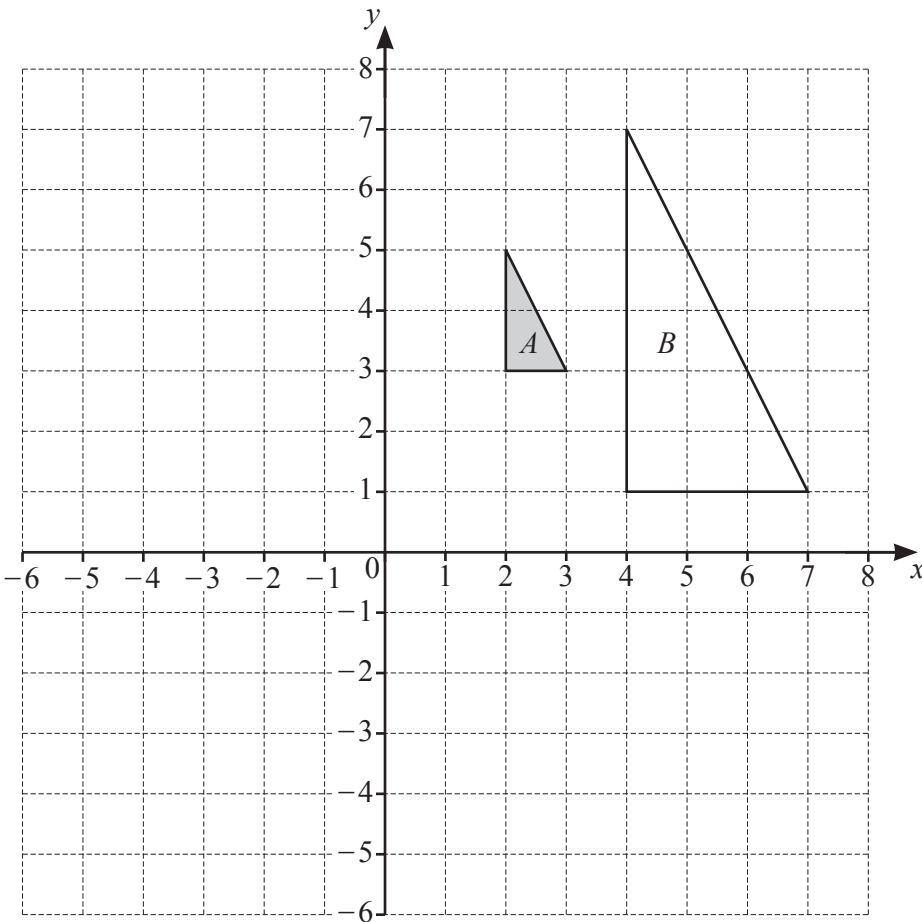
..... % [2]

- (ii) Assume that the population of the Earth increased exponentially by $y\%$ each year for these 17 years.

Find the value of y .

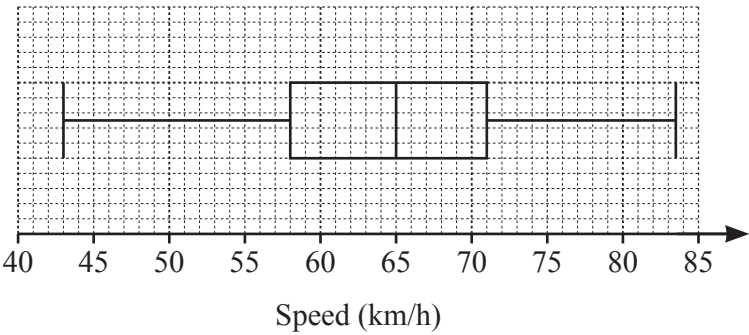
$y =$ [3]

2



- (a) On the grid, draw the image of
- (i) triangle A after a rotation of 90° anticlockwise about $(0, 0)$, [2]
 - (ii) triangle A after a translation by the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$. [2]
- (b) Describe fully the **single** transformation that maps triangle A onto triangle B .
-
- [3]

- 3 (a) The average speeds, in km/h, of cars travelling along a road are recorded. The box-and-whisker plot shows this information.



Find

- (i) the lowest speed recorded,

..... km/h [1]

- (ii) the median,

..... km/h [1]

- (iii) the interquartile range.

..... km/h [1]

- (b) Another car takes 18 seconds to travel 400 m along this road.

Calculate the average speed of this car in km/h.

..... km/h [3]

4



Morgan picks two of these letters, at random, **without** replacement.

(a) Find the probability that he picks

(i) the letter Y first,

..... [1]

(ii) the letter B then the letter Y,

..... [2]

(iii) two letters that are the same.

..... [3]

(b) Morgan now picks a third letter at random.

Find the probability that

(i) all three letters are the same,

..... [2]

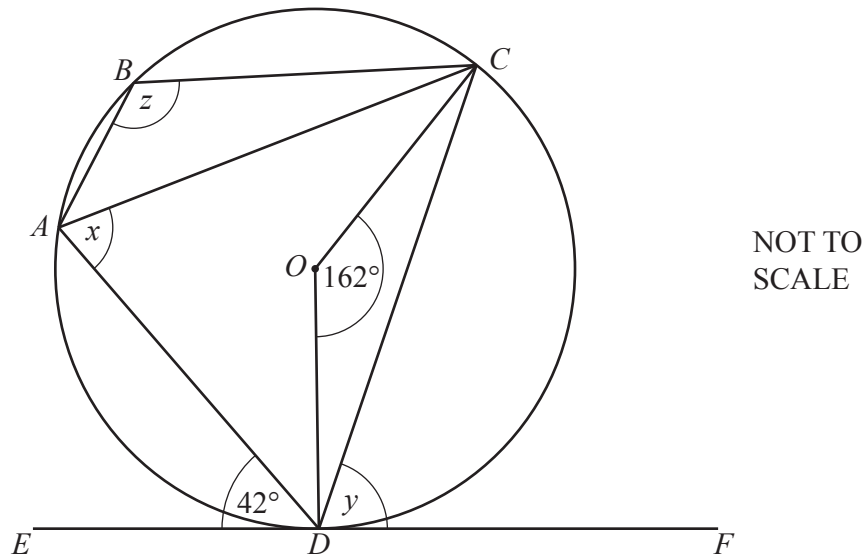
(ii) exactly two of the three letters are the same,

..... [5]

(iii) all three letters are different.

..... [2]

5 (a)



A, B, C and D are points on the circle, centre O .

EF is a tangent to the circle at D .

Angle $ADE = 42^\circ$ and angle $COD = 162^\circ$.

Find the following angles, giving reasons for each of your answers.

(i) Angle x

$x = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$ [2]

(ii) Angle y

$y = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$ [2]

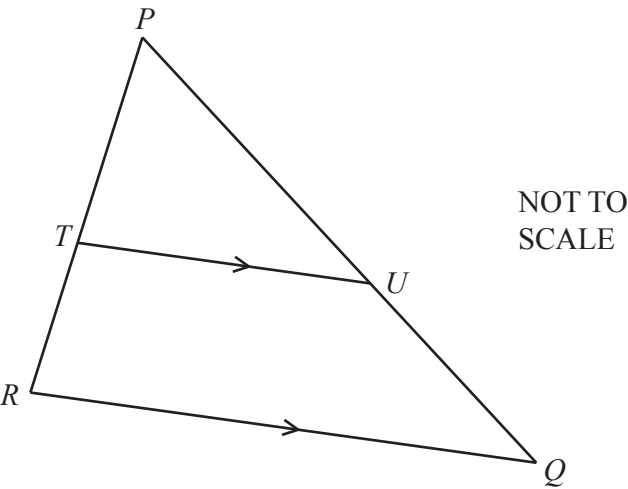
(iii) Angle z

$z = \dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$

$\dots\dots\dots$ [3]

(b)



PQR is a triangle.
 T is a point on PR and U is a point on PQ .
 RQ is parallel to TU .

- (i) Explain why triangle PQR is similar to triangle PUT .
Give a reason for each statement you make.

.....
.....
.....
..... [3]

- (ii) $PT : TR = 4 : 3$

- (a) Find the ratio $PU : PQ$.

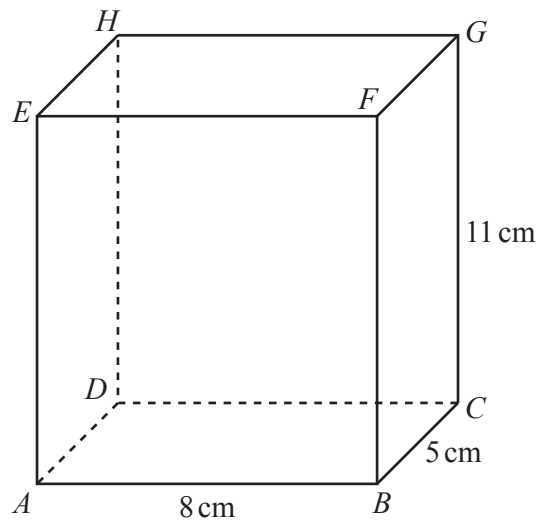
..... : [1]

- (b) The area of triangle PUT is 20 cm^2 .

Find the area of the quadrilateral $QRTU$.

..... cm^2 [3]

6



NOT TO
SCALE

ABCDEFGH is a cuboid.
AB = 8 cm, *BC* = 5 cm and *CG* = 11 cm.

(a) Work out the volume of the cuboid.

..... cm³ [2]

(b) Ivana has a pencil of length 13 cm.

Does this pencil fit completely inside the cuboid?
Show how you decide.

[4]

(c) (i) Calculate angle CAB .

Angle $CAB = \dots\dots\dots$ [2]

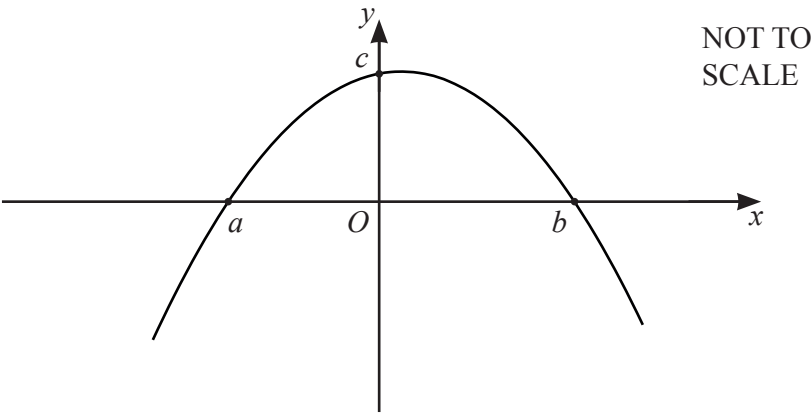
(ii) Calculate angle GAC .

Angle $GAC = \dots\dots\dots$ [2]

7 (a) (i) Factorise $24 + 5x - x^2$.

..... [2]

(ii) The diagram shows a sketch of $y = 24 + 5x - x^2$.



Work out the values of a , b and c .

$a =$

$b =$

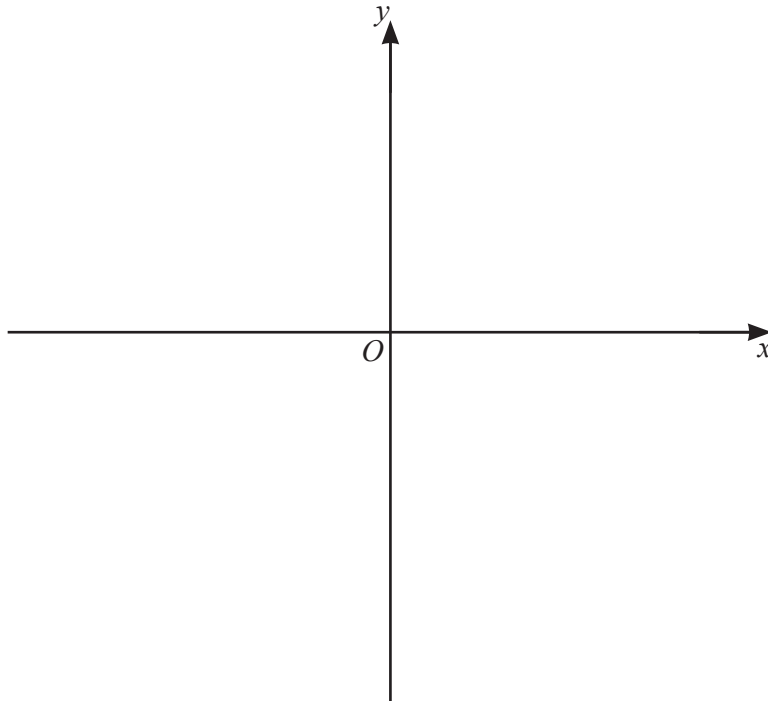
$c =$ [3]

(iii) Calculate the gradient of $y = 24 + 5x - x^2$ at $x = -1.5$.

..... [3]

13

- (b) (i) On the diagram, sketch the graph of $y = (x+1)(x-3)^2$.
Label the values where the graph meets the x -axis and the y -axis.



[4]

- (ii) Write $(x+1)(x-3)^2$ in the form $ax^3 + bx^2 + cx + d$.

..... [3]

14

8 (a) $\overrightarrow{AB} = \begin{pmatrix} 6 \\ -1 \end{pmatrix} \quad \overrightarrow{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix} \quad \overrightarrow{DC} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Find

(i) $\overrightarrow{AC}$,

$$\overrightarrow{AC} = \begin{pmatrix} \\ \end{pmatrix} \quad [2]$$

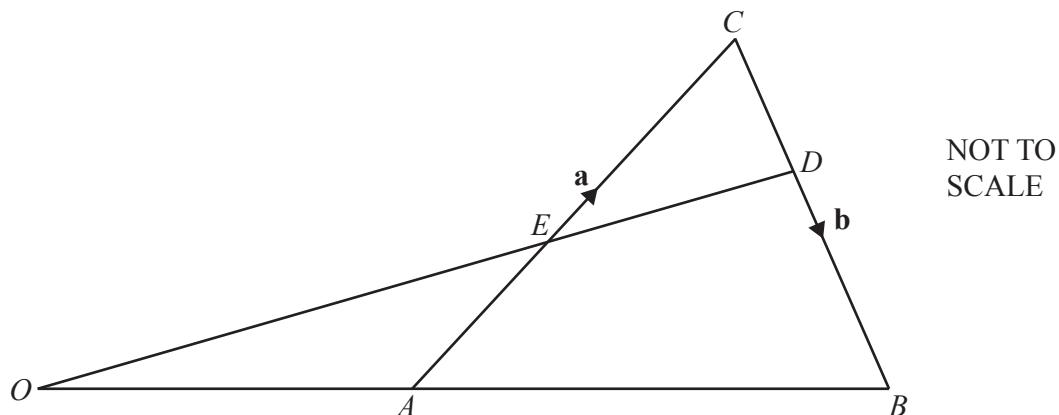
(ii) $\overrightarrow{BD}$,

$$\overrightarrow{BD} = \begin{pmatrix} \\ \end{pmatrix} \quad [2]$$

(iii) $|\overrightarrow{BC}|$.

..... [2]

(b)



In the diagram, OAB and OED are straight lines.
 O is the origin, A is the midpoint of OB and E is the midpoint of AC .
 $\vec{AC} = \mathbf{a}$ and $\vec{CB} = \mathbf{b}$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

(i) $\vec{AB}$,

$$\vec{AB} = \dots\dots\dots [1]$$

(ii) $\vec{OE}$,

$$\vec{OE} = \dots\dots\dots [2]$$

(iii) the position vector of D .

$$\dots\dots\dots [3]$$

- 9 (a) Find the integer values that satisfy the inequality $2 < 2x \leq 10$.

..... [2]

- (b) Factorise completely.

(i) $6y^2 - 15xy$

..... [2]

(ii) $y^2 - 9x^2$

..... [2]

- (c) Simplify.

$$\frac{3}{x-1} - \frac{2}{2x+1}$$

..... [3]

- (d) The straight line $y = 3x + 2$ intersects the curve $y = 2x^2 + 7x - 11$ at two points.

Find the coordinates of these two points.

Give your answers correct to 2 decimal places.

(..... , ...)

(..... , ...) [6]

18

10 $f(x) = 4 - 3x$ $g(x) = x^2 + x$ $h(x) = 3^x$

(a) Find $fh(2)$.

..... [2]

(b) Find $f^{-1}(x)$.

$f^{-1}(x) =$ [2]

(c) Simplify.

(i) $f(1 - 2x)$

..... [2]

(ii) $gf(x) - 9g(x)$

..... [4]

(d) $\frac{1}{h(x)} = 9^{kx}$

Find the value of k .

$k =$ [2]

11 The table shows the first four terms in sequences A , B , and C .

Sequence	1st term	2nd term	3rd term	4th term	5th term		n th term
A	4	9	14	19			
B	3	10	29	66			
C	1	4	16	64			

Complete the table.

[9]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

October/November 2020

MARK SCHEME

Maximum Mark: 130

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **9** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	$5.101[00\dots] \times 10^8$ final answer	1	
1(a)(ii)	361 150 800 oe	2	FT <i>their (a)(i)</i> M1 for $\frac{70.8}{100} \times 510\,100\,000$ or for $\frac{70.8}{100} \times \text{their (a)(i)}$
1(b)(i)	6070 oe	1	
1(b)(ii)	32 000 oe	2	B1 for figs 32
1(b)(iii)	6.68 or 6.677 ...	2	M1 for $\frac{6.41 \times 10^5}{9.6[0] \times 10^6} [\times 100]$ oe
1(b)(iv)	1250 or 1248 to 1249 oe	2	B1 for figs 125 or figs 1248 to figs 1249
1(c)(i)	25.1 or 25.08...	2	M1 for $\frac{7.53[\times 10^9] - 6.02[\times 10^9]}{6.02[\times 10^9]}$ oe or $\frac{7.53[\times 10^9]}{6.02[\times 10^9]} \times 100$
1(c)(ii)	1.33 or 1.325...	3	M2 for $\sqrt[17]{\frac{7.53[\times 10^9]}{6.02[\times 10^9]}}$ or $\sqrt[17]{1 + \frac{\text{their (c)(i)}}{100}}$ or M1 for $6.02[\times 10^9] \times p^{17} = 7.53[\times 10^9]$ or $p^{17} = 1 + \frac{\text{their (c)(i)}}{100}$
2(a)(i)	Triangle at (–3, 2) (–3, 3) (–5, 2)	2	B1 for correct rotation about incorrect point or for rotation 90 clockwise around (0, 0)
2(a)(ii)	Triangle at (5, –2) (6, –2) (5, 0)	2	B1 for translation by $\begin{pmatrix} 3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$
2(b)	Enlargement [SF] 3 [Centre] (1, 4)	3	B1 for each
3(a)(i)	43	1	
3(a)(ii)	65	1	
3(a)(iii)	13	1	

Question	Answer	Marks	Partial Marks
3(b)	80	3	M2 for $\frac{400}{18} \times \frac{60 \times 60}{1000}$ oe Or M1 for $\frac{400}{18}$ or for <i>their</i> speed in m/s $\times \frac{60 \times 60}{1000}$ or for $\frac{400}{1000}$ and $\frac{18}{60 \times 60}$ soi
4(a)(i)	$\frac{1}{11}$ oe	1	
4(a)(ii)	$\frac{1}{110}$ oe	2	M1 for $\frac{1}{11} \times \frac{1}{10}$ oe
4(a)(iii)	$\frac{4}{55}$ oe	3	M2 for $\left(\frac{2}{11} \times \frac{1}{10}\right) + \left(\frac{3}{11} \times \frac{2}{10}\right)$ oe or M1 for $\left(\frac{2}{11} \times \frac{1}{10}\right)$ or $\left(\frac{3}{11} \times \frac{2}{10}\right)$ seen oe
4(b)(i)	$\frac{1}{165}$ oe	2	M1 for $\frac{3}{11} \times \frac{2}{10} \times \frac{1}{9}$ oe
4(b)(ii)	$\frac{1}{5}$ oe	5	M4 for $3\left(\frac{2}{11} \times \frac{1}{10} \times \left[\frac{9}{9}\right]\right) + 3\left(\frac{3}{11} \times \frac{2}{10} \times \frac{8}{9}\right)$ oe or M3 for $3\left(\frac{3}{11} \times \frac{2}{10} \times \frac{8}{9}\right)$ or M2 for $3\left(\frac{2}{11} \times \frac{1}{10} \times \left[\frac{9}{9}\right]\right)$ or $\frac{3}{11} \times \frac{2}{10} \times \frac{8}{9}$ oe or M1 for $\frac{2}{11} \times \frac{1}{10} \times \left[\frac{k}{9}\right]$ where k is 3, 6 or 9
4(b)(iii)	$\frac{131}{165}$ oe	2	M1 for $1 - (\text{their (b)(i)} + \text{their (b)(ii)})$ oe
5(a)(i)	81° <u>Angle at centre is twice angle at circumference</u> oe	2	B1 for 81°
5(a)(ii)	81° Alternate segment [theorem] oe	2	FT <i>their (a)(i)</i> B1FT for 81°

Question	Answer	Marks	Partial Marks
5(a)(iii)	123° <u>Angles</u> on a straight <u>line</u> [= 180] Opposite angles in a <u>cyclic quadrilateral</u> are supplementary oe	3	FT <i>their</i> acute (a)(ii) + 42 B1 for each element
5(b)(i)	Angle PTU = angle PRQ corresponding Angle PUT = angle PQR corresponding Angle RPQ is common oe	M2	Accept in any order M1 for one correct pair with reason If 0 scored, SC1 for two correct pairs of equal angles identified with incorrect/no reasons
	Corresponding angles are equal oe	A1	
5(b)(ii)(a)	4 : 7 oe	1	
5(b)(ii)(b)	41.25 oe	3	M2 for $20 \times \left(\frac{7}{4}\right)^2$ oe or $20 \times \frac{7^2 - 4^2}{4^2}$ oe or M1 for $\left(\frac{7}{4}\right)^2$ or $\left(\frac{4}{7}\right)^2$ or $\frac{7^2 - 4^2}{4^2}$ or $\frac{4^2}{7^2 - 4^2}$
6(a)	440	2	M1 for $8 \times 5 \times 11$
6(b)	$\sqrt{8^2 + 5^2 + 11^2}$ oe or $8^2 + 5^2 + 11^2$ and 13^2 <u>ALTERNATIVE</u> $\sqrt{8^2 + 11^2}$ or $8^2 + 11^2$ and 13^2	M3	M2 for $8^2 + 5^2 + 11^2$ or $8^2 + 11^2$ oe or M1 for $8^2 + 5^2$ or $5^2 + 11^2$ oe
	Yes and 14.5 or 14.4 or 14.49... or Yes and 13.6[0...]	A1	Accept equivalent conclusion
6(c)(i)	32.0[...]	2	M1 for $\tan[.] = \frac{5}{8}$ oe
6(c)(ii)	49.4 or 49.38 to 49.39	2	M1 for $\sin[.] = \frac{11}{\text{their } AG}$ oe
7(a)(i)	$(8 - x)(3 + x)$	2	M1 for $8(3 + x) - x(3 + x)$ or $3(8 - x) + x(8 - x)$ or $(a - x)(b + x)$ where $ab = 24$ or $a - b = 5$

Question	Answer	Marks	Partial Marks
7(a)(ii)	$[a =] -3$ $[b =] 8$ $[c =] 24$	3	FT their (a)(i) for a and b B1FT for each of a and b or both correct but reversed B1 for $[c =] 24$
7(a)(iii)	8	3	M2 for $5 - 2x$ or M1 for $-2x$ or $5 - kx$, $k \neq 0$
7(b)(i)	Correct sketch: positive cubic shape and max on the y -axis or to the right of y -axis with one root at $(-1, 0)$ and turning point at $(3, 0)$ and y -intercept at $(0, 9)$ all labelled	4	B1 for positive cubic shape with max on the y -axis or to the right of y -axis B1 for root at $(-1, 0)$ B1 for turning point at $(3, 0)$ B1 for y -intercept $(0, 9)$ If 0 score SC1 for all three intercepts on axes identified
7(b)(ii)	$x^3 - 5x^2 + 3x + 9$ final answer	3	B2 for correct expansion of three brackets unsimplified B1 for correct expansion of two brackets with at least 3 terms correct
8(a)(i)	$\begin{pmatrix} 4 \\ 4 \end{pmatrix}$	2	B1 for $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$
8(a)(ii)	$\begin{pmatrix} -4 \\ 8 \end{pmatrix}$	2	B1 for $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 8 \end{pmatrix}$
8(a)(iii)	5.39 or 5.385..	2	M1 for $(-2)^2 + 5^2$ oe
8(b)(i)	$\mathbf{a} + \mathbf{b}$	1	
8(b)(ii)	$\frac{3}{2}\mathbf{a} + \mathbf{b}$	2	M1 for a correct route, e.g. $\overrightarrow{OA} + \overrightarrow{AE}$
8(b)(iii)	$2\mathbf{a} + \frac{4}{3}\mathbf{b}$	3	M2 for unsimplified $\overrightarrow{OD}$ or for $\frac{4}{3}\mathbf{b}$ or M1 for $\overrightarrow{OD}$ attempted in terms of $\mathbf{a}$ and $\mathbf{b}$ or for $\overrightarrow{CD} = \frac{1}{3}\mathbf{b}$ or $\overrightarrow{DB} = \frac{2}{3}\mathbf{b}$ seen
9(a)	2, 3, 4, 5	2	B1 for 3 correct and no extra or 4 correct and one extra or M1 for $1 < x \leq 5$
9(b)(i)	$3y(2y - 5x)$	2	B1 for $3(2y^2 - 5xy)$ or $y(6y - 15x)$ or for the correct answer seen and then spoiled

Question	Answer	Marks	Partial Marks
9(b)(ii)	$(y - 3x)(y + 3x)$	2	B1 for $(y + 3)(y - 3)$
9(c)	$\frac{4x + 5}{(x - 1)(2x + 1)}$ or $\frac{4x + 5}{2x^2 - x - 1}$ final answer	3	M1 for $3(2x + 1) - 2(x - 1)$ oe isw M1 for $(x - 1)(2x + 1)$ oe isw
9(d)	$(1.74, 7.21 \text{ to } 7.24)$ and $(-3.74, -9.20 \text{ to } -9.22)$ cao	6	For the y values accept any value rounded to 2 decimal places in the given range B5 for $(1.74, 7.21 \text{ to } 7.24)$ or $(-3.74, -9.20 \text{ to } -9.22)$ or $x = 1.74$ and $x = -3.74$ OR M2 for $2x^2 + 4x - 13 = 0$ or $2y^2 + 4y - 133 = 0$ or M1 for $2x^2 + 7x - 11 = 3x + 2$ or $y = 2\left(\frac{y-2}{3}\right)^2 + 7\left(\frac{y-2}{3}\right) - 11$ AND FT <i>their</i> quadratic expression (not $2x^2 + 7x - 11$) M2FT for $\frac{-4 \pm \sqrt{4^2 - 4 \times 2 \times -13}}{2 \times 2}$ or $-1 \pm \sqrt{\frac{15}{2}}$ oe or M1FT for $\sqrt{4^2 - 4 \times 2 \times -13}$ oe or for $\frac{-4 + \sqrt{k}}{2 \times 2}$ or $\frac{-4 - \sqrt{k}}{2 \times 2}$ or $(x + 1)^2 [-13/2 - 1 = 0]$
10(a)	-23	2	M1 for $4 - 3(3^x)$ oe soi
10(b)	$\frac{4 - x}{3}$ oe final answer	2	M1 for $x = 4 - 3y$ or $y + 3x = 4$ or $x + 3y = 4$ or $\frac{y}{-3} = \frac{4}{-3} + x$ oe or $\frac{x}{-3} = \frac{4}{-3} + y$ oe
10(c)(i)	$1 + 6x$ final answer	2	M1 for $4 - 3(1 - 2x)$

Question	Answer	Marks	Partial Marks
10(c)(ii)	$20 - 36x$ or $4(5 - 9x)$ final answer	4	B3 for $20 - 36x$ seen in working then spoiled OR M1 for $(4 - 3x)^2 + 4 - 3x - 9(x^2 + x)$ or better B1 for $[(4 - 3x)^2 =] 16 - 12x - 12x + 9x^2$ or better B1 for answer $20 - kx$ or $k - 36x$ oe or answer $20 - 36x + kx^2$ $k \neq 0$
10(d)	$-\frac{1}{2}$ oe	2	M1 for $(3^2)^{kx}$ or $9^{kx} = 9^{-\frac{1}{2}x}$ oe
11A	24	B1	
	$5n - 1$ oe	B2	B1 for $5n - k$ or $jn - 1$ oe $j \neq 0$
11B	127	B1	
	$n^3 + 2$ oe	B2	B1 for n^3 oe
11C	256	B1	
	$4^{(n-1)}$ oe	B2	B1 for 4^k oe



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MATHEMATICS**0580/21**

Paper 2 (Extended)

May/June 2020**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

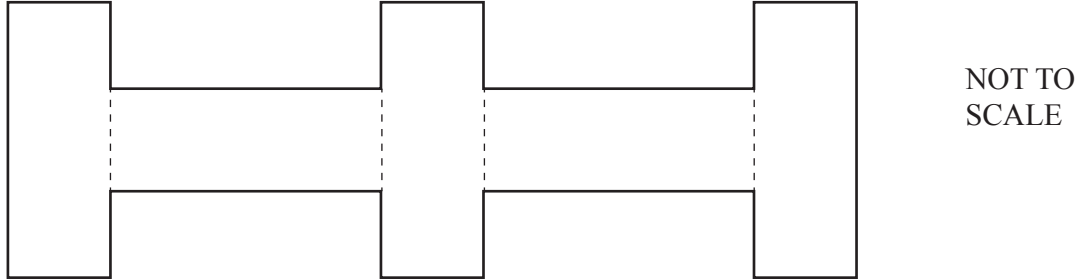
- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Blank pages are indicated.

- 1 Rectangle A measures 3 cm by 8 cm.



Five rectangles congruent to A are joined to make a shape.



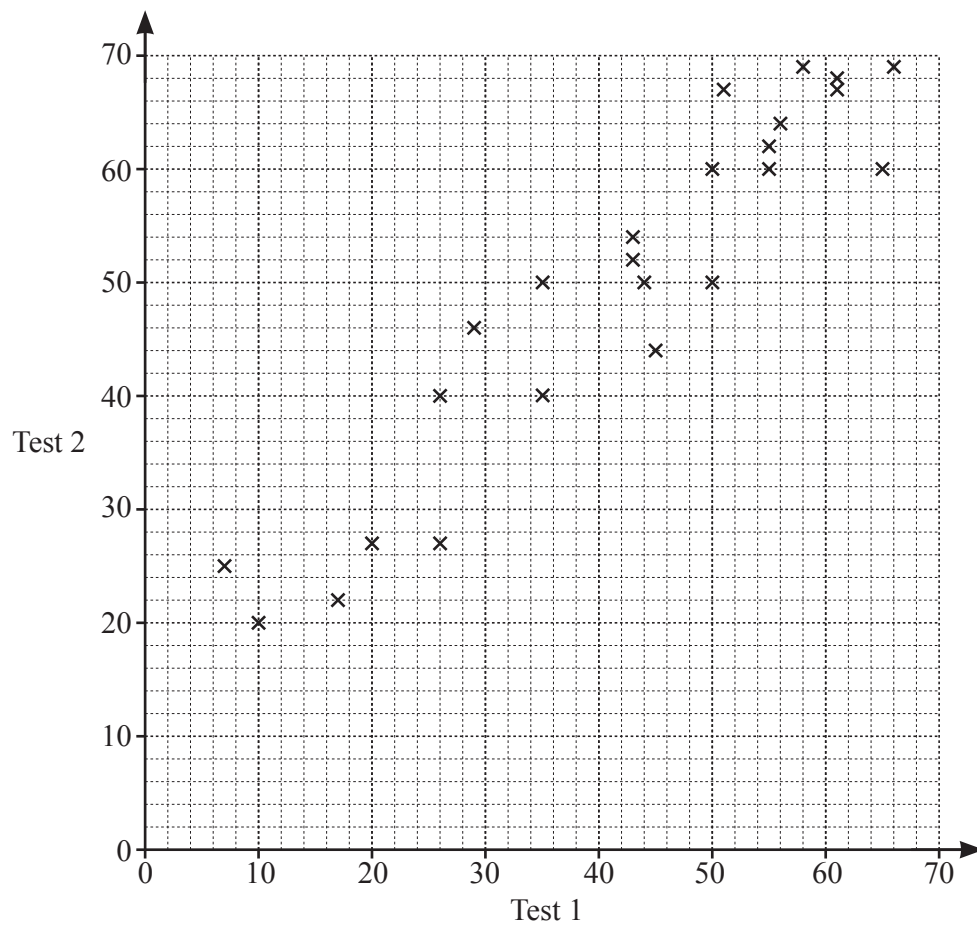
Work out the perimeter of this shape.

..... cm [2]

- 2 Find the highest **odd** number that is a factor of 60 and a factor of 90.

..... [1]

- 3 Mrs Salaman gives her class two mathematics tests.
The scatter diagram shows information about the marks each student scored.



- (a) Write down the highest mark scored on test 1. [1]
- (b) Write down the type of correlation shown in the scatter diagram. [1]
- (c) Draw a line of best fit on the scatter diagram. [1]
- (d) Hamish scored a mark of 40 on test 1.
He was absent for test 2.

Use your line of best fit to find an estimate for his mark on test 2.

..... [1]

- 4 A bag contains blue, red, yellow and green balls only.
A ball is taken from the bag at random.
The table shows some information about the probabilities.

Colour	Blue	Red	Yellow	Green
Probability	0.15	0.2		0.43

- (a) Complete the table.

[2]

- (b) Abdul takes a ball at random and replaces it in the bag.
He does this 200 times.

Find how many times he expects to take a red ball.

..... [1]

- 5 (a) The n th term of a sequence is $60 - 8n$.

Find the largest number in this sequence.

..... [1]

- (b) Here are the first five terms of a different sequence.

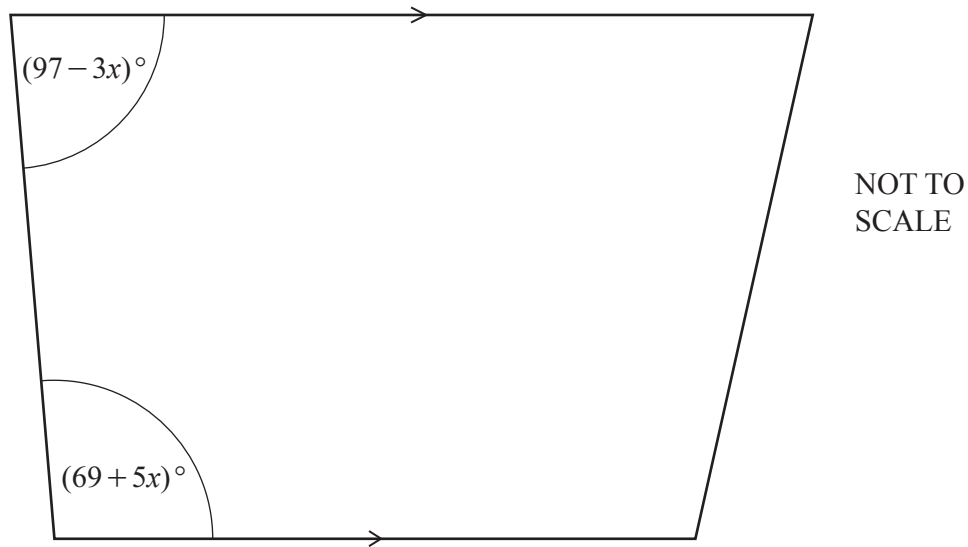
12 19 26 33 40

Find an expression for the n th term of this sequence.

..... [2]

5

- 6 The diagram shows a trapezium.



Work out the value of x .

$x = \dots\dots\dots$ [3]

- 7 $234 = 2 \times 3^2 \times 13$ $1872 = 2^4 \times 3^2 \times 13$ $234 \times 1872 = 438\,048$

Use this information to write 438 048 as a product of its prime factors.

$\dots\dots\dots$ [1]

- 8 Without using a calculator, work out $\left(2\frac{1}{3} - \frac{7}{8}\right) \times \frac{6}{25}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [4]

- 9 Factorise completely.

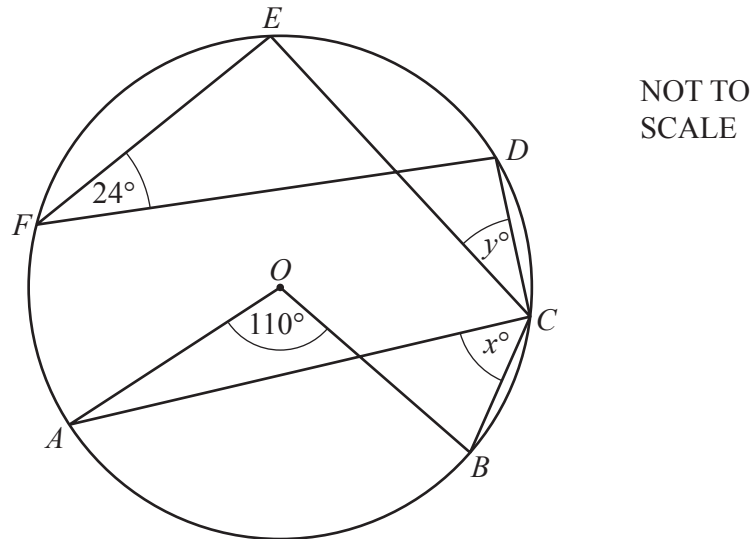
(a) $21a^2 + 28ab$

..... [2]

(b) $20x^2 - 45y^2$

..... [3]

10



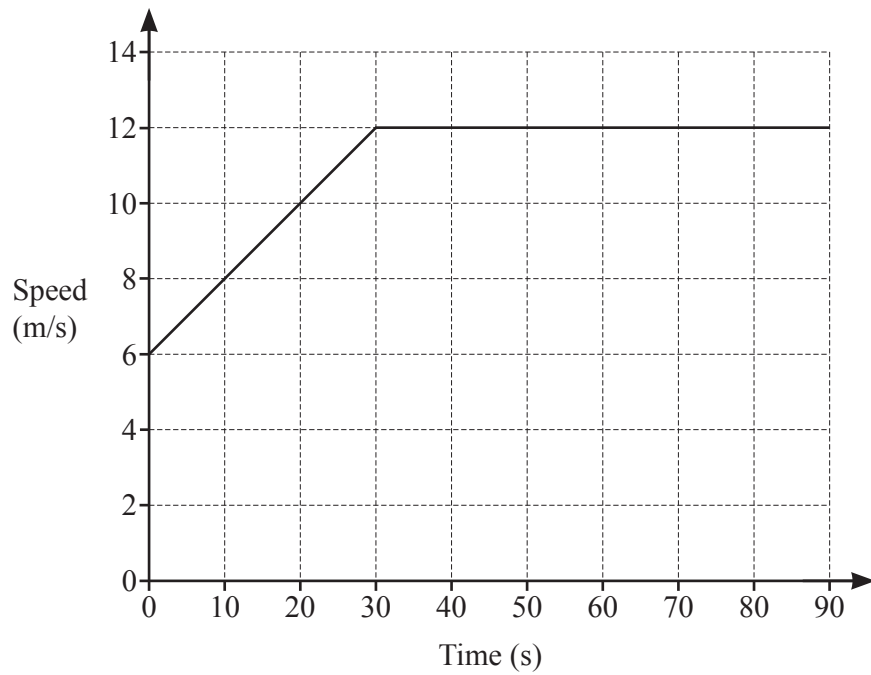
Points A , B , C , D , E and F lie on the circle, centre O .

Find the value of x and the value of y .

$x =$

$y =$ [2]

11

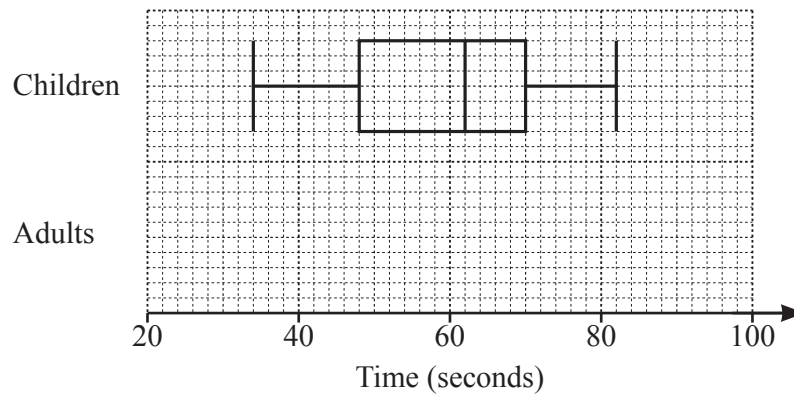


The diagram shows the speed–time graph for 90 seconds of a journey.

Calculate the total distance travelled during the 90 seconds.

..... m [3]

- 12 Gemma records the times, in seconds, taken for a group of children and a group of adults to complete a puzzle.
The box-and-whisker plot shows information about the times taken for the children to complete the puzzle.



- (a) Find the interquartile range of the times taken for the children to complete the puzzle.

..... seconds [2]

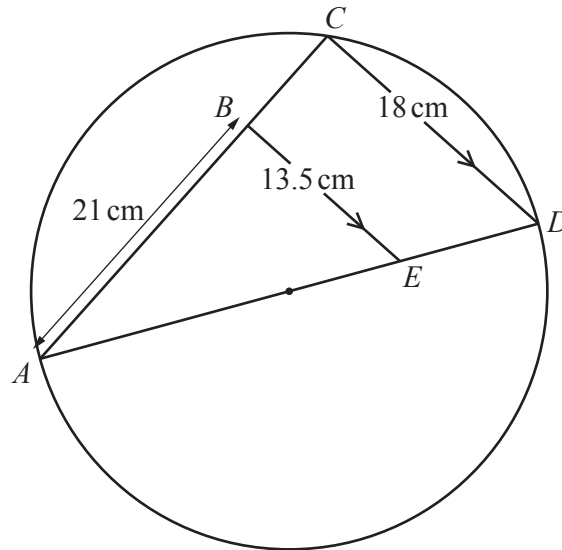
- (b) The table shows some information about the times, in seconds, taken for the adults to complete the puzzle.

Minimum	Lower quartile	Median	Upper quartile	Maximum
28	42	58	70	75

On the grid above, draw the box-and-whisker plot for the adults.

[2]

13



NOT TO
SCALE

C lies on a circle with diameter AD .
 B lies on AC and E lies on AD such that BE is parallel to CD .
 $AB = 21$ cm, $CD = 18$ cm and $BE = 13.5$ cm.

Work out the radius of the circle.

..... cm [5]

11

14 (a) $f(x) = 4x + 3$ $g(x) = 5x - 4$

$$fg(x) = 20x + p$$

Find the value of p .

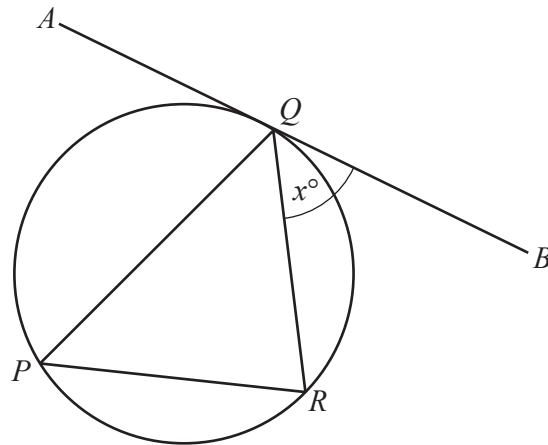
$$p = \dots\dots\dots [2]$$

(b) $h(x) = \frac{5x-1}{3}$

Find $h^{-1}(x)$.

$$h^{-1}(x) = \dots\dots\dots [3]$$

15



NOT TO
SCALE

P , R and Q are points on the circle.
 AB is a tangent to the circle at Q .
 QR bisects angle PQB .
 Angle $BQR = x^\circ$ and $x < 60$.

Use this information to show that triangle PQR is an isosceles triangle.
 Give a geometrical reason for each step of your work.

[3]

- 16 m is inversely proportional to the square of $(p - 1)$.
 When $p = 4$, $m = 5$.

Find m when $p = 6$.

$m = \dots\dots\dots$ [3]

17 (a) (i) $\mathbf{m} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

Find $3\mathbf{m}$.

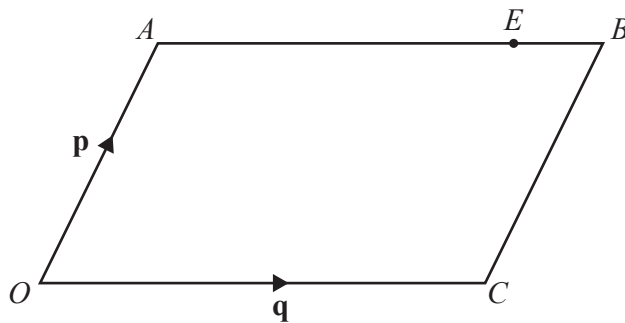
$$\begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

(ii) $\overrightarrow{VW} = \begin{pmatrix} 10 \\ -24 \end{pmatrix}$

Find $|\overrightarrow{VW}|$.

..... [2]

(b)



NOT TO
SCALE

$OACB$ is a parallelogram.

$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.

E is the point on AB such that $AE : EB = 3 : 1$.

Find $\overrightarrow{OE}$, in terms of $\mathbf{p}$ and $\mathbf{q}$, in its simplest form.

$$\overrightarrow{OE} = \text{.....} \quad [2]$$

18 $P = 2(w + h)$

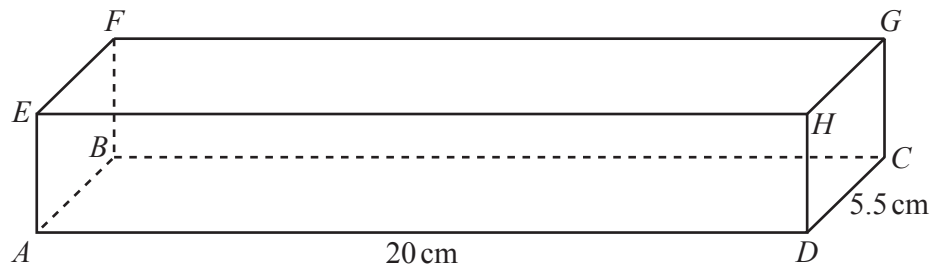
$w = 12$ correct to the nearest whole number.

$h = 4$ correct to the nearest whole number.

Work out the upper bound for the value of P .

..... [2]

19



NOT TO
SCALE

The diagram shows cuboid $ABCDEFGH$ of length 20 cm and width 5.5 cm.
The volume of the cuboid is 495 cm^3 .

Find the angle between the line AG and the base of the cuboid $ABCD$.

..... [5]

- 20** The curve $y = x^2 - 2x + 1$ is drawn on a grid.
 A line is drawn on the same grid.
 The points of intersection of the line and the curve are used to solve the equation $x^2 - 7x + 5 = 0$.
 Find the equation of the line in the form $y = mx + c$.

$y = \dots\dots\dots$ [1]

- 21** Expand and simplify $(x + 3)(x - 5)(3x - 1)$.

$\dots\dots\dots$ [3]

Question 22 is printed on the next page.

22 Find the area of a regular hexagon with side length 7.4 cm.

..... cm^2 [3]

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Cambridge IGCSE™

MATHEMATICS

0580/21

Paper 2 (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 70

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of 7 printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles

1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.

2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1	86	2	M1 for correct method to find the perimeter e.g. $(8 + 3) \times 2 \times 5 - 3 \times 8$ If 0 scored, SC1 for answer 98
2	15	1	
3(a)	66	1	
3(b)	Positive	1	
3(c)	Ruled line of best fit	1	
3(d)	46 to 50	1	FT <i>their</i> line of best fit if a positive gradient
4(a)	0.22 oe	2	M1 for $0.15 + 0.2 + ? + 0.43 = 1$ or better
4(b)	40	1	
5(a)	52	1	
5(b)	$7n + 5$ oe final answer	2	B1 for $7n + a$ or $bn + 5$ $b \neq 0$
6	7	3	M2 for $166 + 2x = 180$ or better or M1 for $97 - 3x + 69 + 5x = 180$ oe
7	$2^5 \times 3^4 \times 13^2$	1	
8	$\frac{56}{24} - \frac{21}{24}$	M2	M2 for correct method for common denominator or B1 for $\frac{7}{3}$
	<i>their</i> $\frac{35}{24} \times \frac{6}{25}$	M1	
	$\frac{7}{20}$	A1	
9(a)	$7a(3a + 4b)$ final answer	2	B1 for partial factorisation $7(3a^2 + 4ab)$ or $a(21a + 28b)$

Question	Answer	Marks	Partial Marks
9(b)	$5(2x + 3y)(2x - 3y)$ final answer	3	B2 for $(2x + 3y)(2x - 3y)$ or $(10x + 15y)(2x - 3y)$ or $(2x + 3y)(10x - 15y)$ or B1 for $5(4x^2 - 9y^2)$
10	$[x =] 55$ $[y =] 24$	2	B1 for each
11	990	3	M2 for correct complete area statement e.g. $\frac{1}{2} \times 30 \times (6 + 12) + 60 \times 12$ oe or M1 for one area calculation
12(a)	22	2	B1 for 48 and 70
12(b)	Children Adults	2	M1 for a box with two whiskers and at least two correct from Min 28, LQ 42, Med 58, UQ 70, Max 75
13	16.6 or 16.64...	5	M2 for $21 \times \frac{18}{13.5} = [AC]$ oe or M1 for scale factor $\frac{13.5}{18}$ or $\frac{18}{13.5}$ oe soi Then Pythagoras method: and M2 for $\sqrt{28^2 + 18^2} [\div 2]$ or $\sqrt{(theirAC)^2 + 18^2} [\div 2]$ or M1 for $AD^2 = 28^2 + 18^2$ or $AD^2 = (theirAC)^2 + 18^2$ OR alternative trigonometry method e.g. M1 for $\tan E = \frac{21}{13.5}$ and M1 for $AD = \frac{18}{\cos their 57.3}$
14(a)	$[p =] -13$	2	M1 for $4(5x - 4) + 3$ or better
14(b)	$\frac{3x+1}{5}$	3	M2 for $x = \frac{3y+1}{5}$, $5y = 3x + 1$ or $y - \frac{1}{5} = \frac{3x}{5}$ M1 for $x = \frac{5y-1}{3}$, $3y = 5x - 1$ or $y + \frac{1}{3} = \frac{5x}{3}$

Question	Answer	Marks	Partial Marks
15	Complete explanation with geometrical reasons	3	B1 for $RQP = x^\circ$ QR bisects angle PQB B1 for $RPQ = x^\circ$ alternate segment theorem B1 for triangle PQR has two equal angles both less than 60 (so can't be equilateral) so must be isosceles
16	1.8 or $1\frac{4}{5}$	3	M2 for $m = \frac{k}{(p-1)^2}$ or M1 for $m = \frac{their k}{(6-1)^2}$ OR M2 for $5(4-1)^2 = m(6-1)^2$ oe
17(a)(i)	$\begin{pmatrix} 15 \\ 21 \end{pmatrix}$	1	
17(a)(ii)	26	2	M1 for $10^2 + (-24)^2$ or better
17(b)	$\mathbf{p} + \frac{3}{4} \mathbf{q}$	2	M1 for a correct route or for $\overrightarrow{AE} = \frac{3}{4} \mathbf{q}$
18	34	2	M1 for $12 + 0.5$ or $4 + 0.5$ or better seen
19	12.2 or 12.24...	5	M4 for $\tan = \frac{4.5}{\sqrt{20^2 + 5.5^2}}$ oe or M1 for recognising angle GAC M1 for $\frac{495}{20 \times 5.5}$ M1 for $\sqrt{20^2 + 5.5^2}$ or $\sqrt{20^2 + 5.5^2 + (their 4.5)^2}$ M1 for $\tan = \frac{their 4.5}{\sqrt{20^2 + 5.5^2}}$ oe
20	$[y =] 5x - 4$	1	
21	$3x^3 - 7x^2 - 43x + 15$	3	B2 for correct expansion and simplification of two of the brackets or B1 for correct expansion of two brackets with at least 3 terms correct

Question	Answer	Marks	Partial Marks
22	142 or 142.2 to 142.3	3	M2 for $\frac{1}{2} \times 7.4 \times 7.4 \times \sin 60 \times 6$ or $\tan 60 \times \frac{7.4}{2} \times \frac{7.4}{2} \times 6$ or M1 for $\frac{1}{2} \times 7.4 \times 7.4 \times \sin 60$ or $\tan 60 \times \frac{7.4}{2}$



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NUMBER

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NUMBER

MATHEMATICS**0580/22**

Paper 2 (Extended)

May/June 2020**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

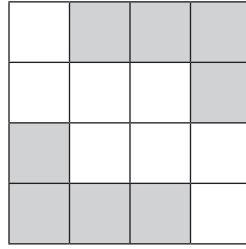
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

1



Write down the order of rotational symmetry of the diagram.

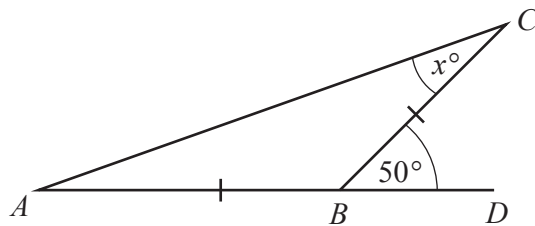
..... [1]

- 2 At noon the temperature in Maseru was 21°C .
At midnight the temperature had fallen by 26°C .

Work out the temperature at midnight.

..... $^{\circ}\text{C}$ [1]

3



NOT TO
SCALE

$AB = BC$ and ABD is a straight line.

Find the value of x .

$x =$ [2]

- 4 Write down

(a) a square number greater than 10,

..... [1]

(b) an irrational number.

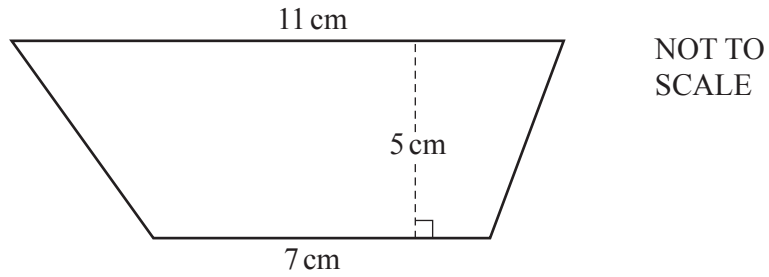
..... [1]

5 $y = mx + c$

Find the value of y when $m = -3$, $x = -2$ and $c = -8$.

$y = \dots\dots\dots$ [2]

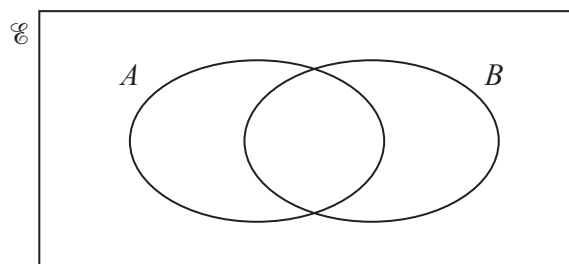
6



Calculate the area of the trapezium.

$\dots\dots\dots \text{cm}^2$ [2]

7

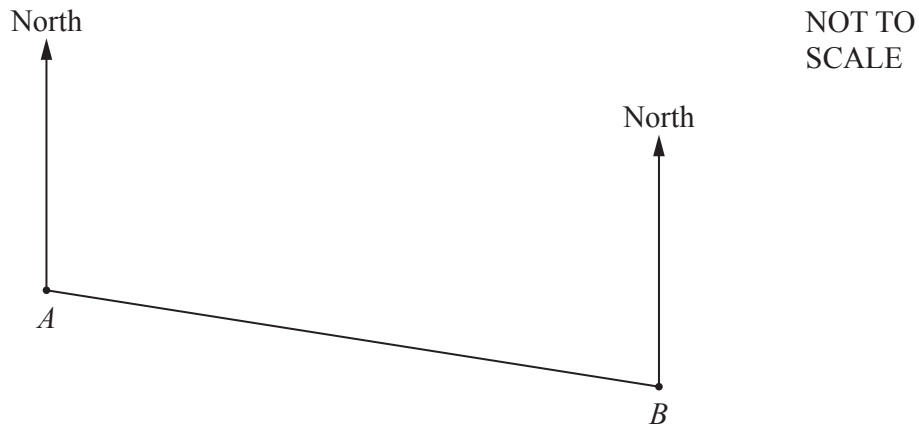


On the Venn diagram, shade the region $A \cap B$. [1]

8 Write 2^{-4} as a decimal.

$\dots\dots\dots$ [1]

9



The bearing of B from A is 105° .

Find the bearing of A from B .

..... [2]

10 Simplify.

$$\frac{p}{2q} \times \frac{4pq}{t}$$

..... [2]

11 **Without using a calculator**, work out $1\frac{3}{4} - \frac{11}{12}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

- 12 Roberto buys a toy for \$5.00 .
He then sells it for \$4.60 .

Calculate his percentage loss.

..... % [2]

- 13 Simplify $8t^8 \div 4t^4$.

..... [2]

- 14 Solve the equation.

$$\frac{1-x}{3} = 5$$

$x =$ [2]

- 15 Ella's height is 175 cm, correct to the nearest 5 cm.

Write down the upper bound of Ella's height.

..... cm [1]

- 16 Calculate $(3 \times 10^{-3})^3$.

Give your answer in standard form.

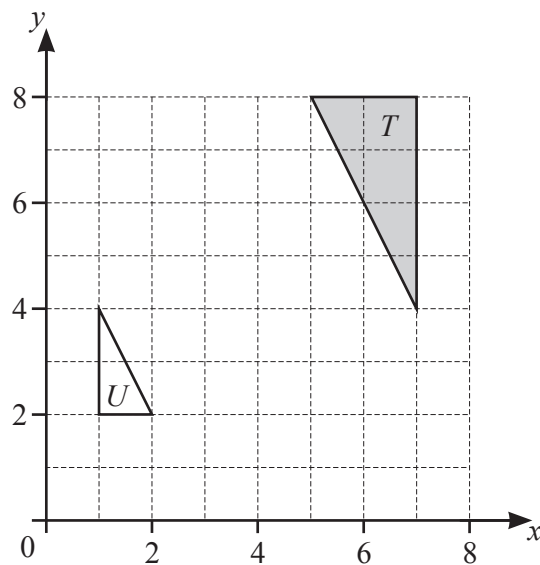
..... [1]

- 17 A train of length 105 m takes 11 seconds to pass completely through a station of length 225 m.

Calculate the speed of the train in km/h.

..... km/h [3]

18



Describe fully the **single** transformation that maps triangle *T* onto triangle *U*.

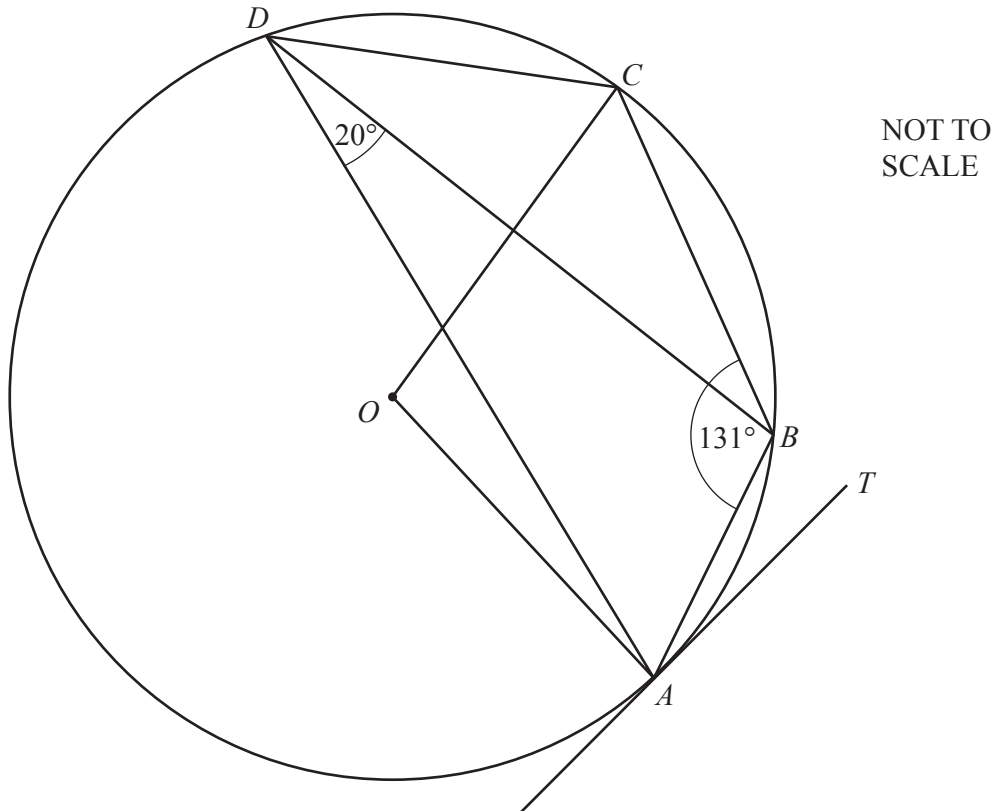
.....
 [3]

- 19 Make *y* the subject of the formula.

$$h^2 = x^2 + 2y^2$$

$y =$ [3]

20



A, B, C and D lie on the circle, centre O .
 TA is a tangent to the circle at A .
 Angle $ABC = 131^\circ$ and angle $ADB = 20^\circ$.

Find

(a) angle ADC ,

Angle $ADC = \dots\dots\dots$ [1]

(b) angle AOC ,

Angle $AOC = \dots\dots\dots$ [1]

(c) angle BAT ,

Angle $BAT = \dots\dots\dots$ [1]

(d) angle OAB .

Angle $OAB = \dots\dots\dots$ [1]

21 Simplify.

(a) $(5x^4)^3$

..... [2]

(b) $(256x^{256})^{\frac{3}{8}}$

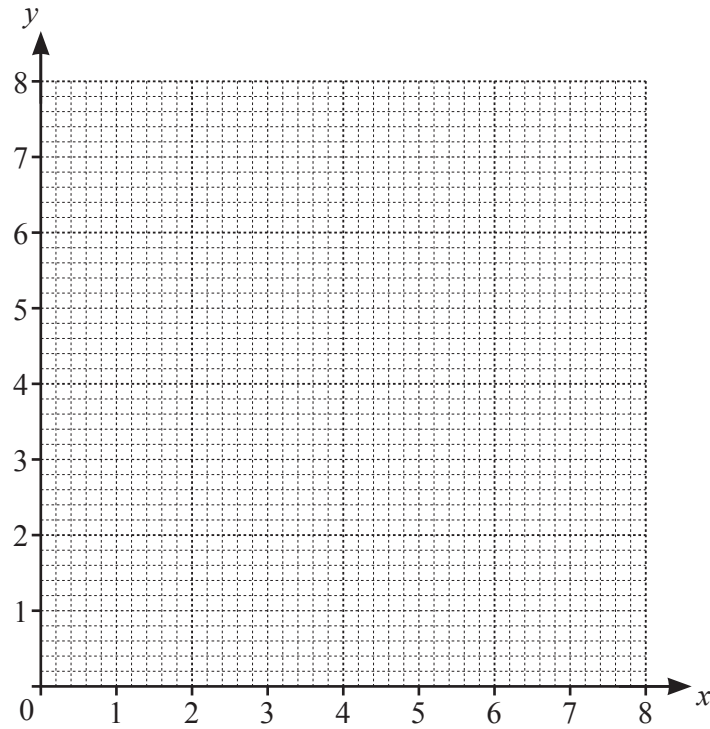
..... [2]

22 p is directly proportional to $(q + 2)^2$.
When $q = 1$, $p = 1$.

Find p when $q = 10$.

$p =$ [3]

23



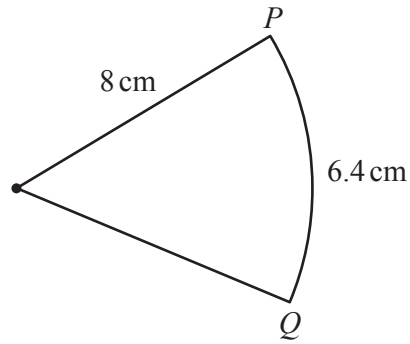
- (a) By drawing suitable lines and shading unwanted regions, find the region, R , where

$$x \geq 2, \quad y \geq x \quad \text{and} \quad 2x + y \leq 8. \quad [5]$$

- (b) Find the largest value of $x + y$ in the region R .

..... [1]

24



NOT TO
SCALE

The diagram shows a sector of a circle of radius 8 cm.
The length of the arc PQ is 6.4 cm.

Find the area of the sector.

..... cm^2 [4]

25 Simplify.

$$\frac{2x^2 + x - 15}{ax + 3a - 2bx - 6b}$$

..... [5]

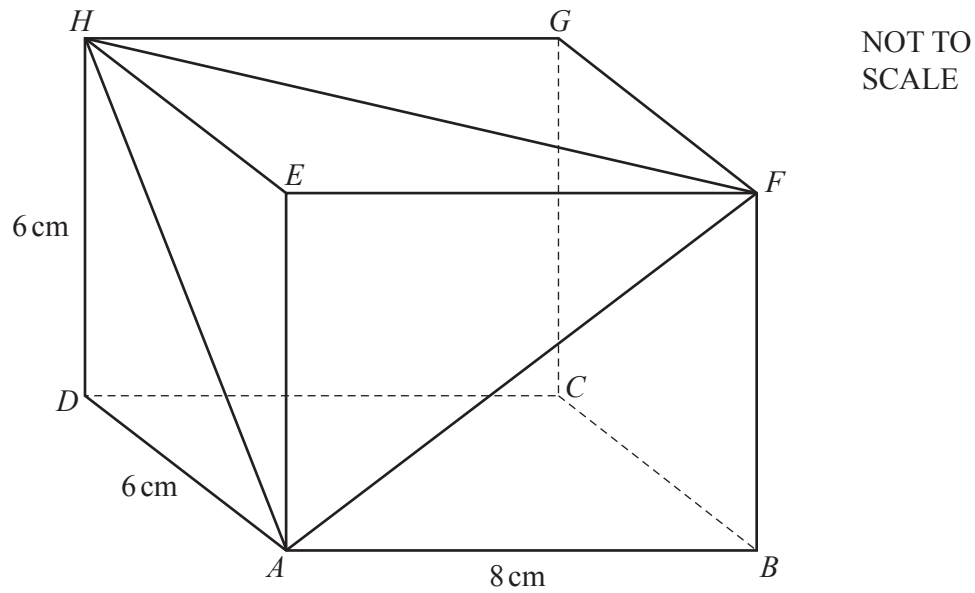
26 $\sqrt[3]{y^2} = \sqrt[n]{x}$ and $y = \sqrt[n]{x}$.

Find the value of n .

$n =$ [2]

Question 27 is printed on the next page.

27



The diagram shows a cuboid.
 $AB = 8\text{ cm}$, $AD = 6\text{ cm}$ and $DH = 6\text{ cm}$.

Calculate angle HAF .

Angle $HAF = \dots\dots\dots$ [6]

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MATHEMATICS

0580/22

Paper 2 (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 70

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

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This document consists of **6** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer		Marks	Partial Marks
1	2		1	
2	−5		1	
3	25		2	B1 for 130 seen or M1 for $50 \div 2$
4(a)	Any square number greater than 10		1	
4(b)	Any irrational number		1	
5	−2		2	M1 for $(-3)(-2) + (-8)$
6	45		2	M1 for $\frac{11+7}{2} \times 5$ oe
7	Intersection shaded		1	
8	0.0625		1	
9	285		2	M1 for $180 + 105$ or 75 or 105 seen in correct position at <i>B</i>
10	$\frac{2p^2}{t}$		2	B1 for correct unsimplified answer
11	$\frac{7}{4}$	$\frac{9}{12}$	B1	
	$\frac{21}{12}$	$1 - \frac{2}{12}$	M1	
	$\frac{5}{6}$	$\frac{5}{6}$	A1	
12	8		2	M1 for $\frac{5-4.60}{5} [\times 100]$ or $\frac{4.60}{5} \times 100$
13	$2t^4$		2	B1 for $2t^n$ or kt^4 ($n, k \neq 0$)

Question	Answer	Marks	Partial Marks
14	-14	2	M1 for $1 - x = 3 \times 5$ or better or $\frac{x}{3} = 5 - \frac{1}{3}$ or better
15	177.5	1	
16	2.7×10^{-8}	1	
17	108	3	M1 for $(105 + 225) \div 11$ M1 for <i>their</i> speed $\times \frac{60 \times 60}{1000}$
18	Enlargement [scale factor] $-\frac{1}{2}$ [centre] (3, 4)	3	B1 for each
19	$[\pm] \sqrt{\frac{h^2 - x^2}{2}}$	3	M1 for correct rearrangement for y or y^2 term M1 for correct square root M1 for correct division by 2 or $\sqrt{2}$
20(a)	49	1	
20(b)	98	1	FT $2 \times \text{their (a)}$
20(c)	20	1	
20(d)	70	1	FT $90 - \text{their (c)}$
21(a)	$125x^{12}$	2	B1 for $125x^k$ or kx^{12}
21(b)	$8x^{96}$	2	B1 for $8x^k$ or kx^{96}
22	16	3	M1 for $p = k(q + 2)^2$ M1 for $p = (\text{their } k)(10 + 2)^2$ OR M2 for $\frac{p}{(10 + 2)^2} = \frac{1}{(1 + 2)^2}$ oe
23(a)	Correct lines and correct region clear 	5	B2 for $2x + y = 8$ correctly ruled or B1 for ruled line with negative gradient B1 for $y = x$ correctly ruled B1 for $x = 2$ correctly ruled
23(b)	6	1	

Question	Answer	Marks	Partial Marks
24	25.6 or 25.59 to 25.60...	4	M3 for $\frac{6.4}{2 \times \pi \times 8} \times \pi \times 8^2$ or M2 for $\frac{x}{360} = \frac{6.4}{2 \times \pi \times 8}$ oe or M1 for $\frac{x}{360} \times 2 \times \pi \times 8 = 6.4$ oe
25	$\frac{2x-5}{a-2b}$ final answer	5	B2 for $(2x-5)(x+3)$ or B1 for $(2x+p)(x+q)$ where $pq = -15$ or $p+2q = 1$ B2 for $(x+3)(a-2b)$ or B1 for $x(a-2b) + 3(a-2b)$ or $a(x+3) - 2b(x+3)$
26	4	2	M1 for $y^{\frac{2}{3}} = x^{\frac{1}{6}}$ or $y^2 = \sqrt{x}$ or $y^4 = x$
27	64.9 or 64.89 to 64.90	6	B5 for $[\cos =] \frac{100+72-100}{2 \times 10 \times \sqrt{72}}$ OR M1 for $8^2 + 6^2$ M1 for $6^2 + 6^2$ M2 for $\frac{(theirAF)^2 + (theirAH)^2 - (theirHF)^2}{2 \times (theirAF) \times (theirAH)}$ or M1 for $(theirHF)^2 = (theirAF)^2 + (theirAH)^2 - 2 \times (theirAF) \times (theirAH) \cos(HAF)$ AF, AH etc from correct method



Cambridge IGCSE™

CANDIDATE
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CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/23**

Paper 2 (Extended)

May/June 2020**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

2

1 32 33 34 35 36 37 38 39

From this list of numbers, write down

(a) a multiple of 8,

..... [1]

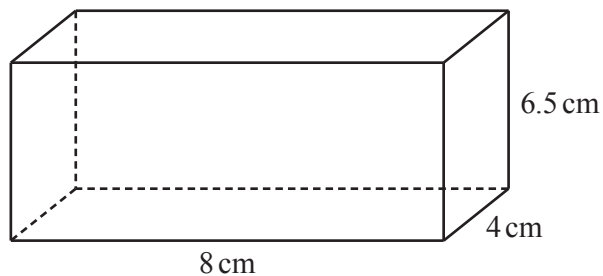
(b) a square number,

..... [1]

(c) a prime number.

..... [1]

2



NOT TO
SCALE

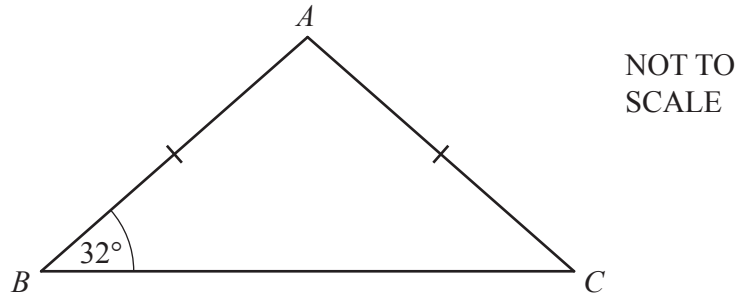
The diagram shows a cuboid.

Calculate the volume of the cuboid.

..... cm^3 [1]

3

3



Triangle ABC is isosceles.
Angle $ABC = 32^\circ$ and $AB = AC$.

Find angle BAC .

Angle $BAC = \dots\dots\dots$ [2]

4 A train journey takes 5 hours 54 minutes.

(a) The journey starts at 09 15.

Find the time that the journey ends.

$\dots\dots\dots$ [1]

(b) The average speed of the train for this journey is 80 km/h.

Calculate the distance travelled.

$\dots\dots\dots$ km [2]

5 Sofia has a bag containing 8 blue beads and 7 red beads only.
She takes one bead out of the bag at random and replaces it.
She does this 90 times.

Find the number of times she expects to take a red bead.

$\dots\dots\dots$ [2]

6 Simplify.

(a) $p^2 \times p^4$

..... [1]

(b) $m^{15} \div m^5$

..... [1]

(c) $(k^3)^5$

..... [1]

7 **Without using a calculator**, work out $3\frac{1}{4} - 2\frac{2}{3}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

8 The bearing of X from Y is 274° .

Calculate the bearing of Y from X .

..... [2]

- 9 Calculate the area of the sector of a circle with radius 65 mm and sector angle 42° .
Give your answer in square centimetres.

..... cm^2 [3]

- 10 A solid cylinder has radius 3 cm and height 4.5 cm.
Calculate the **total** surface area of the cylinder.

..... cm^2 [4]

- 11 y is directly proportional to the cube root of $(x+3)$.
When $x = 5$, $y = \frac{2}{3}$.
Find y when $x = 24$.

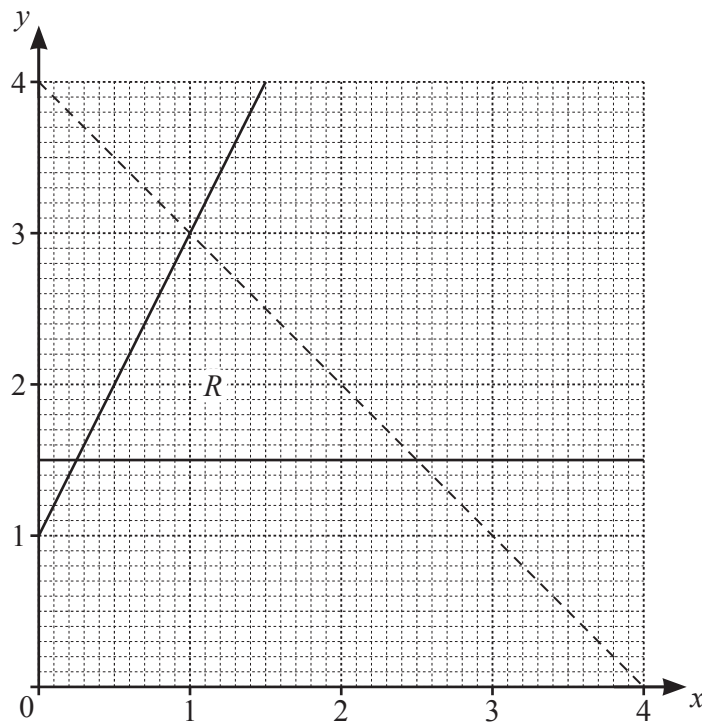
$y =$ [3]

- 12 The total perimeter of a semicircle is 19.02 cm.

Calculate the radius of the semicircle.

..... cm [3]

- 13

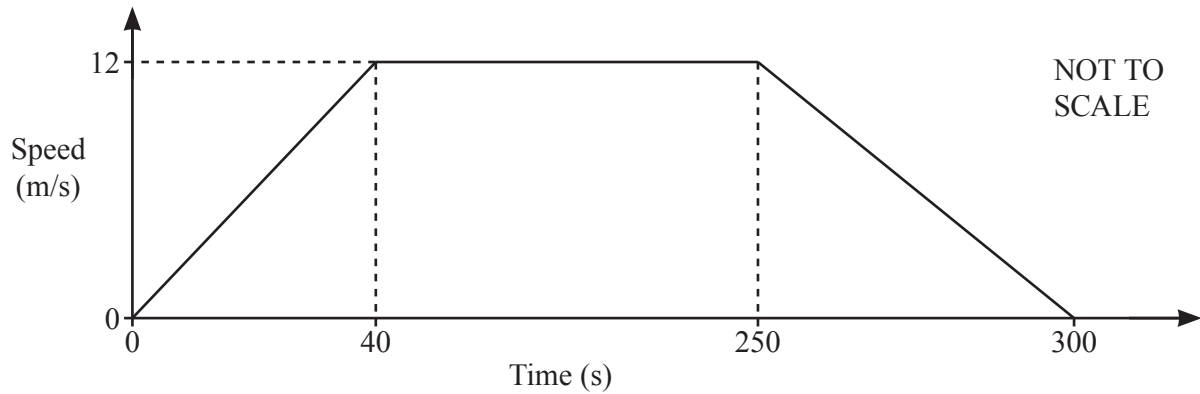


Write down the three inequalities that define the region R .

.....

 [4]

- 14 The diagram shows the speed–time graph of a train journey between two stations.



- (a) Find the acceleration of the train during the first 40 seconds.

..... m/s^2 [1]

- (b) Calculate the distance between the two stations.

..... m [3]

- 15 The table shows the amount of money, \$ x , given to a charity by each of 60 people.

Amount (\$ x)	$0 < x \leq 20$	$20 < x \leq 25$	$25 < x \leq 35$	$35 < x \leq 50$	$50 < x \leq 100$
Frequency	21	16	6	10	7

Calculate an estimate of the mean.

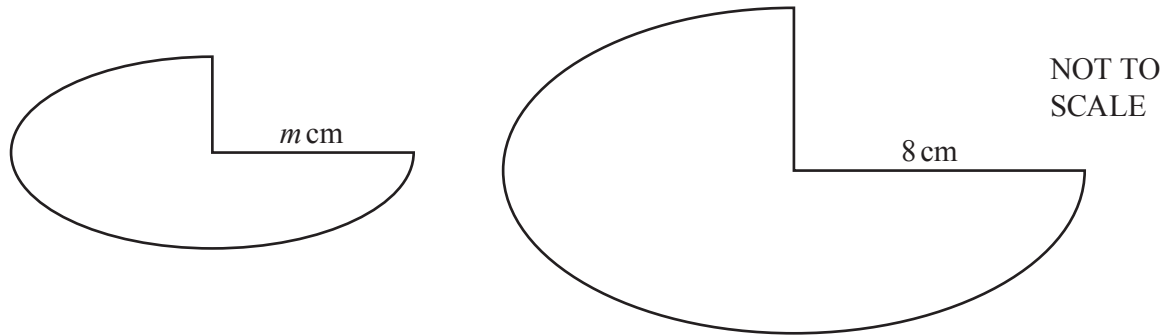
\$ [4]

- 16** Paddy and Anna each invest \$2000 for 5 years.
Paddy earns simple interest at a rate of 1.25% per year.
Anna earns compound interest at a rate of $r\%$ per year.
At the end of 5 years, Paddy's investment is worth the same as Anna's investment.

Calculate the value of r .

$r = \dots\dots\dots$ [5]

17



The diagram shows two shapes that are mathematically similar.
The smaller shape has area 52.5 cm^2 and the larger shape has area 134.4 cm^2 .

Calculate the value of m .

$m = \dots\dots\dots$ [3]

18 (a) Write $x^2 - 18x - 27$ in the form $(x + k)^2 + h$.

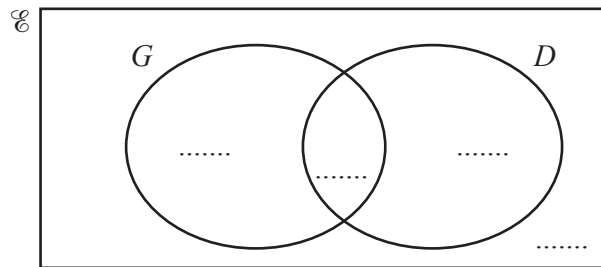
$\dots\dots\dots$ [2]

(b) Use your answer to **part (a)** to solve the equation $x^2 - 18x - 27 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

19 (a) In a class of 40 students:

- 28 wear glasses (G)
- 13 have driving lessons (D)
- 4 do not wear glasses and do not have driving lessons.

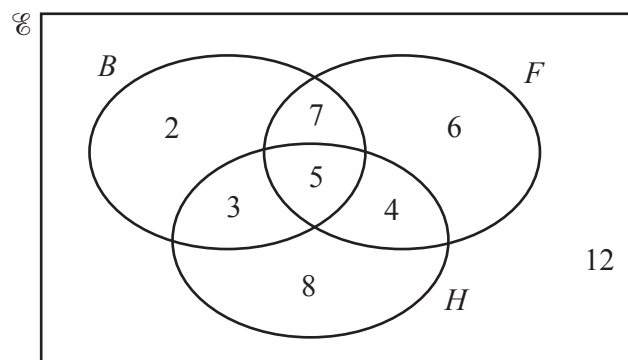


(i) Complete the Venn diagram. [2]

(ii) Use set notation to describe the region that contains a total of 32 students.

..... [1]

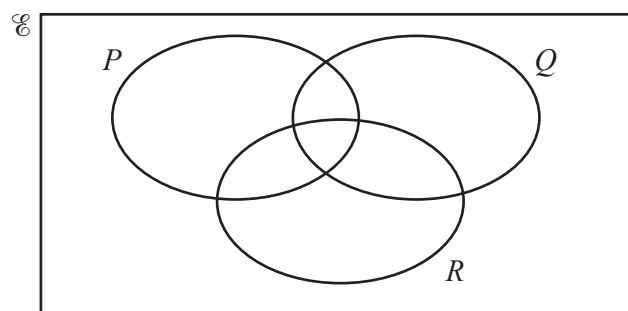
(b) This Venn diagram shows information about the number of students who play basketball (B), football (F) and hockey (H).



Find $n((B \cup F) \cap H')$.

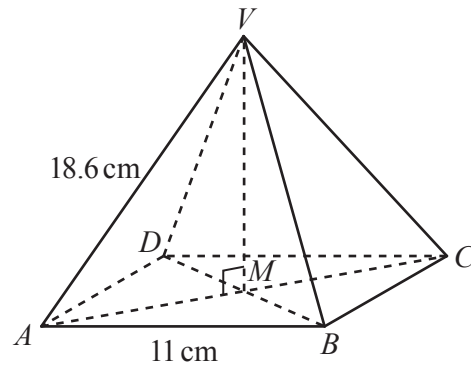
..... [1]

(c)



Shade the region $P \cup (Q \cap R)'$. [1]

20



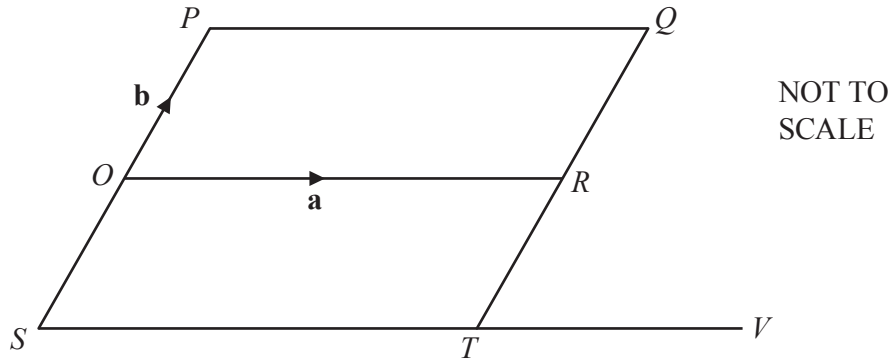
NOT TO
SCALE

The diagram shows a pyramid with a square base $ABCD$.
The diagonals AC and BD intersect at M .
The vertex V is vertically above M .
 $AB = 11$ cm and $AV = 18.6$ cm.

Calculate the angle that AV makes with the base.

..... [4]

Question 21 is printed on the next page.



O is the origin and $OPQR$ is a parallelogram.

SOP is a straight line with $SO = OP$.

TRQ is a straight line with $TR = RQ$.

STV is a straight line and $ST : TV = 2 : 1$.

$\vec{OR} = \mathbf{a}$ and $\vec{OP} = \mathbf{b}$.

(a) Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form,

(i) the position vector of T ,

..... [2]

(ii) $\vec{RV}$.

$\vec{RV} =$ [1]

(b) Show that PT is parallel to RV .

[2]

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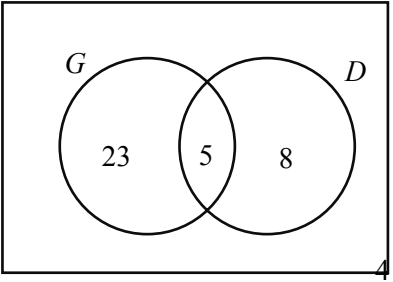
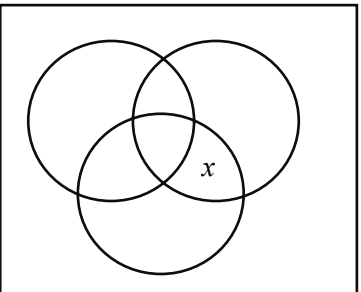
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FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	32	1	
1(b)	36	1	
1(c)	37	1	
2	208	1	
3	116	2	M1 for angle $ACB = 32$ soi
4(a)	15 09	1	Accept 3 09 pm
4(b)	472	2	M1 for $80 \times \text{their time}$ oe or B1 for time = 5.9
5	42	2	M1 for $\frac{7}{15} [\times 90]$
6(a)	p^6	1	
6(b)	m^{10}	1	
6(c)	k^{15}	1	
7	Correct common denominator	M1	
	Correct method	M1	e.g. $1\frac{3-8}{12}$ or $\frac{12+3-8}{12}$ or $\frac{((3 \times 4) + 1) \times 3 - ((2 \times 3) + 2) \times 4}{12}$ or $\frac{39-32}{12}$
	$\frac{7}{12}$ cao	A1	
8	[0]94	2	M1 for 86 or $274 - 180$ or for sketch with 274 marked correctly

Question	Answer	Marks	Partial Marks
9	15.5 or 15.48 to 15.49	3	B2 for 1550 or 1548 to 1549 or M2 for $\frac{42}{360} \times \pi \times 6.5^2$ or M1 for $\frac{42}{360} \times \pi \times 65^2$
10	141 or 141.3 to 141.4	4	M1 for $[2 \times] \pi \times 3^2$ M2 for $2 \times \pi \times 3 \times 4.5$ or M1 for $2 \times \pi \times 3 [\times 4.5]$
11	$[y =] 1$	3	M1 for $y = k \times \sqrt[3]{x+3}$ M1 for $y = \text{their } k \times \sqrt[3]{24+3}$ OR M2 for $\frac{y}{\sqrt[3]{24+3}} = \frac{2}{3} \times \frac{1}{\sqrt[3]{5+3}}$ oe
12	3.7[0] or 3.689 to 3.699...	3	M2 for $\frac{19.02}{2+\pi}$ or M1 for $2r + \pi r [=19.02]$ oe
13	$x + y < 4$ $y \geq 1.5$ $y \leq 2x + 1$	4	B3 for any two correct or B1 for $y \geq 1.5$ B2 for $x + y < 4$ or $y \leq 2x + 1$ or $x + y = 4$ and $y = 2x + 1$ or with incorrect inequality signs or B1 for $x + y = 4$ or $y = 2x + 1$ or SC3 for $>$ instead of $\geq$ etc.
14(a)	0.3 oe	1	
14(b)	3060	3	M2 for $\frac{1}{2}(300+210) \times 12$ oe or M1 for one correct part area
15	28.33 or 28.3 or 28.33...	4	M1 for midpoints soi M1 for use of Σfx M1 dep for $\Sigma fx \div 60$
16	1.22 or 1.219 to 1.22	5	M1 for $SI = \frac{2000 \times 5 \times 1.25}{100}$ M3 for $\sqrt[5]{\frac{2000 + \text{their } 125}{2000}}$ or M2 for $2000k^5 = 2000 + \text{their } SI$ or M1 for $CI = 2000k^5$

Question	Answer	Marks	Partial Marks
17	5	3	M2 for $8 \times \sqrt{\frac{52.5}{134.4}}$ oe or M1 for $\sqrt{\frac{52.5}{134.4}}$ or $\sqrt{\frac{134.4}{52.5}}$ oe
18(a)	$(x-9)^2 - 108$	2	B1 for $(x+h)^2 - 108$ or $(x-9)^2 + h$ or $k = -9$
18(b)	19.4 or 19.39... – 1.39 or – 1.392...	2	M1FT $x - \text{their } 9 = \pm \sqrt{\text{their } 108}$ A1 for $9 \pm \sqrt{108}$ or $9 \pm 6\sqrt{3}$
19(a)(i)		2	B1 for two correct
19(a)(ii)	$G \cup D'$ oe	1	
19(b)	15	1	
19(c)		1	Shade whole rectangle except for region containing x
20	65.3 or 65.28..	4	M3 for $\cos = \frac{\frac{1}{2}\sqrt{11^2 + 11^2}}{18.6}$ or better or M2 for $AM = \frac{1}{2}\sqrt{11^2 + 11^2}$ oe or M1 for $AC^2 = 11^2 + 11^2$ If 0 scored, SC1 for identifying angle VAM

Question	Answer	Marks	Partial Marks
21(a)(i)	$\mathbf{a} - \mathbf{b}$ or $-\mathbf{b} + \mathbf{a}$	2	B1 for a correct route or identifying $\overrightarrow{OT}$
21(a)(ii)	$\frac{1}{2}\mathbf{a} - \mathbf{b}$ or $-\mathbf{b} + \frac{1}{2}\mathbf{a}$	1	
21(b)	$\overrightarrow{PT} = \mathbf{a} - 2\mathbf{b}$ oe	M1	
	$\overrightarrow{PT} = 2\overrightarrow{RV}$ oe	A1	Dep on correct vector RV Accept in words



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MATHEMATICS**0580/41**

Paper 4 (Extended)

May/June 2020**2 hours 30 minutes**

You must answer on the question paper.

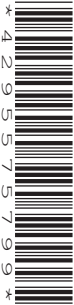
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- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

1 (a) In 2018, Gretal earned \$32 000.

(i) She paid tax of 24% on these earnings.

Work out the amount she paid in tax in 2018.

\$ [2]

(ii) In 2019, Gretal's earnings increased by 7%.

Work out her earnings in 2019.

\$ [2]

(b) Gretal invests \$5000 at a rate of 2% per year compound interest.

Calculate the value of her investment at the end of 3 years.

\$ [2]

(c) One month, Gretal spent a total of \$360 on presents.

She spent $\frac{1}{5}$ of this total on presents for her parents.

She spent $\frac{2}{3}$ of the remaining money on presents for her friends.

She spent the rest of the money on presents for her sisters.

Calculate the percentage of the \$360 that she spent on presents for her sisters.

..... % [4]

- (d) Arjun earned \$36 515 in 2019.
This was an increase of 9% on his earnings in 2018.

Work out his earnings in 2018.

\$ [2]

- (e) Arjun and Gretal each pay rent.

In 2018, the ratio of the amount each paid in rent was Arjun : Gretal = 5 : 7.

In 2019, the ratio of the amount each paid in rent was Arjun : Gretal = 9 : 13.

Arjun paid the same amount of rent in both 2018 and 2019.

Gretal paid \$290 more rent in 2019 than she did in 2018.

Work out the amount Arjun paid in rent in 2019.

\$ [4]

- 2 The heights, h metres, of the 120 boys in an athletics club are recorded.
The table shows information about the heights of the boys.

Height (h metres)	$1.3 < h \leq 1.4$	$1.4 < h \leq 1.5$	$1.5 < h \leq 1.6$	$1.6 < h \leq 1.7$	$1.7 < h \leq 1.8$	$1.8 < h \leq 1.9$
Frequency	7	18	30	24	27	14

- (a) (i) Write down the modal class.

..... $< h \leq$ [1]

- (ii) Calculate an estimate of the mean height.

..... m [4]

- (b) (i) One boy is chosen at random from the club.

Find the probability that this boy has a height greater than 1.8 m.

..... [1]

- (ii) Three boys are chosen at random from the club.

Calculate the probability that one of the boys has a height greater than 1.8 m and the other two boys each have a height of 1.4 m or less.

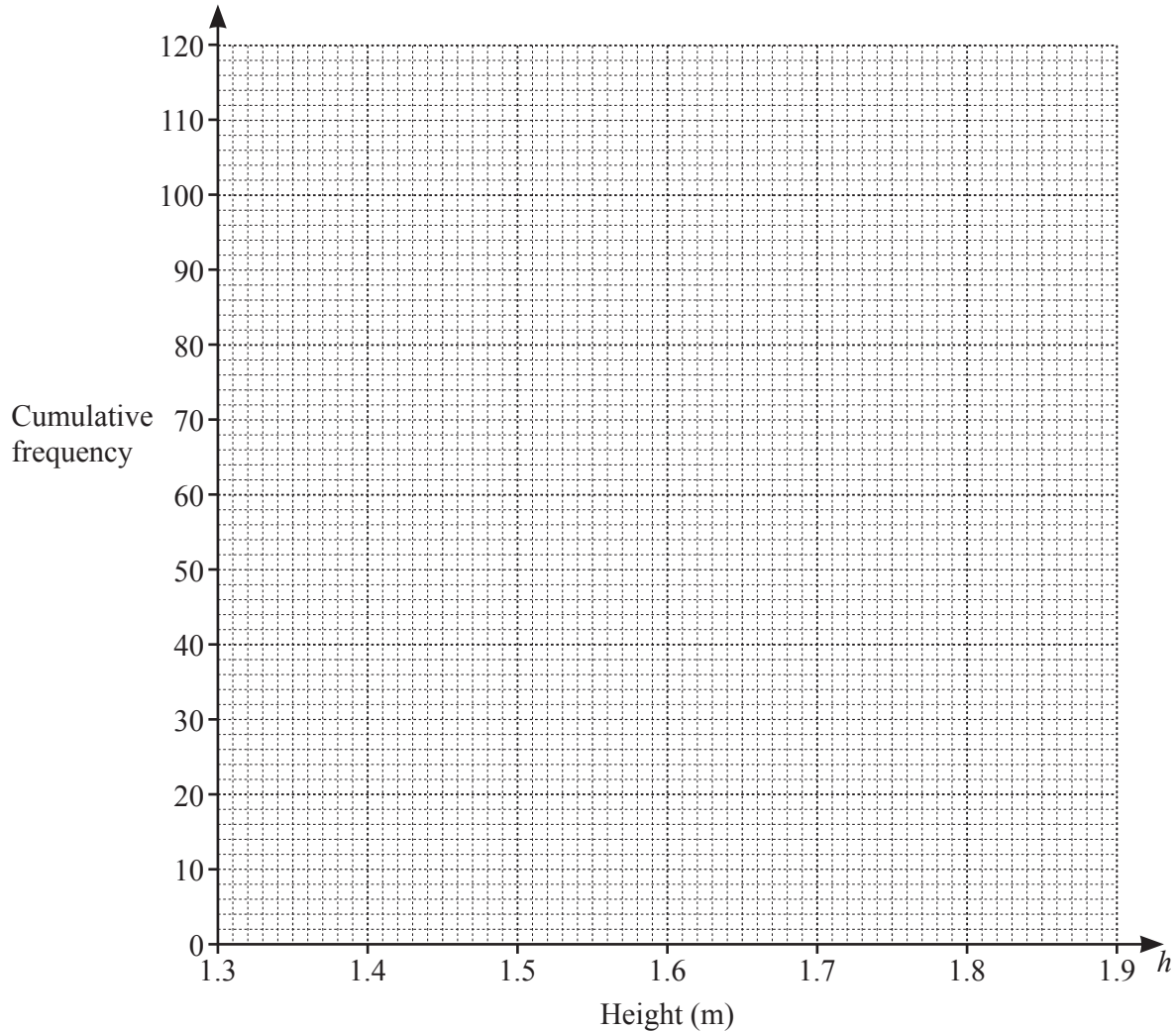
..... [4]

(c) (i) Use the frequency table on page 4 to complete the cumulative frequency table.

Height (h metres)	$h \leq 1.4$	$h \leq 1.5$	$h \leq 1.6$	$h \leq 1.7$	$h \leq 1.8$	$h \leq 1.9$
Cumulative frequency	7	25				

[2]

(ii) On the grid, draw a cumulative frequency diagram to show this information.



[3]

(d) Use your diagram to find an estimate for

(i) the median height,

..... m [1]

(ii) the 40th percentile.

..... m [2]

3 (a) $s = ut + \frac{1}{2}at^2$

Find the value of s when $u = 5.2$, $t = 7$ and $a = 1.6$.

$s = \dots\dots\dots$ [2]

(b) Simplify.

(i) $3a - 5b - a + 2b$

$\dots\dots\dots$ [2]

(ii) $\frac{5}{3x} \times \frac{9x}{20}$

$\dots\dots\dots$ [2]

(c) Solve.

(i) $\frac{15}{x} = -3$

$x = \dots\dots\dots$ [1]

(ii) $4(5 - 3x) = 23$

$x = \dots\dots\dots$ [3]

(d) Simplify.

$$(27x^9)^{\frac{2}{3}}$$

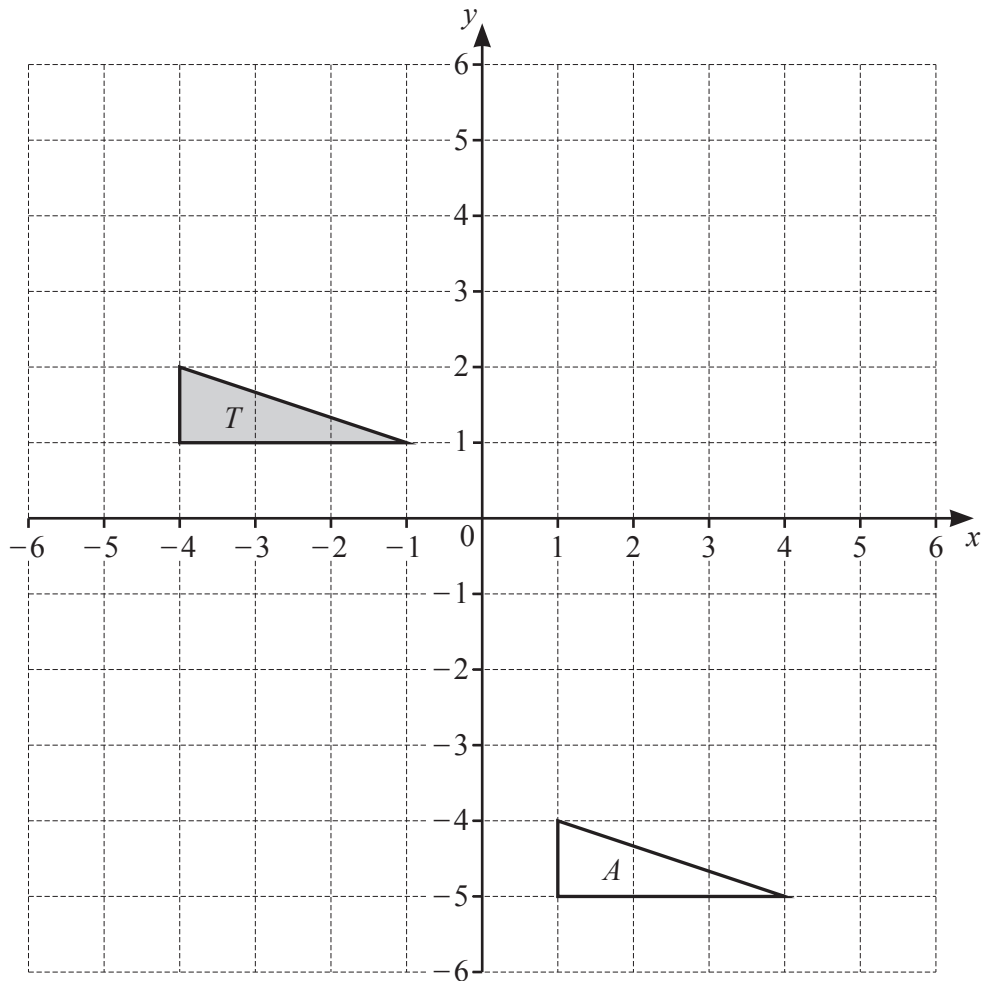
..... [2]

(e) Expand and simplify.

$$(3x - 5y)(2x + y)$$

..... [2]

4



- (a) Draw the image of triangle T after a reflection in the line $y = -1$. [2]
- (b) Draw the image of triangle T after a rotation through 90° clockwise about $(0, 0)$. [2]
- (c) Describe fully the **single** transformation that maps triangle T onto triangle A .

.....

..... [2]

5 x is an integer.

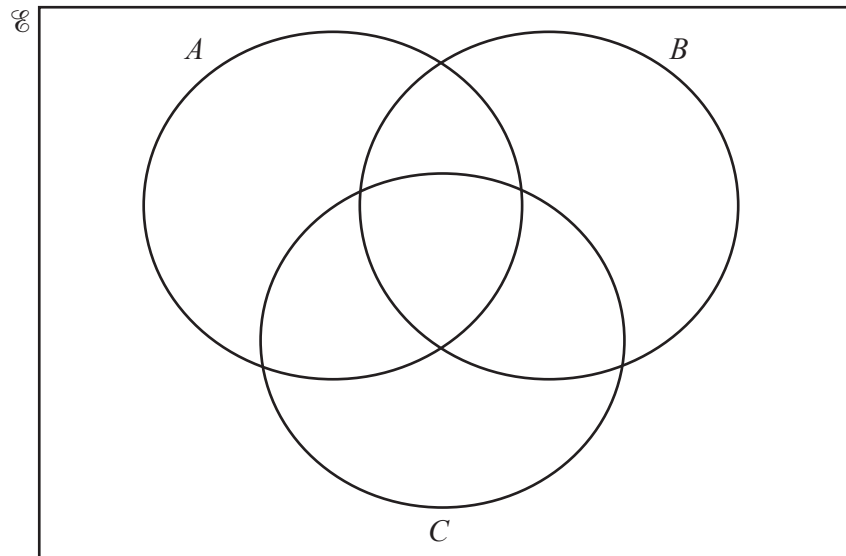
$$\mathcal{C} = \{x : 41 \leq x \leq 50\}$$

$$A = \{x : x \text{ is an odd number}\}$$

$$B = \{x : x \text{ is a multiple of } 3\}$$

$$C = \{x : x \text{ is a prime number}\}$$

(a) Complete the Venn diagram to show this information.



[3]

(b) List the elements of

(i) $A \cap C$,

..... [1]

(ii) $(B \cup C)'$.

..... [1]

(c) Find $n(A \cap B \cap C)$.

..... [1]

- 6 Raheem makes baskets and mats.
Each week he makes x baskets and y mats.

He makes fewer than 10 mats.

The number of mats he makes is greater than or equal to the number of baskets he makes.

- (a) One of the inequalities that shows this information is $y < 10$.

Write down the other inequality.

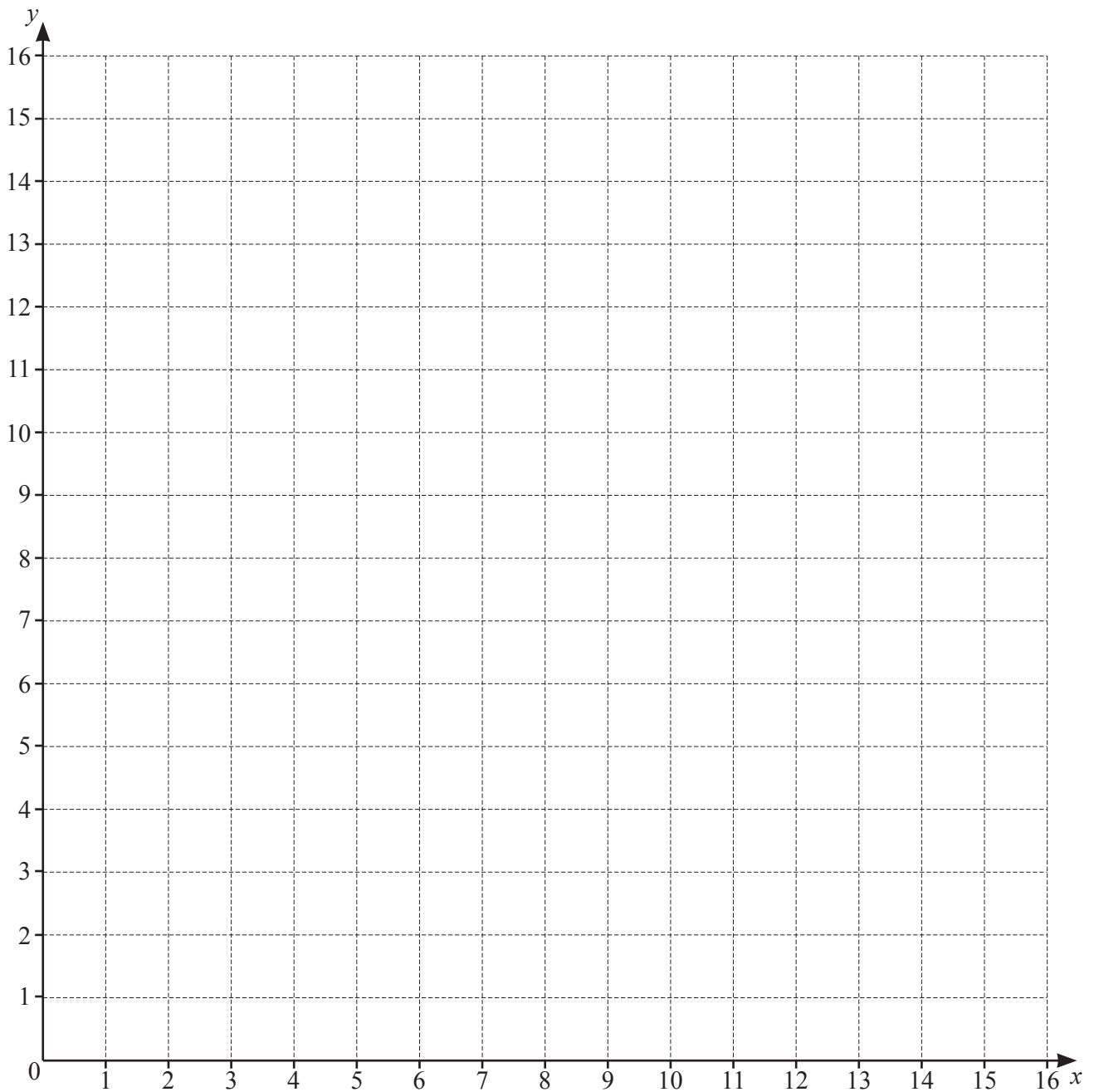
..... [1]

- (b) He takes $2\frac{1}{4}$ hours to make a basket and $1\frac{1}{2}$ hours to make a mat.
Each week he works for a maximum of 22.5 hours.

Show that $3x + 2y \leq 30$.

[2]

(c) On the grid, draw three straight lines and shade the **unwanted** regions to show these inequalities.



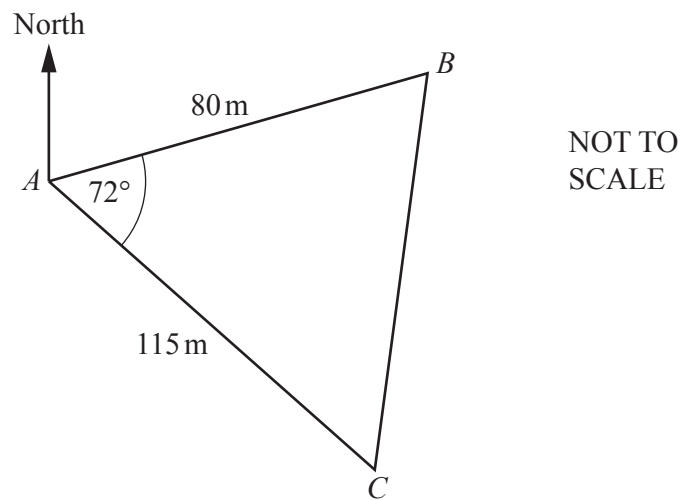
[5]

(d) He makes \$40 profit on each basket he sells and \$28 profit on each mat he sells.

Calculate the maximum profit he can make each week.

\$ [2]

7



The diagram shows the positions of three points A , B and C in a field.

(a) Show that BC is 118.1 m, correct to 1 decimal place.

[3]

(b) Calculate angle ABC .

Angle $ABC = \dots\dots\dots$ [3]

- (c) The bearing of C from A is 147° .

Find the bearing of

- (i) A from B ,

..... [3]

- (ii) B from C .

..... [2]

- (d) Mitchell takes 35 seconds to run from A to C .

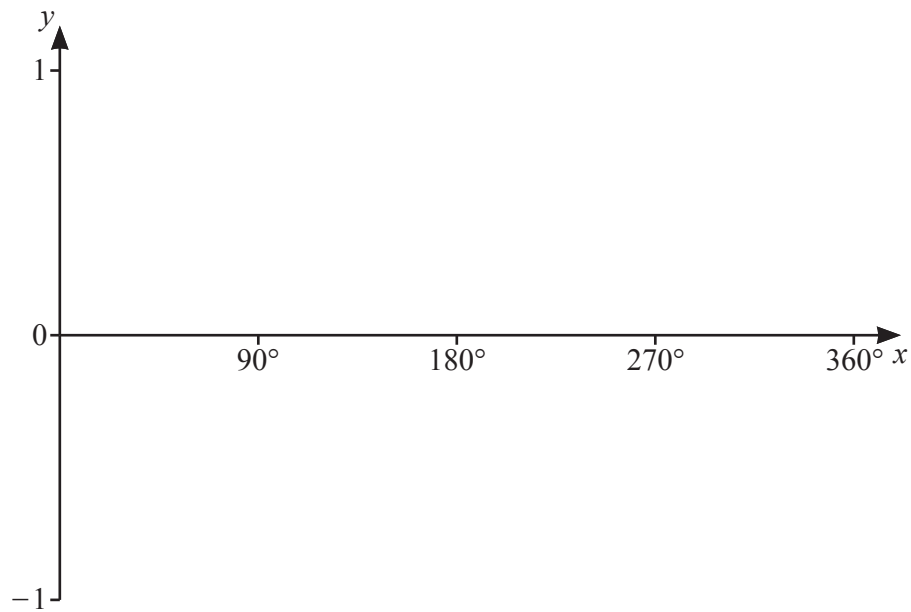
Calculate his average running speed in kilometres per hour.

..... km/h [3]

- (e) Calculate the shortest distance from point B to AC .

..... m [3]

- 8 (a) (i) On the axes, sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.

.....

[2]

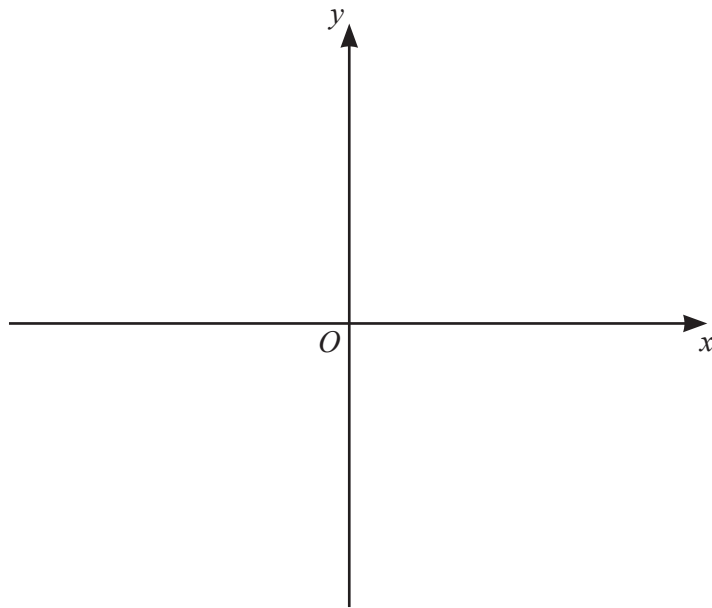
- (b) Solve $4 \sin x - 1 = 2$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [3]

(c) (i) Write $x^2 + 10x + 14$ in the form $(x + a)^2 + b$.

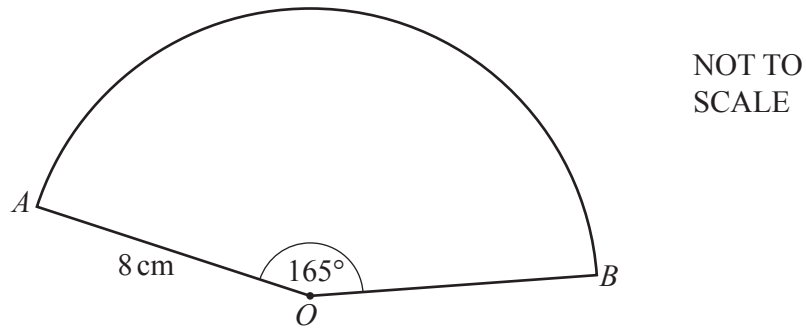
..... [2]

(ii) On the axes, sketch the graph of $y = x^2 + 10x + 14$, indicating the coordinates of the turning point.



[3]

9



The diagram shows a sector of a circle with centre O , radius 8 cm and sector angle 165° .

- (a) Calculate the total perimeter of the sector.

..... cm [3]

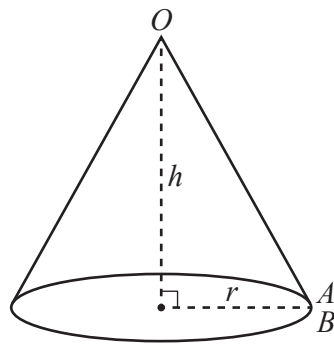
- (b) The surface area of a sphere is the same as the area of the sector.

Calculate the radius of the sphere.

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

..... cm [4]

(c)



NOT TO
SCALE

A cone is made from the sector by joining OA to OB .

(i) Calculate the radius, r , of the cone.

$r = \dots\dots\dots$ cm [2]

(ii) Calculate the volume of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

$\dots\dots\dots$ cm³ [4]

10 (a) A rhombus $ABCD$ has a diagonal AC where A is the point $(-3, 10)$ and C is the point $(4, -4)$.

(i) Calculate the length AC .

..... [3]

(ii) Show that the equation of the line AC is $y = -2x + 4$.

[2]

(iii) Find the equation of the line BD .

..... [4]

(b) A curve has the equation $y = x^3 + 8x^2 + 5x$.

(i) Work out the coordinates of the two turning points.

(....., ...) and (....., ...) [6]

(ii) Determine whether each of the turning points is a maximum or a minimum.
Give reasons for your answers.

[3]

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Cambridge IGCSE™

MATHEMATICS

0580/41

Paper 4 (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 130

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

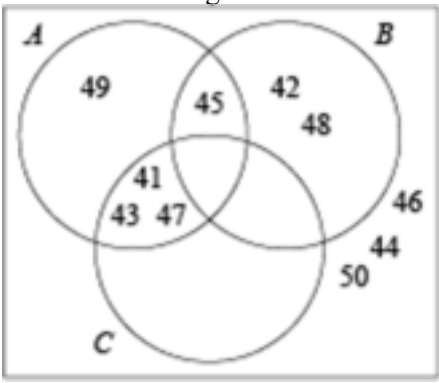
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	7680	2	M1 for $0.24 \times 32\,000$ oe
1(a)(ii)	34 240	2	M1 for $32\,000 \times \frac{100+7}{100}$ oe
1(b)	5306.04	2	M1 for $5000 \times \left(1 + \frac{2}{100}\right)^3$ oe
1(c)	26.7 or 26.66... to 26.67	4	B3 for 96 or $\frac{96}{360}$ oe OR M3 for $\left(1 - \frac{1}{5}\right) \times \left(1 - \frac{2}{3}\right) \times 100$ oe or M2 for $\left(1 - \frac{1}{5}\right)$ and $\left(1 - \frac{2}{3}\right)$ oe OR M1 for $360 \div 5 [\times 4]$ oe M1 for <i>their</i> $288 \div 3 [\times 2]$
1(d)	33 500	2	M1 for $36\,515 \div \frac{100+9}{100}$ oe
1(e)	6525	4	M3 for $\left(\frac{65}{45} - \frac{63}{45}\right)[A] = 290$ oe or M2 for $\left(\frac{13}{9} - \frac{7}{5}\right)[A] = 290$ oe or M1 for correct attempt to convert to a common ratio value for Arjun or for $\frac{13}{9} - \frac{7}{5}$ oe
2(a)(i)	$1.5 < h \leq 1.6$	1	
2(a)(ii)	1.62 or 1.623... nfw	4	M1 for 1.35, 1.45, 1.55, 1.65, 1.75 1.85 soi M1 for Σfx M1 dep for <i>their</i> $\Sigma fx \div 120$

Question	Answer	Marks	Partial Marks
2(b)(i)	$\frac{14}{120}$ oe	1	
2(b)(ii)	$\frac{21}{20060}$ oe	4	M3 for $3\left(\frac{14}{120} \times \frac{7}{119} \times \frac{6}{118}\right)$ or M2 for $\frac{14}{120} \times \frac{7}{119} \times \frac{6}{118}$ isw or M1 for $\frac{14}{120}, \frac{7}{119}, \frac{6}{118}$ After 0 scored, SC1 for answer $\frac{343}{864000}$ or $\frac{343}{288000}$ oe
2(c)(i)	55, 79, 106, 120	2	B1 for 2 or 3 correct
2(c)(ii)	Correct diagram	3	B1 for correct horizontal plots B1FT for correct vertical plots B1FT dep on at least B1 for reasonable increasing curve or polygon through <i>their</i> 6 points If 0 scored SC1 for 5 out of 6 points correctly plotted
2(d)(i)	1.62 to 1.63	1	
2(d)(ii)	1.57 to 1.58	2	B1 for 48 soi
3(a)	75.6	2	M1 for $5.2 \times 7 + \frac{1}{2} \times 1.6 \times 7^2$
3(b)(i)	$2a - 3b$ final answer	2	B1 for answer $2a + kb$ or $ka - 3b$ or for $2a - 3b$ seen in working
3(b)(ii)	$\frac{3}{4}$	2	B1 for $\frac{45x}{60x}$ oe single fraction
3(c)(i)	-5	1	
3(c)(ii)	-0.25 or $-\frac{1}{4}$	3	M1 for $20 - 12x = 23$ or for $5 - 3x = \frac{23}{4}$ M1 for correct completion to $ax = b$ FT <i>their</i> first step
3(d)	$9x^6$	2	B1 for $9x^k$ or kx^6
3(e)	$6x^2 - 7xy - 5y^2$	2	M1 for 3 terms out of 4 from $6x^2 - 10xy + 3xy - 5y^2$

Question	Answer	Marks	Partial Marks
4(a)	Triangle at $(-4, -4)$ $(-1, -3)$ $(-4, -3)$	2	B1 for correct points not joined or for reflection in any $y = k$ or for reflection in $x = -1$
4(b)	Triangle at $(1, 1)$ $(1, 4)$ $(2, 4)$	2	B1 for correct points not joined or rotation 90 clockwise around any point or rotation 90 anticlockwise around $(0, 0)$
4(c)	Translation $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$	2	B1 for translation or correct vector oe
5(a)	Correct Venn diagram 	3	B2 for 8 or 9 numbers correct or B1 for 6 or 7 numbers correct
5(b)(i)	41, 43, 47	1	FT their Venn diagram
5(b)(ii)	44, 46, 49, 50	1	FT their Venn diagram
5(c)	0	1	FT their Venn diagram
6(a)	$y \geq x$ oe	1	
6(b)	$2.25x + 1.5y \leq 22.5$ oe	M1	
	One step shown to $3x + 2y \leq 30$	A1	
6(c)	$y = 10$ ruled	1	Broken line
	$3x + 2y = 30$ ruled	B2	Solid line B1 for line passing through $(0, 15)$ or $(10, 0)$
	$y = x$ ruled	B1	Solid line
	Correct region indicated	B1	
6(d)	412	2	M1 for $(4, 9)$ identified or for evaluation $40x + 28y$ for an integer point in the region $(x > 0 \text{ and } y > 0)$
7(a)	$[BC^2 =] 80^2 + 115^2 - 2 \times 80 \times 115 \cos 72$ oe	M1	
	118.06...	A2	A1 for 13939...

Question	Answer	Marks	Partial Marks
7(b)	67.8 or 67.9 or 67.83 to 67.88	3	M2 for $[\sin B =] \frac{115 \times \sin 72}{118.1}$ oe or M1 for $\frac{115}{\sin B} = \frac{118.1}{\sin 72}$ oe
7(c)(i)	255	3	B1 for bearing of B from A is 75 soi M1 for $180 + 75$ oe
7(c)(ii)	[00]7.2	2	M1 for <i>their (c)(i) – their (b)</i> –180
7(d)	11.8 or 11.82 to 11.83	3	M1 for $115 \div 35$ oe M1 for <i>their</i> speed in m/s $\times 60 \times 60 \div 1000$
7(e)	76.1 or 76.08 to 76.09	3	M2 for $\frac{\text{distance}}{80} = \sin 72$ oe or M1 for distance required is perpendicular to AC soi
8(a)(i)	Correct sketch	2	B1 for correct shape but inaccurate
8(a)(ii)	Rotational [symmetry] order 2 [centre] (180, 0)	2	B1 for rotational [symmetry]
8(b)	48.6 or 48.59 to 48.60 and 131.4 or 131.40 to 131.41	3	B2 for 48.6 or 48.59 to 48.60 or 131.4 or 131.40 to 131.41 or M1 for $\sin x = 0.75$ or better If 0 scored, SC1 for two answers adding to 180
8(c)(i)	$(x + 5)^2 - 11$	2	M1 for $(x + 5)^2 + k$ or $(x + \text{their } 5)^2 + 14 - (\text{their } 5)^2$ or $a = 5$
8(c)(ii)	Sketch of U-shaped parabola with a minimum indicated at $(-5, -11)$ with no part of graph in 4 th quadrant	3	FT <i>their</i> $(x + 5)^2 - 11$ provided in that form B1 for U shape curve B1FT for turning point at $(-5, k)$ or $(k, -11)$
9(a)	39[.0] or 39.03 to 39.04...	3	M2 for $\frac{165}{360} \times 2 \times \pi \times 8 + 16$ or M1 for $\frac{165}{360} \times 2 \times \pi \times 8$
9(b)	2.71 or 2.708...	4	M3 for $\sqrt{\frac{\frac{165}{360} [\times \pi] \times 8^2}{4 [\times \pi]}}$ oe or M2 for $r^2 = \frac{\frac{165}{360} [\times \pi] \times 8^2}{4 [\times \pi]}$ oe or M1 for $\frac{165}{360} \times \pi \times 8^2$ oe seen

Question	Answer	Marks	Partial Marks
9(c)(i)	3.67 or 3.666 to 3.667	2	M1 for $\frac{165}{360} \times 2[\times\pi] \times 8 = 2[\times\pi] \times r$ or better or for $\frac{165}{360}[\times\pi] \times 8^2 = [\pi\times]r \times 8$ or better
9(c)(ii)	100 or 100.0 to 100.1... final answer	4	M3 for $\frac{1}{3}\pi \times their(c)(i)^2 \times \sqrt{8^2 - their\ radius^2}$ or M2 for $\sqrt{8^2 - their\ radius^2}$ or M1 for $(their\ (c)(i))^2 + h^2 = 8^2$
10(a)(i)	15.7 or 15.65...	3	M2 for $\sqrt{(4-10)^2 + (4-3)^2}$ oe or M1 for $(-4-10)^2 + (4--3)^2$ oe
10(a)(ii)	$\frac{-10-4}{4-3} [= -2]$ oe	M1	
	$10 = -2(-3) + c$ Or $-4 = -2(4) + c$ and correct completion to $y = -2x + 4$	A1	
10(a)(iii)	$y = \frac{1}{2}x + \frac{11}{4}$ oe	4	M1 for grad = $\frac{1}{2}$ soi M1 for [midpoint =] ($\frac{1}{2}$, 3) M1 for substitution of ($\frac{1}{2}$, 3) into <i>their</i> $y = mx + c$ oe
10(b)(i)	$\left(-\frac{1}{3}, -\frac{22}{27}\right)$ oe and $(-5, 50)$	6	B2 for $3x^2 + 16x + 5$ Or B1 for one correct M1 for derivative = 0 or <i>their</i> derivative = 0 M1 for $[x =] -\frac{1}{3}$ and $[x =] -5$ B1 for $-\frac{22}{27}$ and 50
10(b)(ii)	$\left(-\frac{1}{3}, -\frac{22}{27}\right)$ minimum $(-5, 50)$ maximum with correct reasons	3	B2 for one correct with reason or M1 for correct attempt e.g. 2 nd derivatives, gradients or sketching



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CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/42**

Paper 4 (Extended)

May/June 2020**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

- 1 (a) (i) Divide \$24 in the ratio 7 : 5.

\$, \$ [2]

- (ii) Write \$24.60 as a fraction of \$2870.
Give your answer in its lowest terms.

..... [2]

- (iii) Write \$1.92 as a percentage of \$1.60 .

..... % [1]

- (b) In a sale the original prices are reduced by 15%.

- (i) Calculate the sale price of a book that has an original price of \$12.

\$ [2]

- (ii) Calculate the original price of a jacket that has a sale price of \$38.25 .

\$ [2]

- (c) (i) Dean invests \$500 for 10 years at a rate of 1.7% per year simple interest.

Calculate the total interest earned during the 10 years.

\$ [2]

- (ii) Ollie invests \$200 at a rate of 0.0035% **per day** compound interest.

Calculate the value of Ollie's investment at the end of 1 year.

[1 year = 365 days.]

\$ [2]

- (iii) Edna invests \$500 at a rate of $r\%$ per year compound interest.

At the end of 6 years, the value of Edna's investment is \$559.78 .

Find the value of r .

$r =$ [3]

2 (a) $\mathbf{p} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$

(i) Find $2\mathbf{p} + \mathbf{q}$.

$$\begin{pmatrix} \\ \end{pmatrix} \quad [2]$$

(ii) Find $|\mathbf{p}|$.

..... [2]

(b) A is the point $(4, 1)$ and $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$.

Find the coordinates of B .

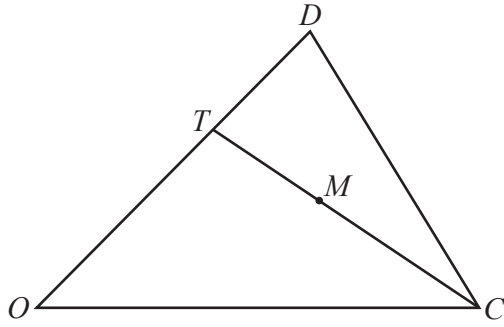
(..... , ...) [1]

(c) The line $y = 3x - 2$ crosses the y -axis at G .

Write down the coordinates of G .

(..... , ...) [1]

(d)



NOT TO
SCALE

In the diagram, O is the origin, $OT = 2TD$ and M is the midpoint of TC .
 $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{OD} = \mathbf{d}$.

Find the position vector of M .
 Give your answer in terms of $\mathbf{c}$ and $\mathbf{d}$ in its simplest form.

..... [3]

- 3 The speed, v km/h, of each of 200 cars passing a building is measured.
The table shows the results.

Speed (v km/h)	$0 < v \leq 20$	$20 < v \leq 40$	$40 < v \leq 45$	$45 < v \leq 50$	$50 < v \leq 60$	$60 < v \leq 80$
Frequency	16	34	62	58	26	4

- (a) Calculate an estimate of the mean.

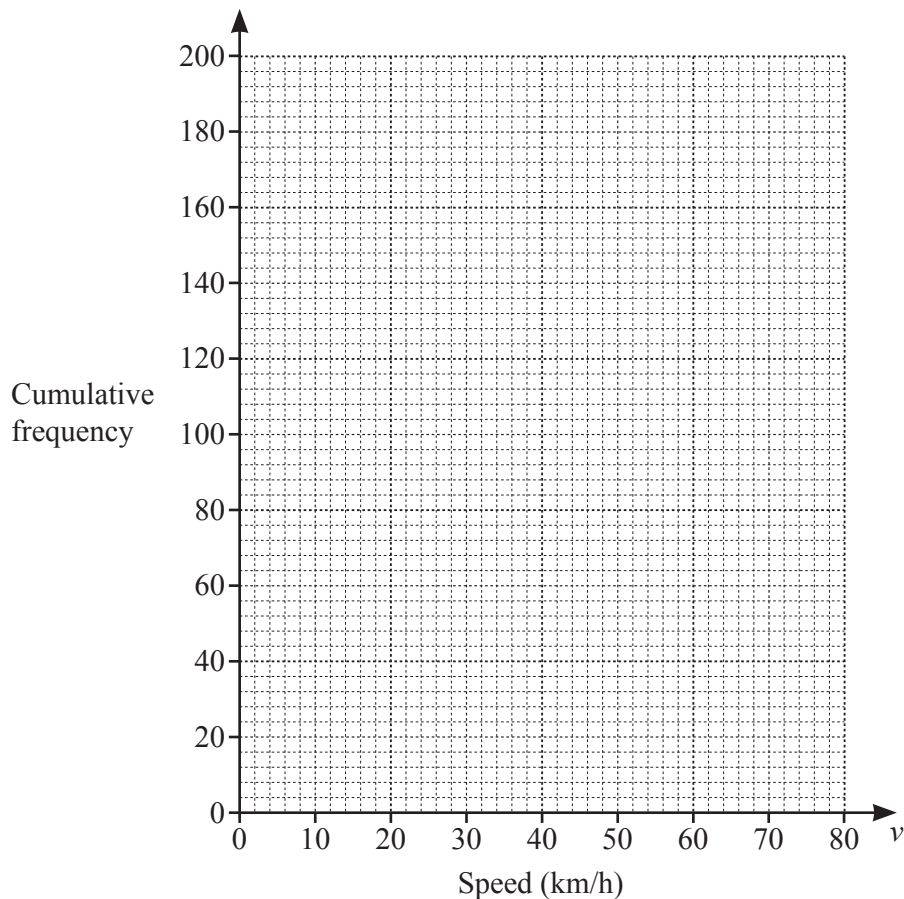
..... km/h [4]

- (b) (i) Use the frequency table to complete the cumulative frequency table.

Speed (v km/h)	$v \leq 20$	$v \leq 40$	$v \leq 45$	$v \leq 50$	$v \leq 60$	$v \leq 80$
Cumulative frequency	16	50			196	200

[1]

- (ii) On the grid, draw a cumulative frequency diagram.



[3]

(iii) Use your diagram to find an estimate of

(a) the upper quartile,

..... km/h [1]

(b) the number of cars with a speed greater than 35 km/h.

..... [2]

(c) Two of the 200 cars are chosen at random.

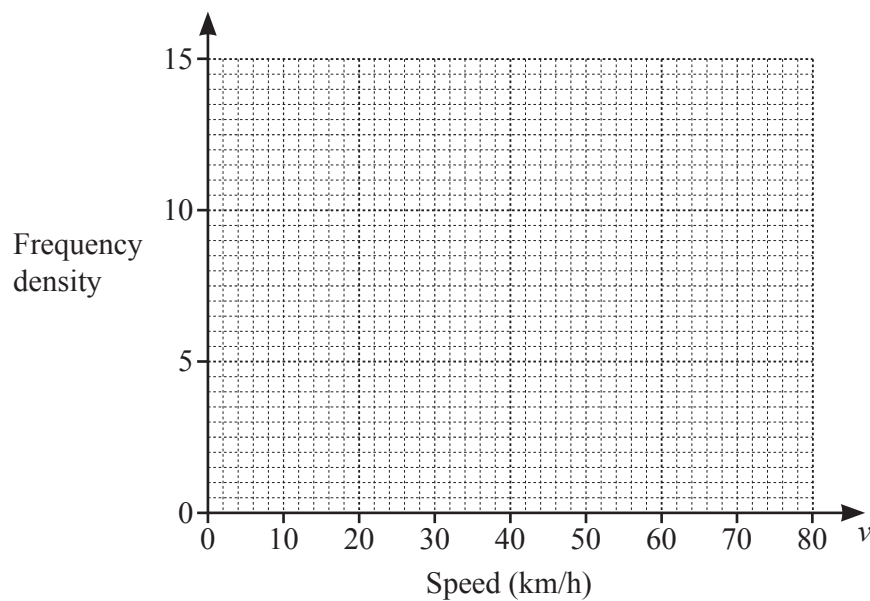
Find the probability that they both have a speed greater than 50 km/h.

..... [2]

(d) A new frequency table is made by combining intervals.

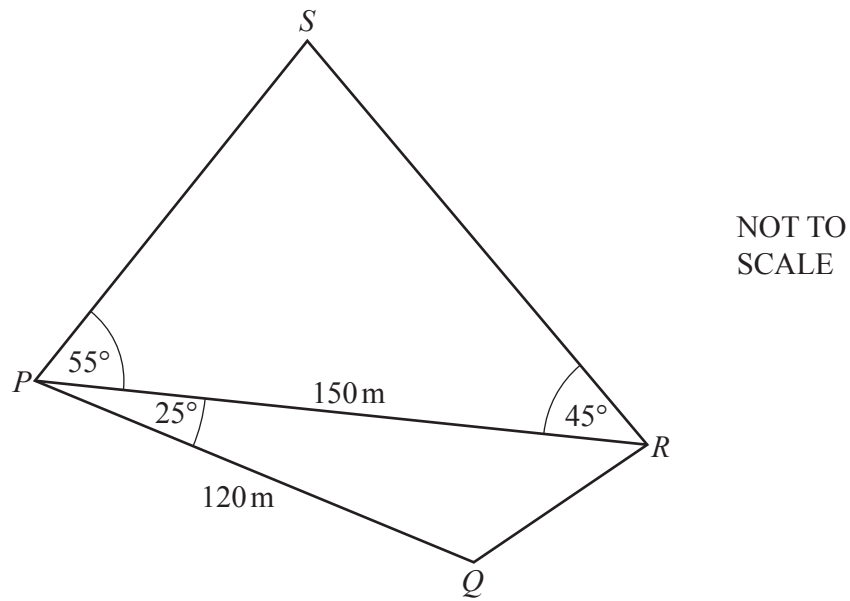
Speed (v km/h)	$0 < v \leq 40$	$40 < v \leq 50$	$50 < v \leq 80$
Frequency	50	120	30

On the grid, draw a histogram to show the information in this table.



[3]

4



The diagram shows two triangles.

(a) Calculate QR .

$QR = \dots\dots\dots\text{ m}$ [3]

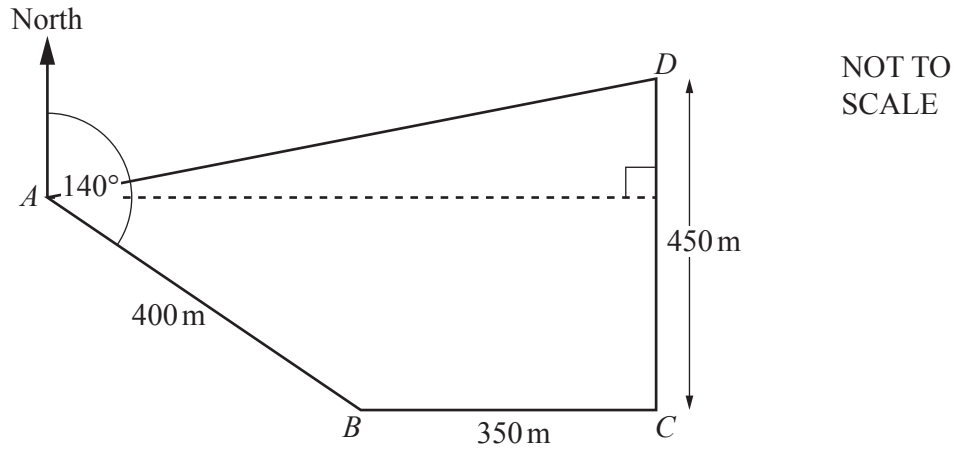
(b) Calculate RS .

$RS = \dots\dots\dots\text{ m}$ [4]

- (c) Calculate the total area of the two triangles.

..... m² [3]

5



The diagram shows a field $ABCD$.
 The bearing of B from A is 140° .
 C is due east of B and D is due north of C .
 $AB = 400$ m, $BC = 350$ m and $CD = 450$ m.

(a) Find the bearing of D from B .

..... [2]

- (b) Calculate the distance from D to A .

..... m [6]

- (c) Jono runs around the field from A to B , B to C , C to D and D to A .
He runs at a speed of 3 m/s.

Calculate the total time Jono takes to run around the field.
Give your answer in minutes and seconds, correct to the nearest second.

..... min s [4]

12

6 $f(x) = 3x + 2$ $g(x) = x^2 + 1$ $h(x) = 4^x$

(a) Find $h(4)$.

..... [1]

(b) Find $fg(1)$.

..... [2]

(c) Find $gf(x)$ in the form $ax^2 + bx + c$.

..... [3]

(d) Find x when $f(x) = g(7)$.

$x =$ [2]

(e) Find $f^{-1}(x)$.

$f^{-1}(x) =$ [2]

(f) Find $\frac{g(x)}{f(x)} + x$.

Give your answer as a single fraction, in terms of x , in its simplest form.

..... [3]

(g) Find x when $h^{-1}(x) = 2$.

$x =$ [1]

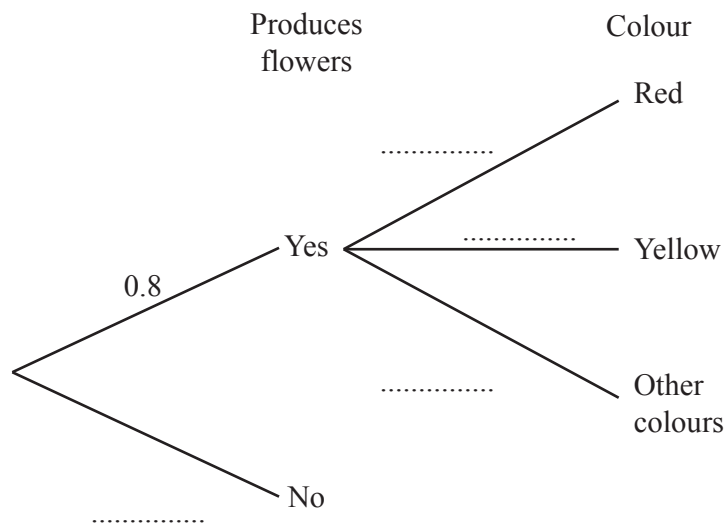
- 7 Tanya plants some seeds.
The probability that a seed will produce flowers is 0.8 .
When a seed produces flowers, the probability that the flowers are red is 0.6 and the probability that the flowers are yellow is 0.3 .

(a) Tanya has a seed that produces flowers.

Find the probability that the flowers are not red and not yellow.

..... [1]

(b) (i) Complete the tree diagram.



[2]

(ii) Find the probability that a seed chosen at random produces red flowers.

..... [2]

- (iii) Tanya chooses a seed at random.

Find the probability that this seed does not produce red flowers and does not produce yellow flowers.

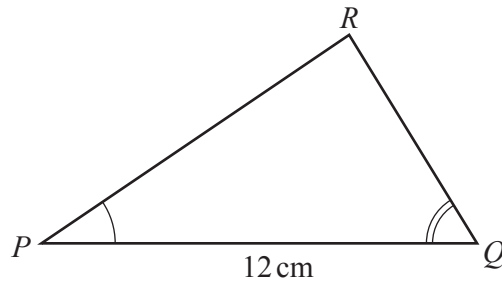
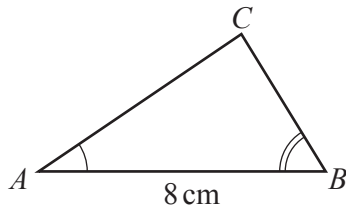
..... [3]

- (c) Two of the seeds are chosen at random.

Find the probability that one produces flowers and one does not produce flowers.

..... [3]

8 (a)



NOT TO
SCALE

Triangle ABC is mathematically similar to triangle PQR .
The area of triangle ABC is 16 cm^2 .

(i) Calculate the area of triangle PQR .

..... cm^2 [2]

(ii) The triangles are the cross-sections of prisms which are also mathematically similar.
The volume of the smaller prism is 320 cm^3 .

Calculate the length of the larger prism.

..... cm [3]

- (b) A cylinder with radius 6 cm and height h cm has the same volume as a sphere with radius 4.5 cm.

Find the value of h .

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$$h = \dots\dots\dots [3]$$

- (c) A solid metal cube of side 20 cm is melted down and made into 40 solid spheres, each of radius r cm.

Find the value of r .

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$$r = \dots\dots\dots [3]$$

- (d) A solid cylinder has radius x cm and height $\frac{7x}{2}$ cm.

The surface area of a sphere with radius R cm is equal to the total surface area of the cylinder.

Find an expression for R in terms of x .

[The surface area, A , of a sphere with radius r is $A = 4\pi r^2$.]

$$R = \dots\dots\dots [3]$$

9 (a) (i) Write $x^2 + 8x - 9$ in the form $(x + k)^2 + h$.

..... [2]

(ii) Use your answer to **part (a)(i)** to solve the equation $x^2 + 8x - 9 = 0$.

$x =$ or $x =$ [2]

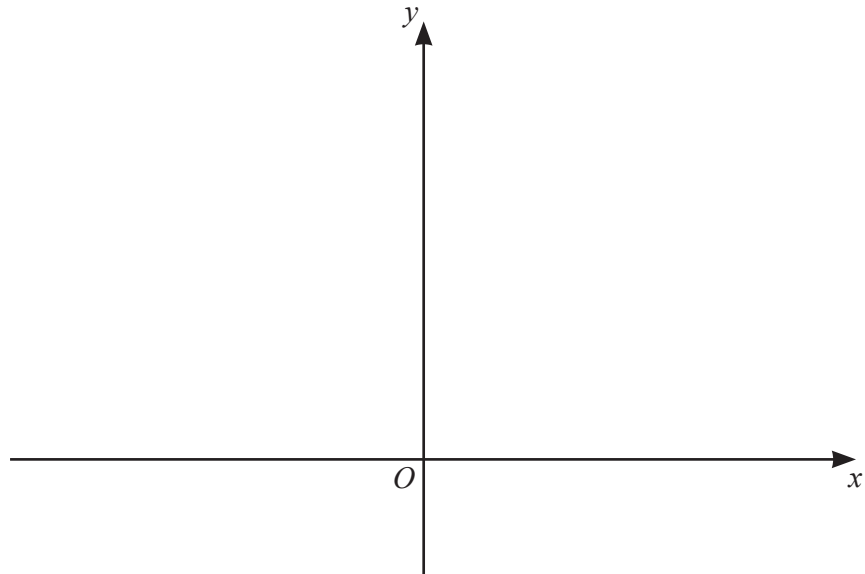
(b) The solutions of the equation $x^2 + bx + c = 0$ are $\frac{-7 + \sqrt{61}}{2}$ and $\frac{-7 - \sqrt{61}}{2}$.

Find the value of b and the value of c .

$b =$

$c =$ [3]

(c) (i)



On the diagram,

(a) sketch the graph of $y = (x - 1)^2$, [2]

(b) sketch the graph of $y = \frac{1}{2}x + 1$. [2]

(ii) The graphs of $y = (x - 1)^2$ and $y = \frac{1}{2}x + 1$ intersect at A and B .

Find the length of AB .

$AB = \dots\dots\dots$ [7]

Question 10 is printed on the next page.

10 (a) $y = x^4 - 4x^3$

(i) Find the value of y when $x = -1$.

$$y = \dots\dots\dots [2]$$

(ii) Find the two stationary points on the graph of $y = x^4 - 4x^3$.

$$(\dots\dots\dots, \dots\dots\dots)$$

$$(\dots\dots\dots, \dots\dots\dots) [6]$$

(b) $y = x^p + 2x^q$

$$\frac{dy}{dx} = 11x^{10} + 10x^4, \text{ where } \frac{dy}{dx} \text{ is the derived function.}$$

Find the value of p and the value of q .

$$p = \dots\dots\dots$$

$$q = \dots\dots\dots [2]$$

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 130

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

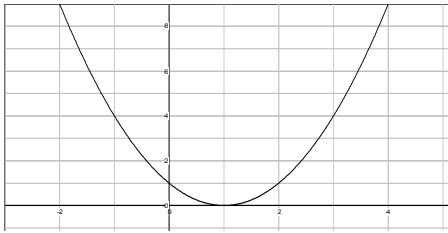
Abbreviations

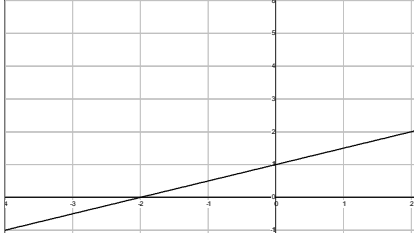
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	14, 10	2	M1 for $24 \div (7 + 5)$
1(a)(ii)	$\frac{3}{350}$	2	B1 for correct fraction not in lowest terms
1(a)(iii)	120	1	
1(b)(i)	10.2[0]	2	M1 for $\frac{15}{100} \times 12$ oe or better
1(b)(ii)	45	2	M1 for $\frac{38.25}{1 - \frac{15}{100}}$ oe
1(c)(i)	85	2	M1 for $\frac{500 \times 1.7 \times 10}{100}$ oe
1(c)(ii)	203 or 202.5 to 202.6	2	M1 for $200 \times \left(1 + \frac{0.0035}{100}\right)^{365}$
1(c)(iii)	1.9	3	M2 for $\sqrt[6]{\frac{559.78}{500}}$ or M1 for $500 \left(1 + \frac{r}{100}\right)^6 = 559.78$
2(a)(i)	$\begin{pmatrix} 6 \\ 17 \end{pmatrix}$	2	B1 for each
2(a)(ii)	6.4[0] or 6.403...	2	M1 for $4^2 + 5^2$
2(b)	(1, 2)	1	
2(c)	(0, -2)	1	

Question	Answer	Marks	Partial Marks
2(d)	$\frac{1}{2}\mathbf{c} + \frac{1}{3}\mathbf{d}$	3	B2 for correct unsimplified answer or M1 for $\overrightarrow{CT} = -\mathbf{c} + \frac{2}{3}\mathbf{d}$ oe or $\overrightarrow{TC} = \mathbf{c} - \frac{2}{3}\mathbf{d}$ oe or for correct route
3(a)	41.4	4	M1 for 10, 30, 42.5, 47.5, 55, 70 M1 for Σfx where x lies in or on the boundary of each interval. M1 dep for $\frac{\Sigma fx}{200}$ dep on second M1
3(b)(i)	112, 170	1	
3(b)(ii)	Correct diagram	3	B1 for correct horizontal plot B1FT for correct vertical plots B1 FT dep on at least B1 earned for reasonable increasing curve or polygon through their 6 points If 0 scored SC1FT for 5 out of 6 points plotted correctly
3(b)(iii)(a)	48	1	
3(b)(iii)(b)	160	2	M1 for 40 seen
3(c)	$\frac{87}{3980}$ oe	2	M1 for $\frac{30}{200} \times \frac{29}{199}$ oe
3(d)	Correct histogram	3	B1 for each column If 0 scored SC1 for correct frequency densities soi 1.25, 12, 1
4(a)	65.4 or 65.36 to 65.37	3	M1 for $150^2 + 120^2 - 2 \times 150 \times 120 \cos 25$ A1 for 4270 or 4272 to 4273
4(b)	125 or 124.7 to 124.8	4	B1 for [angle $S =$] 80 M2 for $\frac{150 \sin 55}{\sin their 80}$ or M1 for $\frac{\sin their 80}{150} = \frac{\sin 55}{RS}$ oe
4(c)	10 400 or 10 410 to 10 440 nfw	3	M1 for $\frac{1}{2} \times 120 \times 150 \sin 25$ oe M1 for $\frac{1}{2} \times 150 \times their (b) \sin 45$ oe

Question	Answer	Marks	Partial Marks
5(a)	[0]38 or [0]37.9 or [0]37.87...	2	M1 for $\tan = \frac{350}{450}$ oe If 0 scored, SC1 for answer [0]52 or [0]52.1 or [0]52.12 to [0]52.13
5(b)	624 or 623.8 to 623.9	6	M2 for $450 - 400 \sin 50$ or M1 for $\sin 50 = \frac{\dots}{400}$ M2 for $350 + 400 \cos 50$ or M1 for $\cos 50 = \frac{\dots}{400}$ M1 for $(\text{their } (450 - 400 \sin 50))^2 + (\text{their } (350 + 400 \cos 50))^2$
5(c)	10 min 8 s	4	B3 for 10.1 or 10.13... or M2 for $(400 + 350 + 450 + \text{their } DA) \div 3 [\div 60]$ oe or M1 for any distance $\div 3$ M1 for rounding <i>their</i> minutes into minutes and seconds to nearest second if clearly seen
6(a)	256	1	
6(b)	8	2	M1 for $3(x^2 + 1) + 2$ or for $3(2) + 2$
6(c)	$9x^2 + 12x + 5$	3	M1 for $(3x + 2)^2 + 1$ B1 for $[(3x + 2)^2 =] 9x^2 + 6x + 6x + 4$ oe
6(d)	16	2	M1 for $3x + 2 = 7^2 + 1$ or better
6(e)	$\frac{x-2}{3}$ oe final answer	2	M1 for $x = 3y + 2$ or for $y - 2 = 3x$ or for $\frac{y}{3} = x + \frac{2}{3}$
6(f)	$\frac{4x^2 + 2x + 1}{3x + 2}$ final answer	3	B1 for $x^2 + 1 + x(3x + 2)$ or better seen M1 for common denominator $3x + 2$
6(g)	16	1	
7(a)	0.1	1	
7(b)(i)	0.2 oe 0.6, 0.3, 0.1 oe	2	B1 for 0.2 B1 for 0.6, 0.3, 0.1
7(b)(ii)	0.48 oe	2	FT <i>their</i> 0.6 from tree diagram M1 for $0.8 \times \text{their } 0.6$

Question	Answer	Marks	Partial Marks
7(b)(iii)	0.28 oe	3	M2 for $0.2 + 0.8 \times 0.1$ oe or M1 for 0.2 or 0.8×0.1 or $0.8 \times (0.6 + 0.3)$
7(c)	0.32 oe	3	M2 for $0.8 \times 0.2 + 0.2 \times 0.8$ oe M1 for one of these products
8(a)(i)	36	2	M1 for $\left(\frac{8}{12}\right)^2$ or $\left(\frac{12}{8}\right)^2$ oe
8(a)(ii)	30	3	M2 for $320 \div 16 \times \frac{12}{8}$ oe or M1 for $320 \div 16$
8(b)	3.375 cao	3	M2 for $\frac{\frac{4}{3}\pi \times 4.5^3}{\pi \times 6^2}$ or better or M1 for $\pi \times 6^2 \times h = \frac{4}{3} \times \pi \times 4.5^3$
8(c)	3.63 or 3.627 to 3.628	3	M2 for $\frac{20^3}{40 \times \frac{4}{3}\pi}$ or M1 for $40 \times \frac{4}{3} \times \pi \times r^3 = 20^3$
8(d)	$\frac{3x}{2}$ or $1.5x$ or $1\frac{1}{2}x$	3	B2 for $4R^2 = 9x^2$ oe or better or M1 for $4\pi R^2 = 2\pi x^2 + \pi \times 2x \times \frac{7x}{2}$
9(a)(i)	$(x+4)^2 - 25$	2	B1 for $(x+k)^2 - 9 - (their\ k)^2$ or $(x+4)^2 - h$ or $k = 4$
9(a)(ii)	$x + 4 = [\pm] 5$	M1	FT <i>their (a)(i)</i>
	-9 and 1	A1	
9(b)	$[b =] 7$ $[c =] -3$	3	B1 for $[b =] 7$ M1 for $b^2 - 4c = 61$
9(c)(i)(a)	Correct sketch 	2	B2 for correct quadratic curve with min touching x -axis or B1 for parabola vertex downwards

Question	Answer	Marks	Partial Marks
9(c)(i)(b)	Correct sketch 	2	B2 for correct straight line intersecting curve on y-axis or B1 for straight line with positive gradient and positive y-intercept
9(c)(ii)	2.8[0] or 2.795...	7	B3 for $x^2 - \frac{5}{2}x = 0$ oe or M1 for $(x-1)^2 = \frac{1}{2}x + 1$ B1 for $[(x-1)^2 =] x^2 - x - x + 1$ AND B2 for (0, 1) and $(\frac{5}{2}, \frac{9}{4})$ oe or B1 $[x =] 0$ and $\frac{5}{2}$ oe AND M1 for (difference in x) ² + (difference in y) ²
10(a)(i)	5	2	M1 for $(-1)^4 - 4(-1)^3$
10(a)(ii)	(0, 0) and (3, -27)	6	B2 for $4x^3 - 12x^2 [= 0]$ or B1 for $4x^3$ or $12x^2$ AND M1 for derivative = 0 or <i>their</i> derivative = 0 M1 for $4x^2(x-3)[= 0]$ B1 for $[x =] 0$ and $[x =] 3$ or $[y =] 0$ and $[y =] -27$ or for one correct coordinate pair
10(b)	$[p =] 11$ $[q =] 5$	2	B1 for each or M1 for $\frac{dy}{dx} = px^{p-1} + 2qx^{q-1}$



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CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/43**

Paper 4 (Extended)

May/June 2020**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **24** pages. Blank pages are indicated.

1 (a)

Campsite fees (per day)	
Tent	\$15.00
Caravan	\$25.00

The sign shows the fees charged at a campsite.
Today there are 54 tents and 18 caravans on the site.

Calculate the fees charged today.

\$ [2]

- (b) In September the total income at the campsite was \$37 054.
This was a decrease of 4.5% on the total income in August.

Calculate the total income in August.

\$ [2]

- (c) The visitors to the campsite today are in the ratio

men : women = 5 : 4 and women : children = 3 : 7.

- (i) Calculate the ratio men : women : children in its simplest form.

..... : : [2]

- (ii) Today there are 224 children at the campsite.

Calculate the total number of men and women.

..... [3]

- (d) The space allowed for each tent is a rectangle measuring 8 m by 6 m, each correct to the nearest metre.

Calculate the upper bound for the area of the space allowed for each tent.

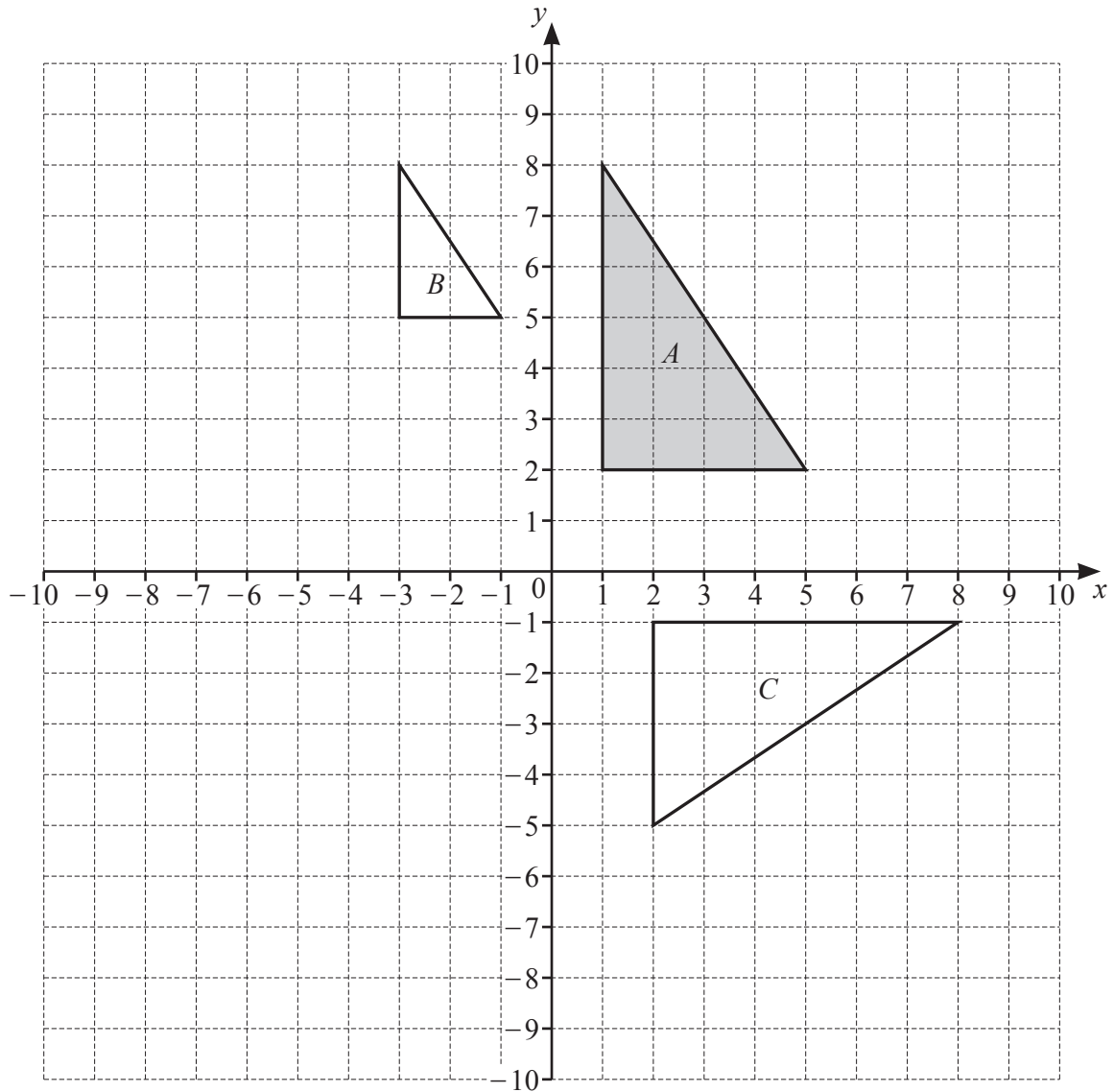
..... m^2 [2]

- (e) The value of the campsite has increased exponentially by 1.5% every year since it opened 30 years ago.

Calculate the value of the campsite now as a percentage of its value 30 years ago.

..... % [2]

2



(a) (i) Draw the image of triangle A after a reflection in the line $y = -x$. [2]

(ii) Draw the image of triangle A after a translation by the vector $\begin{pmatrix} -2 \\ -9 \end{pmatrix}$. [2]

(b) Describe fully the **single** transformation that maps

(i) triangle A onto triangle B ,

.....
 [3]

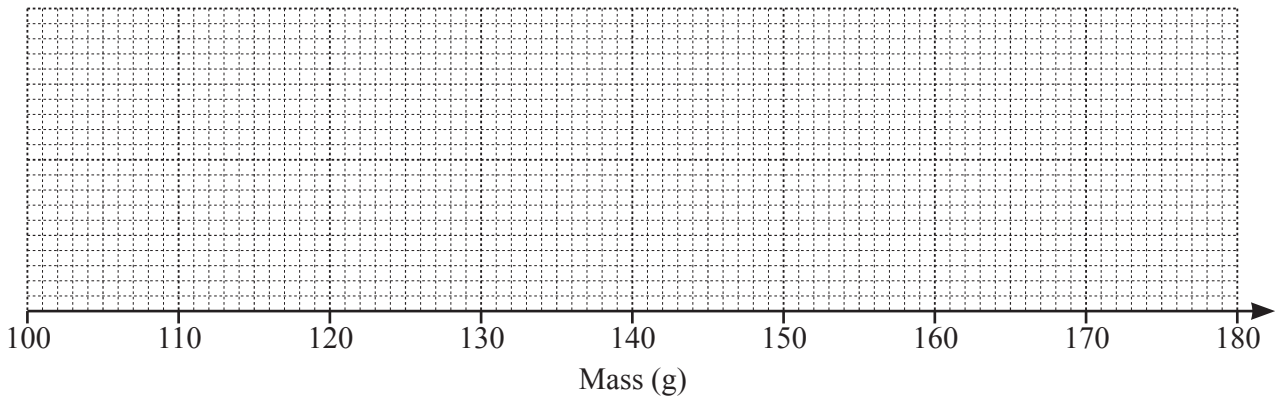
(ii) triangle A onto triangle C .

.....
 [3]

3 (a) Here is some information about the masses of potatoes in a sack:

- The largest potato has a mass of 174 g.
- The range is 69 g.
- The median is 148 g.
- The lower quartile is 121 g.
- The interquartile range is 38 g.

On the grid below, draw a box-and-whisker plot to show this information.



[4]

(b) The table shows the marks scored by some students in a test.

Mark	5	6	7	8	9	10
Frequency	8	2	12	2	0	1

Calculate the mean mark.

..... [3]

- 4 (a) Solve the inequality.

$$3m + 12 \leq 8m - 5$$

..... [2]

- (b) Solve the equation.

$$\frac{2x+5}{3-x} = \frac{14}{15}$$

$x =$ [3]

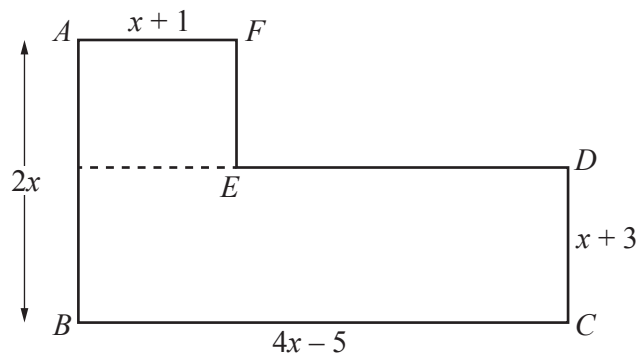
- (c) Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}y &= 4 - x \\x^2 + 2y^2 &= 67\end{aligned}$$

$$x = \dots\dots\dots, y = \dots\dots\dots$$

$$x = \dots\dots\dots, y = \dots\dots\dots [6]$$

5 All the lengths in this question are in centimetres.



NOT TO
SCALE

The diagram shows a shape $ABCDEF$ made from two rectangles.
The total area of the shape is 342 cm^2 .

(a) Show that $x^2 + x - 72 = 0$.

[5]

(b) Solve by factorisation.

$$x^2 + x - 72 = 0$$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

(c) Work out the perimeter of the shape $ABCDEF$.

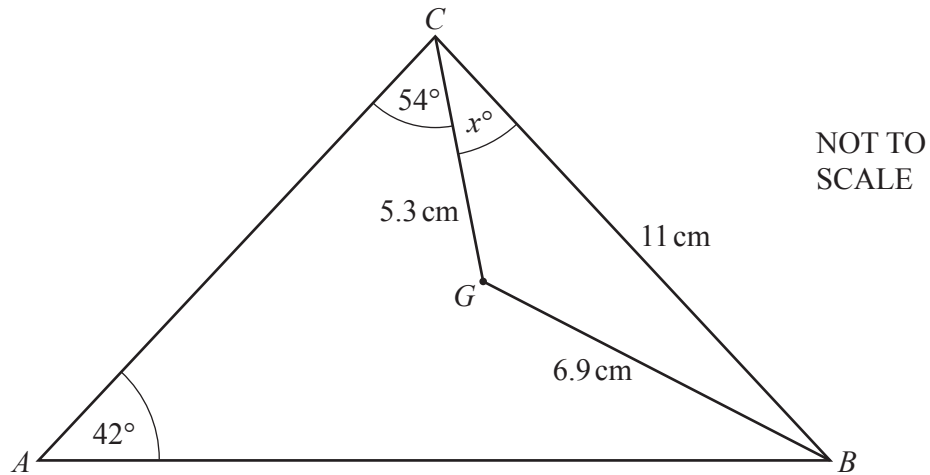
..... cm [2]

(d) Calculate angle DBC .

Angle $DBC =$ [2]

10

6 (a)



The diagram shows triangle ABC with point G inside.
 $CB = 11 \text{ cm}$, $CG = 5.3 \text{ cm}$ and $BG = 6.9 \text{ cm}$.
 Angle $CAB = 42^\circ$ and angle $ACG = 54^\circ$.

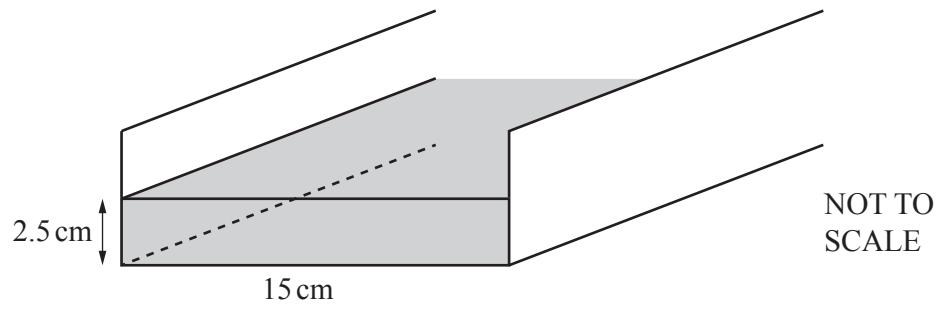
(i) Calculate the value of x .

$x = \dots\dots\dots$ [4]

(ii) Calculate AC .

$AC = \dots\dots\dots \text{ cm}$ [4]

(b)



Water flows at a speed of 20 cm/s along a rectangular channel into a lake.
 The width of the channel is 15 cm.
 The depth of the water is 2.5 cm.

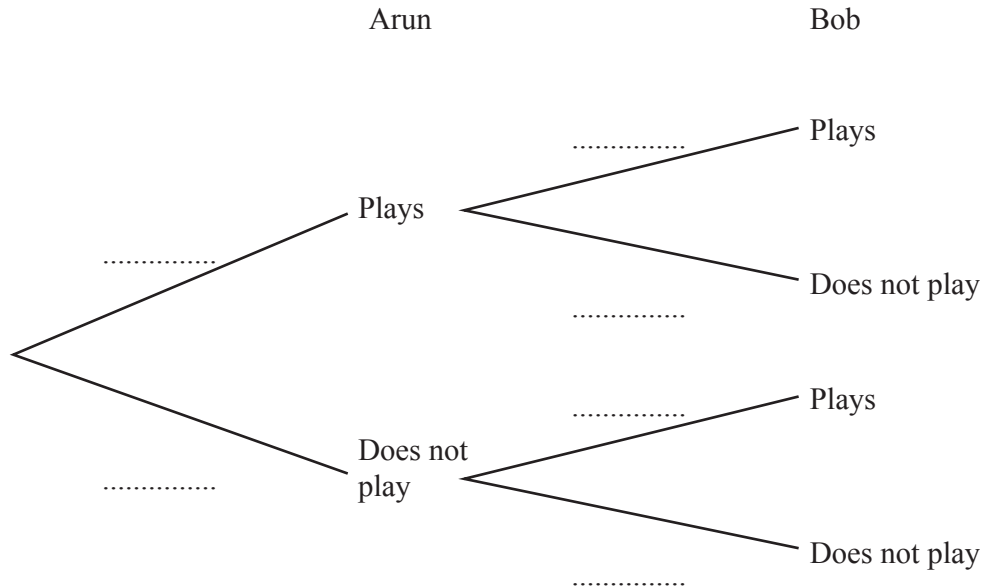
Calculate the amount of water that flows from the channel into the lake in 1 hour.
 Give your answer in litres.

..... litres [4]

7 On any Saturday, the probability that Arun plays football is $\frac{3}{4}$.

On any Saturday, the probability that Bob plays football is $\frac{2}{5}$.

(a) (i) Complete the tree diagram.



[2]

(ii) Calculate the probability that, one Saturday, Arun and Bob both play football.

..... [2]

(iii) Calculate the probability that, one Saturday, either Arun plays football or Bob plays football, but not both.

..... [3]

(b) Calculate the probability that Bob plays football for 2 of the next 3 Saturdays.

..... [3]

(c) When Arun plays football, the probability that he scores the winning goal is $\frac{1}{7}$.

Calculate the probability that Arun scores the winning goal one Saturday.

..... [2]

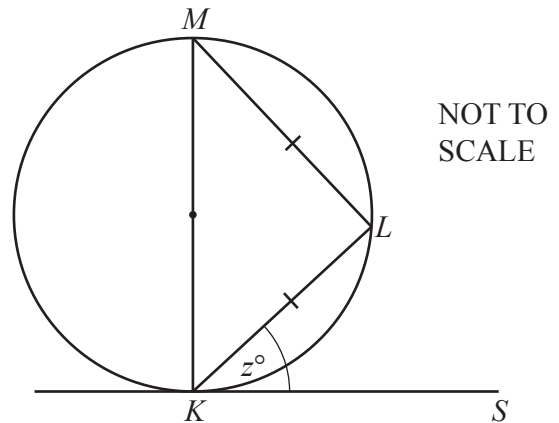
- 8 (a) The interior angle of a regular polygon with n sides is 150° .

Calculate the value of n .

$n = \dots\dots\dots$ [2]

- (b) (i) K, L and M are points on the circle.
 KS is a tangent to the circle at K .
 KM is a diameter and triangle KLM is isosceles.

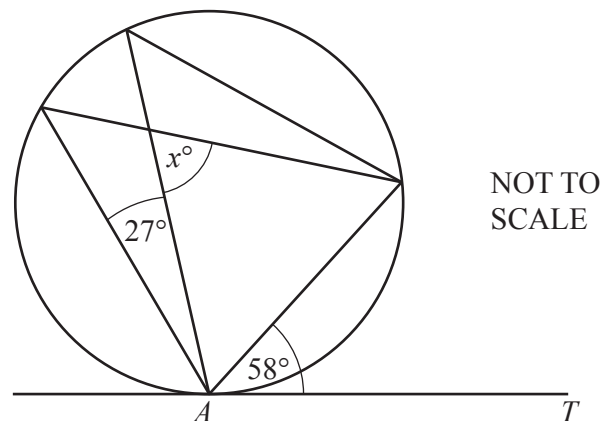
Find the value of z .



$z = \dots\dots\dots$ [2]

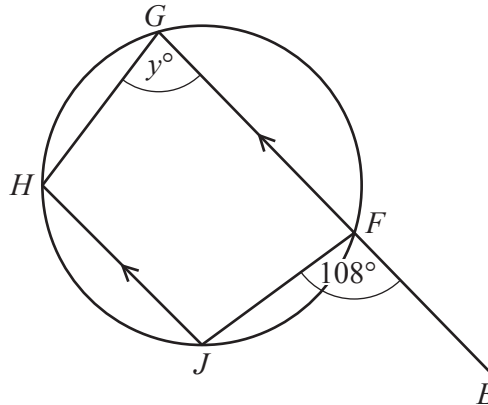
- (ii) AT is a tangent to the circle at A .

Find the value of x .



$x = \dots\dots\dots$ [2]

(iii)



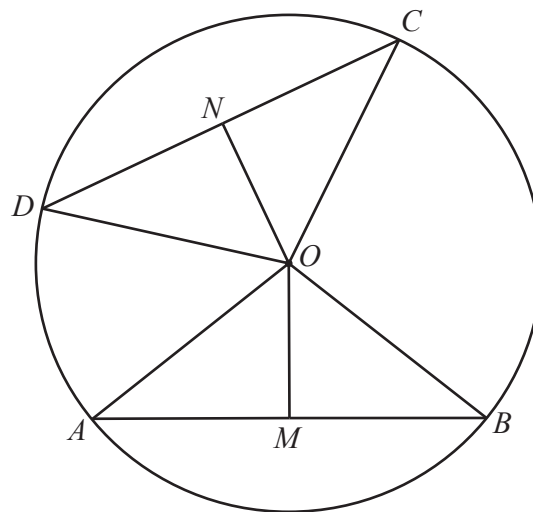
NOT TO
SCALE

F, G, H and J are points on the circle.
 EFG is a straight line parallel to JH .

Find the value of y .

$y = \dots\dots\dots$ [2]

(c)



NOT TO
SCALE

A, B, C and D are points on the circle, centre O .
 M is the midpoint of AB and N is the midpoint of CD .
 $OM = ON$

Explain, giving reasons, why triangle OAB is congruent to triangle OCD .

.....

.....

.....

.....

[3]

16

9 (a) The equation of line L is $3x - 8y + 20 = 0$.

(i) Find the gradient of line L .

..... [2]

(ii) Find the coordinates of the point where line L cuts the y -axis.

(..... , ...) [1]

(b) The coordinates of P are $(-3, 8)$ and the coordinates of Q are $(9, -2)$.

(i) Calculate the length PQ .

..... [3]

(ii) Find the equation of the line parallel to PQ that passes through the point $(6, -1)$.

..... [3]

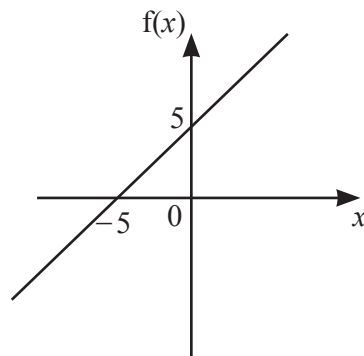
(iii) Find the equation of the perpendicular bisector of PQ .

..... [4]

10 (a) The diagrams show the graphs of two functions.

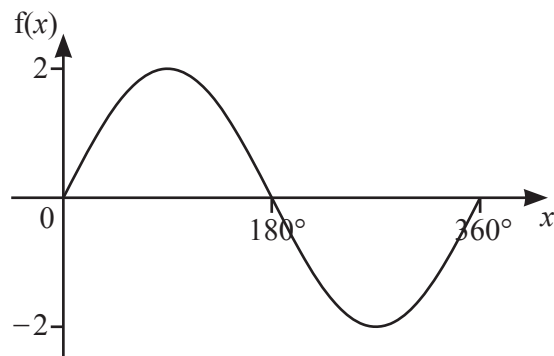
Write down each function.

(i)



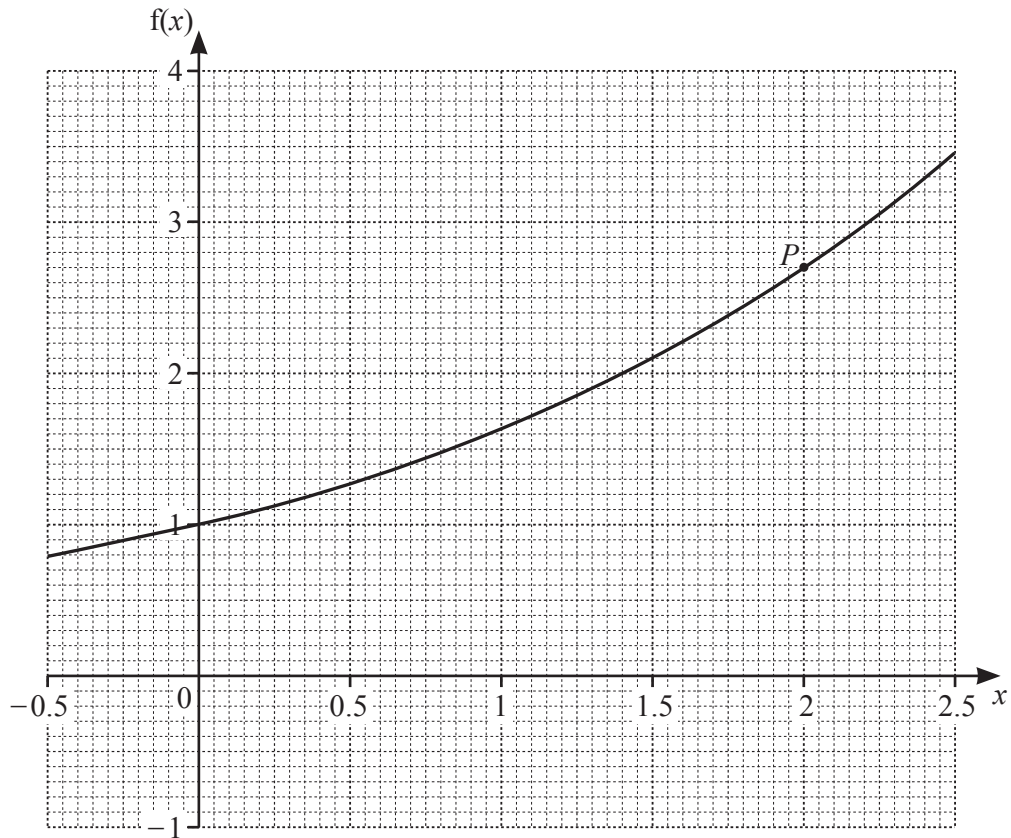
$f(x) = \dots\dots\dots$ [2]

(ii)



$f(x) = \dots\dots\dots$ [2]

(b)



The diagram shows the graph of another function.

By drawing a suitable tangent, find an estimate for the gradient of the function at the point P .

..... [3]

20

11 $f(x) = 7x - 4$ $g(x) = \frac{2x}{x-3}, x \neq 3$ $h(x) = x^2$

(a) Find $g(6)$.

..... [1]

(b) Find $fg(4)$.

..... [2]

(c) Find $fh(x)$.

..... [1]

(d) Find $\frac{f(x)}{2} + g(x)$.

Give your answer as a single fraction, in terms of x , in its simplest form.

..... [3]

(e) Find the value of x when $f(x+2) = -11$.

$x = \dots\dots\dots$ [2]

(f) Find the values of p that satisfy $h(p) = p$.

$\dots\dots\dots$ [2]

12 (a) A curve has equation $y = 4x^3 - 3x + 3$.

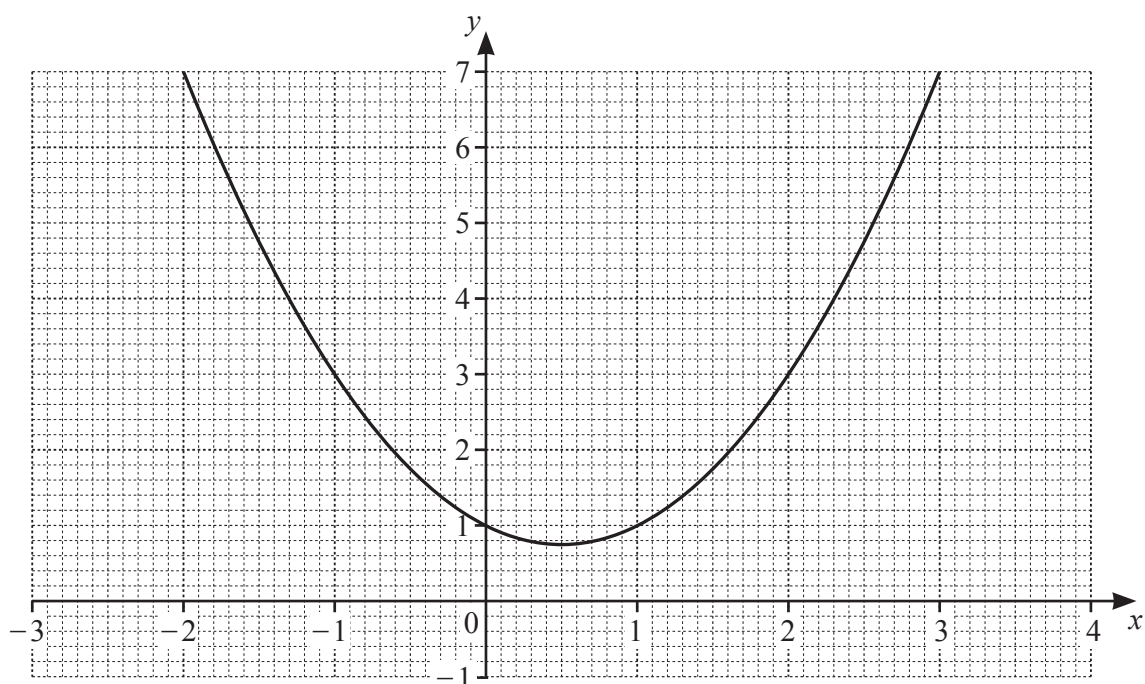
(i) Find the coordinates of the two stationary points.

(..... , ...) and (..... , ...) [5]

(ii) Determine whether each of the stationary points is a maximum or a minimum.
Give reasons for your answers.

[3]

- (b) The graph of $y = x^2 - x + 1$ is shown on the grid.



By drawing a suitable line on the grid, solve the equation $x^2 - 2x - 2 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

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Cambridge IGCSE™

MATHEMATICS

0580/43

Paper 4 (Extended)

May/June 2020

MARK SCHEME

Maximum Mark: 130

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

This document consists of **8** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	1260	2	M1 for $15 \times 54 + 25 \times 18$
1(b)	38 800	2	M1 for $37054 \div \left(1 - \frac{4.5}{100}\right)$ oe
1(c)(i)	15 : 12 : 28	2	M1 for correct attempt to find a common multiple for the women oe
1(c)(ii)	216	3	M2 for $224 \div \text{their } 28 \times \text{their } (15 + 12)$ or M1 for $224 \div \text{their } 28$
1(d)	55.25	2	M1 for $8 + 0.5$ or $6 + 0.5$ seen
1(e)	156 or 156.3...	2	M1 for $\left(1 + \frac{1.5}{100}\right)^{30}$
2(a)(i)	triangle with vertices at (-2, -1) (-8, -1) (-2, -5)	2	B1 for correct reflection in $y = x$
2(a)(ii)	triangle with vertices at (-1, -1) (-1, -7) (3, -7)	2	B1 for translation by $\begin{pmatrix} k \\ -9 \end{pmatrix}$ or $\begin{pmatrix} -2 \\ k \end{pmatrix}$
2(b)(i)	Enlargement [centre] (-7, 8) [sf] $\frac{1}{2}$	3	B1 for each
2(b)(ii)	Rotation [centre] (0, 0) 90° clockwise oe	3	B1 for each
3(a)	correct diagram	4	B1 for median line correctly drawn at 148 B1 for 105 soi B1 for whisker at 159 soi
3(b)	6.48	3	M1 for $(5 \times 8) + (6 \times 2) + (12 \times 7) + \dots$ M1dep for $\text{their } \sum fx \div \text{their } (8 + 2 + 12 + 2 + 0 + 1)$
4(a)	$m \geq 3.4$ oe final answer	2	M1 for $12 + 5 \leq 8m - 3m$ or better or $3m - 8m \leq -5 - 12$ or better

Question	Answer	Marks	Partial Marks
4(b)	$x = -0.75$ oe	3	M1 for $15(2x+5) = 14(3-x)$ B1 for $30x + 75 = 42 - 14x$ or better
4(c)	$3x^2 - 16x - 35 [= 0]$ or $3y^2 - 8y - 51 [= 0]$	M3	M1 for $x^2 + 2(4-x)^2 = 67$ or $(4-y)^2 + 2y^2 = 67$ seen B1 for $16 - 8x + x^2$ or $16 - 8y + y^2$
	$(3x+5)(x-7) [= 0]$ or $(3y-17)(y+3) [= 0]$	M1	or for correct factors for <i>their</i> equation or for correct use of quadratic formula or completing the square for <i>their</i> equation
	$x = 7, y = -3$ $x = -\frac{5}{3}, y = 5\frac{2}{3}$	B2	B1 for $x = 7, x = -\frac{5}{3}$ or for $y = -3, y = 5\frac{2}{3}$ or for a correct pair of x and y values
5(a)	$(4x-5)(x+3) + (x+1)(x-3) = 342$ or $2x(4x-5) - (3x-6)(x-3) = 342$	M2	M1 for $(4x-5)(x+3)$ or $(x+1)(x-3)$ or for $2x(4x-5)$ or $(3x-6)(x-3)$
	$4x^2 + 12x - 5x - 15$ oe and $x^2 + x - 3x - 3$ oe seen OR $8x^2 - 10x$ and $3x^2 - 15x + 18$ seen	M2	M1 for each
	$5x^2 + 5x - 18 = 342$ leading to $x^2 + x - 72 = 0$	A1	no errors or omission
5(b)	$(x+9)(x-8)$	M2	B1 for $(x+a)(x+b)$ where $ab = -72$ or $a+b = 1$ and a, b are integers
	8, -9	B1	
5(c)	86	2	FT for $12 \times \text{their } x - 10$ (x positive) B1 for any one of 27, 11, 16 seen or for $2x + 2x + 4x - 5 + 4x - 5$ oe or better soi
5(d)	22.2 or 22.16 to 22.17	2	M1 for $\tan = \frac{11}{27}$ or $\frac{\text{their } x + 3}{4 \times \text{their } x - 5}$
6(a)(i)	29.5 or 29.50...	4	M2 for $\frac{11^2 + 5.3^2 - 6.9^2}{2 \times 11 \times 5.3}$ or M1 for $6.9^2 = 11^2 + 5.3^2 - 2 \times 11 \times 5.3 \cos x$ A1 for 0.87[0...] oe

Question	Answer	Marks	Partial Marks
6(a)(ii)	13.4 or 13.38...	4	B1FT 84 – <i>their</i> (a)(i) M2 for $\frac{11}{\sin 42} \times \sin$ <i>their</i> 54.5 or M1 for implicit form
6(b)	2700	4	M2 for $15 \times 2.5 \times 20 \times 60 \times 60$ or M1 for $15 \times 2.5 \times 20$ M1 for <i>their</i> volume $\div 1000$ If 0 scored, SC1 for figs 27 with no working
7(a)(i)	$\frac{3}{4}, \frac{1}{4}, \frac{2}{5}, \frac{3}{5}, \frac{2}{5}, \frac{3}{5}$	2	B1 for one correct pair
7(a)(ii)	$\frac{3}{10}$ oe	2	FT <i>their</i> tree diagram M1 for $\frac{3}{4} \times \frac{2}{5}$
7(a)(iii)	$\frac{11}{20}$ oe	3	M2 for $\frac{3}{4} \times \frac{3}{5} + \frac{1}{4} \times \frac{2}{5}$ or M1 for $\frac{3}{4} \times \frac{3}{5}$ or $\frac{1}{4} \times \frac{2}{5}$
7(b)	$\frac{36}{125}$ oe	3	M2 for $\left(\frac{2}{5}\right)^2 \times \frac{3}{5} \times 3$ oe or M1 for $\left(\frac{2}{5}\right)^2 \times \frac{3}{5}$
7(c)	$\frac{3}{28}$ oe	2	M1 for $\frac{3}{4} \times \frac{1}{7}$
8(a)	12	2	M1 for $150 = \frac{(n-2) \times 180}{n}$ or $\frac{360}{180-150}$ oe
8(b)(i)	45	2	B1 for angles at <i>M</i> or <i>K</i> = 45 or angle at <i>L</i> = 90
8(b)(ii)	85	2	B1 for either angle in alt segment = 58
8(b)(iii)	72	2	B1 for either angle at <i>J</i> or <i>H</i> = 108 or angle at <i>F</i> = 72
8(c)	$OA = OB = OC = OD$ Radii	B1	
	$AB = CD$ chords equidistant from centre are equal	B1	
	SSS implies congruent	B1	

Question	Answer	Marks	Partial Marks
9(a)(i)	$\frac{3}{8}$	2	M1 for $8y = 3x + 20$ or better
9(a)(ii)	(0, 2.5) oe	1	
(b)(i)	15.6 or 15.62...	3	M2 for $\sqrt{(9-3)^2 + (-2-8)^2}$ oe seen or M1 for $(9-3)^2$ or $(-2-8)^2$ oe seen
9(b)(ii)	$y = -\frac{5}{6}x + 4$ oe	3	M1 for gradient $\frac{-2-8}{9-3}$ oe M1 for substituting (6, -1) into a linear equation oe
9(b)(iii)	$y = \frac{6}{5}x - \frac{3}{5}$ oe	4	M1 for gradient -1 / <i>their</i> $\left(-\frac{5}{6}\right)$ B1 for midpoint at (3, 3) M1 for <i>their</i> midpoint substituted into $y = \text{their } m \times x + c$ oe
10(a)(i)	$x + 5$	2	B1 for linear equation with positive gradient or intercept 5
10(a)(ii)	$2 \sin x$ oe	2	B1 for recognition of sin or $\cos(x - 90)$
10(b)	tangent ruled at P	B1	
	1.3 to 1.4	B2	dep on tangent drawn M1 for rise/run
11(a)	4	1	
11(b)	52	2	M1 for $f(8)$ seen or $7 \times \frac{2x}{x-3} - 4$
11(c)	$7x^2 - 4$	1	
11(d)	$\frac{7x^2 - 21x + 12}{2(x-3)}$ or $\frac{7x^2 - 21x + 12}{2x-6}$ final answer	3	M1 for $(7x-4)(x-3) + 2 \times 2x$ B1 for denominator $2(x-3)$ or $2x-6$
11(e)	-3	2	M1 for $7x + 14 - 4 = -11$
11(f)	$[p =] 0$ and $[p =] 1$	2	B1 for each
12(a)(i)	$\left(-\frac{1}{2}, 4\right)$ and $\left(\frac{1}{2}, 2\right)$	5	B2 for $12x^2 - 3[=0]$ or B1 for $12x^2$ or -3 M1 for their derivative $= 0$ or $dy/dx = 0$ B1 for $[x =] -\frac{1}{2}$ and $\frac{1}{2}$ or one coordinate pair correct

Question	Answer	Marks	Partial Marks
12(a)(ii)	$\left(-\frac{1}{2}, 4\right)$ Max with reason $\left(\frac{1}{2}, 2\right)$ Min with reason	3	B2 for one correct with reason or M1 for correct attempt to find e.g. 2nd derivative/gradients/sketch
12(b)	line $y = x + 3$ ruled	M2	B1 for $[y =]x + 3$ identified or rules $y = x + k$ or $y = px + 3$
	-0.7 to -0.8 2.7 to 2.8	A1	



Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/22**

Paper 2 (Extended)

February/March 2020**1 hour 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages. Blank pages are indicated.

2

1 3.56 5 $\sqrt{196}$ 8 $\sqrt{7}$ 12

From the list, write down a number that is

(a) a multiple of 3,

..... [1]

(b) a cube number,

..... [1]

(c) a prime number,

..... [1]

(d) an irrational number.

..... [1]

2 The number of people swimming in a pool is recorded each day for 12 days.

24 28 13 38 15 26
45 21 48 36 18 38

(a) Complete the stem-and-leaf diagram.

1	
2	
3	
4	

Key: 1 | 3 represents 13 swimmers

[2]

(b) Find the median number of swimmers.

..... [1]

3

- 3 Point A has coordinates $(6, 4)$ and point B has coordinates $(2, 7)$.

Write $\overrightarrow{AB}$ as a column vector.

$$\overrightarrow{AB} = \begin{pmatrix} \\ \end{pmatrix} \quad [1]$$

- 4 Find the interior angle of a regular polygon with 24 sides.

..... [2]

- 5 **Without using a calculator**, work out $\frac{15}{28} \div \frac{4}{7}$.

You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

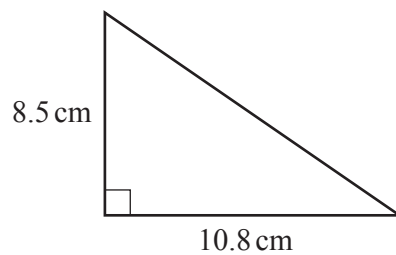
- 6 The table shows the marks scored by 40 students in a test.

Mark	5	6	7	8	9	10
Frequency	8	5	11	7	5	4

Calculate the mean mark.

..... [3]

7



NOT TO
SCALE

The diagram shows a right-angled triangle.

- (a) Calculate the area.

..... cm^2 [2]

- (b) Calculate the perimeter.

..... cm [3]

5

- 8 Calculate the value of $(2.3 \times 10^{-3}) + (6.8 \times 10^{-4})$.
Give your answer in standard form.

..... [1]

- 9 (a) Factorise completely.

$$3x^2 - 12xy$$

..... [2]

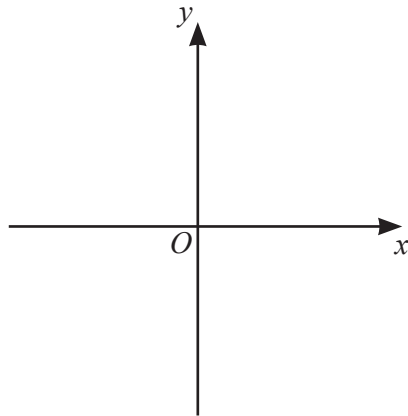
- (b) Expand and simplify.

$$(m - 3)(m + 2)$$

..... [2]

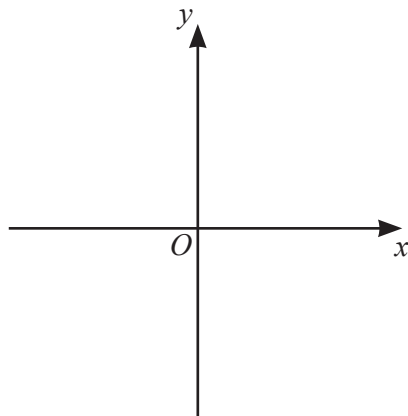
10 Sketch the graph of each function.

(a) $y = x - 3$



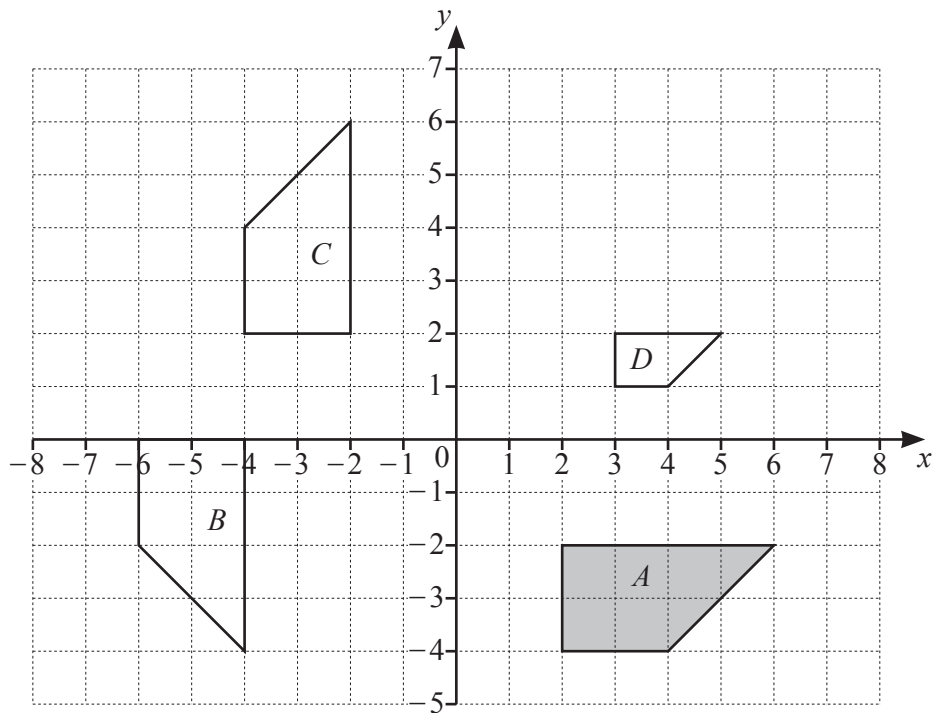
[1]

(b) $y = \frac{1}{x}$



[2]

11



Describe fully the **single** transformation that maps

(a) shape *A* onto shape *B*,

.....
 [3]

(b) shape *A* onto shape *C*,

.....
 [2]

(c) shape *A* onto shape *D*.

.....
 [3]

- 12 The population of a town decreases exponentially at a rate of 1.7% per year.
The population now is 250 000.

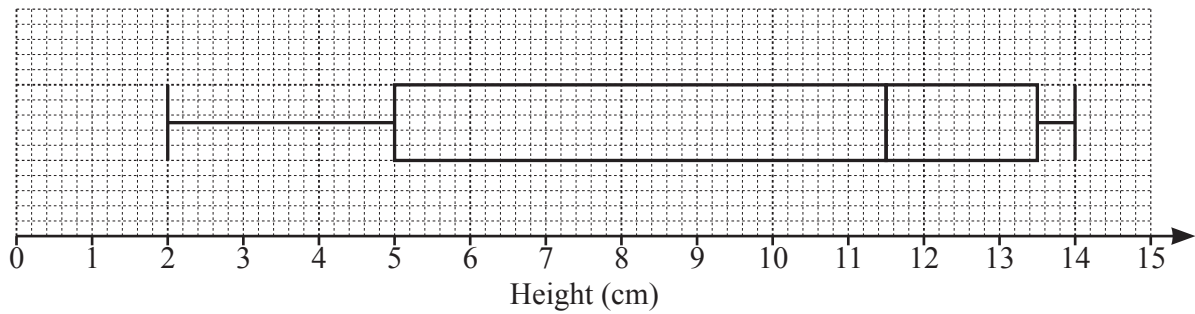
Calculate the population at the end of 5 years.
Give your answer correct to the nearest hundred.

..... [3]

- 13 Write the recurring decimal $0.2\dot{6}$ as a fraction.
You must show all your working.

..... [2]

- 14 The box-and-whisker plot gives information about the heights, in centimetres, of some plants.



- (a) Write down the median.

..... cm [1]

- (b) Find

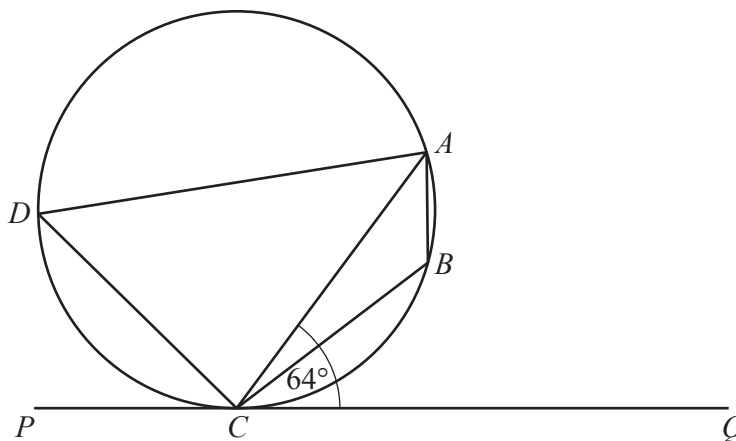
- (i) the range,

..... cm [1]

- (ii) the interquartile range.

..... cm [1]

15



NOT TO
SCALE

A, B, C and D lie on the circle.
 PCQ is a tangent to the circle at C .
 Angle $ACQ = 64^\circ$.

Work out angle ABC , giving reasons for your answer.

Angle $ABC =$ because

.....

..... [3]

- 16** Solve the simultaneous equations.
You must show all your working.

$$\begin{aligned}x &= 7 - 3y \\ x^2 - y^2 &= 39\end{aligned}$$

$$x = \dots\dots\dots y = \dots\dots\dots$$

$$x = \dots\dots\dots y = \dots\dots\dots [6]$$

- 17** A is the point $(3, 5)$ and B is the point $(1, -7)$.

Find the equation of the line perpendicular to AB that passes through the point A .
Give your answer in the form $y = mx + c$.

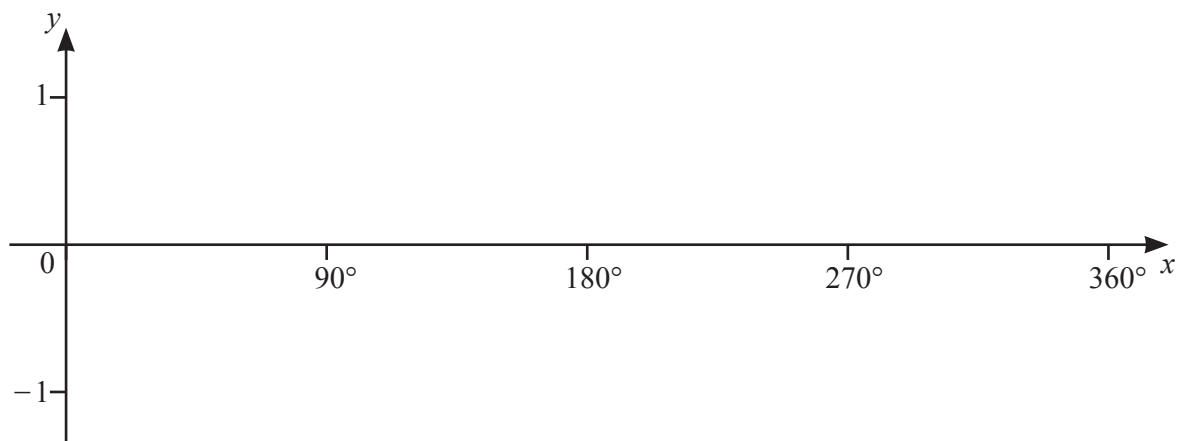
$$y = \dots\dots\dots [4]$$

- 18** A car travels at a constant speed.
It travels a distance of 146.2 m, correct to 1 decimal place.
This takes 7 seconds, correct to the nearest second.

Calculate the upper bound for the speed of the car.

..... m/s [3]

19



- (a) On the diagram, sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$. [2]
- (b) Solve the equation $4 \cos x + 2 = 3$ for $0^\circ \leq x \leq 360^\circ$.

$x = \dots\dots\dots$ and $x = \dots\dots\dots$ [3]

Questions 20 and 21 are printed on the next page.

20 $x^2 - 12x + a = (x + b)^2$

Find the value of a and the value of b .

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots [2]$$

21 $\overrightarrow{XY} = 3\mathbf{a} + 2\mathbf{b}$ and $\overrightarrow{ZY} = 6\mathbf{a} + 4\mathbf{b}$.

Write down two statements about the relationship between the points X , Y and Z .

1

2 [2]

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Cambridge IGCSE™

MATHEMATICS

0580/22

Paper 2 (Extended)

March 2020

MARK SCHEME

Maximum Mark: 70

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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This document consists of 7 printed pages.

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- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

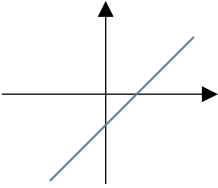
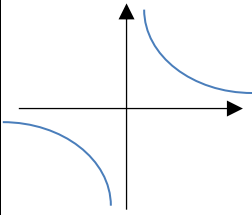
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

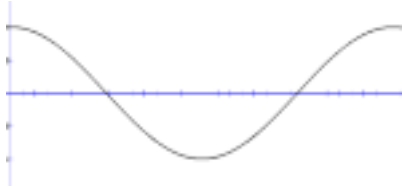
Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	12	1	
1(b)	8	1	
1(c)	5	1	
1(d)	$\sqrt{7}$	1	
2(a)	$\begin{array}{c ccc} 1 & 3 & 5 & 8 \\ 2 & 1 & 4 & 6 \\ 3 & 6 & 8 & 8 \\ 4 & 5 & 8 & \end{array}$	2	M1 for correct but not ordered or for two correct rows ordered
2(b)	27	1	
3	$\begin{pmatrix} -4 \\ 3 \end{pmatrix}$	1	
4	165	2	M1 for $\frac{(24-2) \times 180}{24}$ or $180 - \frac{360}{24}$
5	$\frac{15}{28} \times \frac{7}{4}$ or $\frac{15}{28} \div \frac{16}{28}$ oe	M1	
	$\frac{15}{16}$ cao	A2	A1 for $\frac{105}{112}$ oe
6	7.2	3	M1 for $5 \times 8 + 6 \times 5 + 7 \times 11 + 8 \times 7 + 9 \times 5 + 10 \times 4$ M1dep for $\div 40$
7(a)	45.9	2	M1 for $0.5 \times 8.5 \times 10.8$ oe
7(b)	33[.0] or 33.04...	3	M2 for $8.5 + 10.8 + \sqrt{8.5^2 + 10.8^2}$ oe or M1 for $8.5^2 + 10.8^2$ oe
8	2.98×10^{-3}	1	
9(a)	$3x(x - 4y)$ final answer	2	B1 for $3(x^2 - 4xy)$ or $x(3x - 12y)$

Question	Answer	Marks	Partial Marks
9(b)	$m^2 - m - 6$ final answer	2	M1 for 3 terms from $m^2, -3m, +2m, -6$
10(a)	Correct sketch 	1	Line with positive gradient and negative y intercept
10(b)	Correct sketch 	2	B1 for only one branch or attempt at correct shape
11(a)	Rotation 90° clockwise oe (0, 2)	3	B1 for each
11(b)	Reflection $y = x$	2	B1 for each
11(c)	Enlargement [sf] $\frac{1}{2}$ (4, 6)	3	B1 for each
12	229 500 cao	3	B2 for 229 460... OR M1 for $250\,000 \times \left(1 - \frac{1.7}{100}\right)^5$ oe B1 for <i>their</i> more accurate answer correctly rounded to the nearest 100
13	$2.\dot{6} - 0.2\dot{6}$ oe	M1	
	$\frac{4}{15}$ oe fraction nfw	A1	If M0 scored SC1 for $\frac{k}{90}$
14(a)	11.5	1	
14(b)(i)	12	1	
14(b)(ii)	8.5	1	

Question	Answer	Marks	Partial Marks
15	116°	B1	
	alternate segment theorem	B1	
	angles in opposite segments are supplementary or cyclic quadrilateral or angles at a point on a straight line	B1	
16	$8y^2 - 42y + 10 [= 0]$ or $8x^2 + 14x - 400 [= 0]$	M3	M1 for $(7 - 3y)^2 - y^2 = 39$ oe or $x^2 - \left(\frac{7-x}{3}\right)^2 = 39$ oe M1 for $49 - 21y - 21y + 9y^2$ or better or $49 - 7x - 7x + x^2$ or better or for correct expansion of their quadratic binomial
	$(8y - 2)(y - 5) [= 0]$ oe $(8x - 50)(x + 8) [= 0]$ oe	M1	M1 for correct method to solve <i>their</i> quadratic equation e.g. factors, quadratic formula, completing the square
	$x = 6.25$ oe $y = 0.25$ oe $x = -8$ $y = 5$	B2	B1 for $x = 6.25$, $x = -8$ or for $y = 0.25$, $y = 5$ or for a correct pair of x and y values
17	$[y =] -\frac{1}{6}x + \frac{11}{2}$ oe	4	M1 for [gradient of $AB =] \frac{5 - -7}{3 - 1}$ oe M1 for [gradient of perpendicular =] $-\frac{1}{\text{their grad } AB}$ M1 for substituting (3, 5) in <i>their</i> linear equation
18	22.5 nfww	3	M2 for $\frac{146.2 + 0.05}{7 - 0.5}$ or M1 for $146.2 + 0.05$ or $7 - 0.5$ or better seen
19(a)	Correct sketch 	2	Needs all three features for 2 marks: • Correct curve shape • Maximum at (0, 1) and at (360, 1) and minimum at (180, -1) • Passing through (90, 0) and (270, 0) only B1 for two correct features

Question	Answer	Marks	Partial Marks
19(b)	75.5 or 75.52... and 284.4 to 284.5	3	B2 for one correct or M1 for $\cos x = \frac{1}{4}$ oe If 0 scored, SC1 for two answers with a sum of 360
20	$[a =] 36$ $[b =] - 6$	2	B1 for each or SC1 for correct answers reversed
21	X, Y and Z are collinear oe	1	Allow in a straight line
	X is the midpoint of ZY oe	1	Allow e.g. $ZY = 2XY$, $ZX = XY$ oe



Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS**0580/42**

Paper 4 (Extended)

February/March 2020**2 hours 30 minutes**

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

1 Dhanu has a model railway.

- (a) He has a train that consists of a locomotive and 4 coaches.
The mass of the locomotive is 87 g and the mass of each coach is 52 g.

(i) Work out the total mass of the train.

..... g [2]

(ii) Work out the mass of the locomotive as a percentage of the total mass of the train.

..... % [1]

- (b) The train is 61 cm long and travels at a speed of 18 cm/s.
It takes 4 seconds for the whole of the train to cross a bridge.

Calculate the length of the bridge.

..... cm [2]

- (c) A new locomotive costs \$64.

Calculate the cost of the locomotive in rupees when the exchange rate is 1 rupee = \$0.0154 .
Give your answer correct to the nearest 10 rupees.

..... rupees [2]

- (d) The cost of a railway magazine increases by 12.5% to \$2.70 .

Calculate the cost of the magazine before this increase.

\$ [2]

- (e) Dhanu plays with his model railway from 06 50 to 11 15.
He then rides his bicycle for 3 hours.

Find the ratio time playing with model railway : time riding bicycle.
Give your answer in its simplest form.

..... : [3]

- (f) The value of Dhanu's model railway is \$550.
This value increases exponentially at a rate of $r\%$ per year.
At the end of 5 years the value will be \$736.

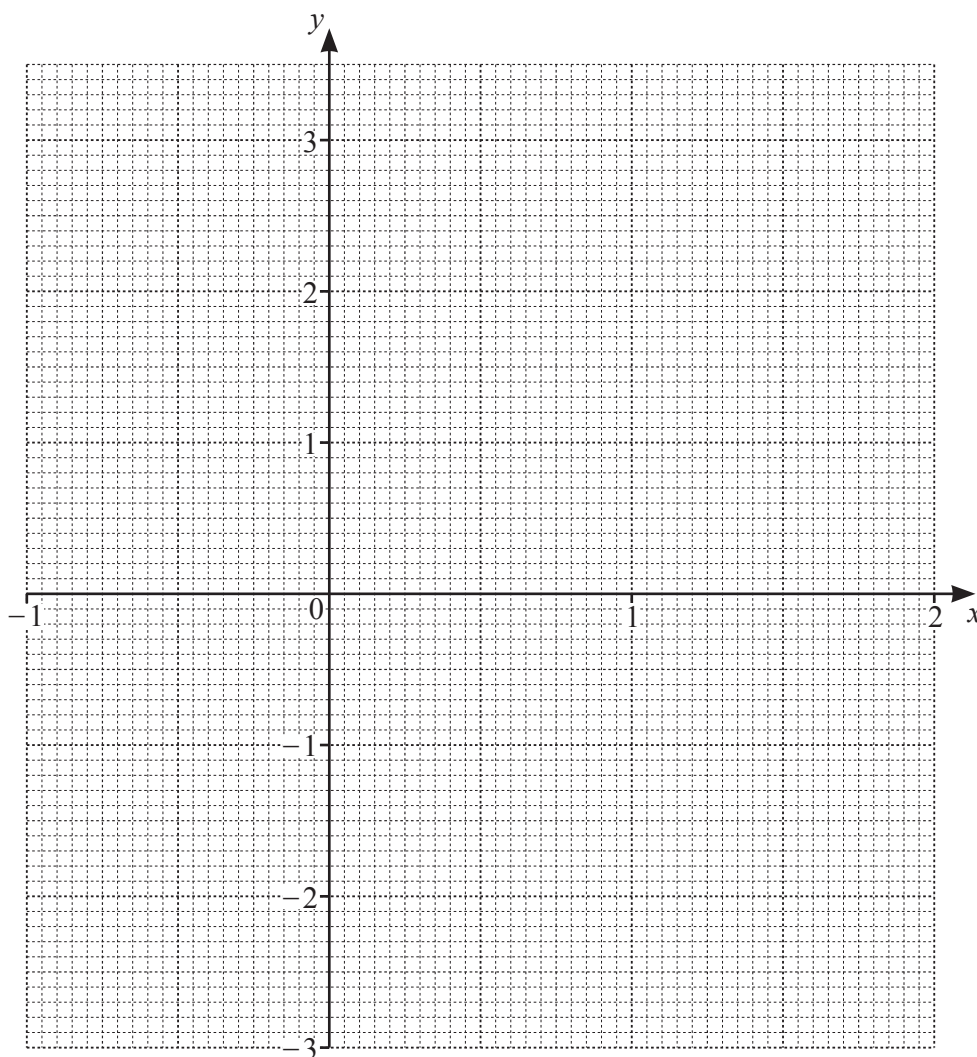
Calculate the value of r .

$r =$ [3]

- 2 (a) The table shows some values for $y = 2x^3 - 4x^2 + 3$.

x	-1	-0.5	0	0.5	1	1.5	2
y	-3	1.75				0.75	3

- (i) Complete the table. [3]
- (ii) On the grid, draw the graph of $y = 2x^3 - 4x^2 + 3$ for $-1 \leq x \leq 2$.



- (iii) Use your graph to solve the equation $2x^3 - 4x^2 + 3 = 1.5$.

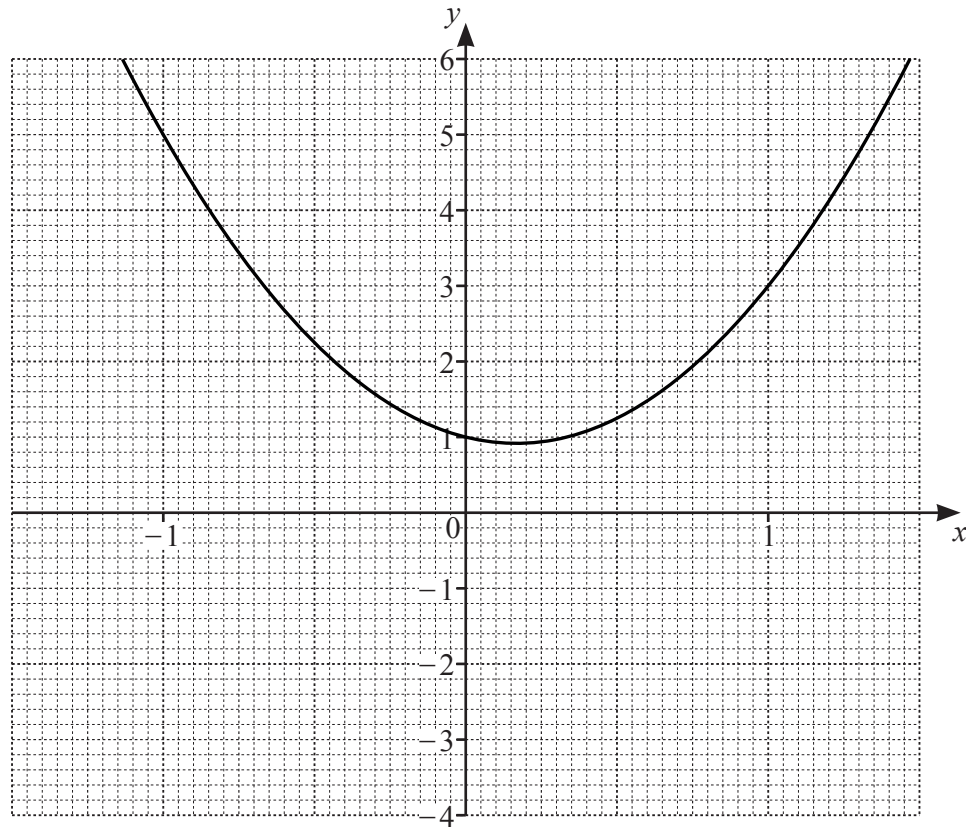
$x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

- (iv) The equation $2x^3 - 4x^2 + 3 = k$ has only one solution for $-1 \leq x \leq 2$.

Write down a possible integer value of k .

$\dots\dots\dots$ [1]

(b)



(i) On the grid, draw the tangent to the curve at $x = 1$. [1]

(ii) Use your tangent to estimate the gradient of the curve at $x = 1$.

..... [2]

(iii) Write down the equation of your tangent in the form $y = mx + c$.

$y =$ [2]

- 3 (a) Manjeet uses 220 litres of water each day.
She reduces the amount of water she uses by 15%.

Calculate the number of litres of water she now uses each day.

..... litres [2]

- (b) Manjeet has two mathematically similar bottles in her bathroom.
The large bottle holds 1.35 litres and is 29.7 cm high.
The small bottle holds 0.4 litres.

Calculate the height of the small bottle.

..... cm [3]

- (c) Water from Manjeet's shower flows at a rate of 12 litres per minute.
The water from the shower flows into a tank that is a cuboid of length 90 cm and width 75 cm.

Calculate the increase in the level of water in the tank when the shower is used for 7 minutes.

..... cm [3]

4 A solid metal cone has radius 1.65 cm and slant height 4.70 cm.

(a) Calculate the **total** surface area of the cone.

[The curved surface area, A , of a cone with radius r and slant height l is $A = \pi rl$.]

..... cm^2 [2]

(b) Find the angle the slant height makes with the base of the cone.

..... [2]

(c) (i) Calculate the volume of the cone.

[The volume, V , of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [4]

(ii) A metal sphere with radius 5 cm is melted down to make cones identical to this one.

Calculate the number of complete identical cones that are made.

[The volume, V , of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... [4]

- 5 (a) Write as a single fraction in its simplest form.

$$\frac{x+3}{x-3} - \frac{x-2}{x+2}$$

..... [4]

(b) $2^{12} \div 2^{\frac{k}{2}} = 32$

Find the value of k .

$k =$ [2]

(c) Expand and simplify.

$$(y+3)(y-4)(2y-1)$$

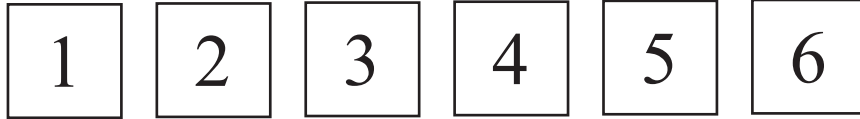
..... [3]

(d) Make x the subject of the formula.

$$x = \frac{3+x}{y}$$

$x =$ [3]

- 6 Suleika has six cards numbered 1 to 6.



- (a) She takes one card at random, records the number and replaces the card.

- (i) Write down the probability that the number is 5 or 6.

..... [1]

- (ii) Suleika does this 300 times.

Find how many times she expects the number 5 or 6.

..... [1]

- (b) Suleika takes two cards at random, without replacement.

- (i) Find the probability that the sum of the numbers on the two cards is 5.

..... [3]

- (ii) Find the probability that at least one of the numbers on the cards is a square number.

..... [3]

- 7 (a) Naga has n marbles.
 Panav has three times as many marbles as Naga.
 Naga loses 5 marbles and Panav buys 10 marbles.
 Together they now have more than 105 marbles.

Write down and solve an inequality in n .

..... [3]

- (b) y is inversely proportional to x^2 .
 When $x = 4$, $y = 7.5$.

Find y when $x = 5$.

$y =$ [3]

- (c) Find the n th term of each sequence.

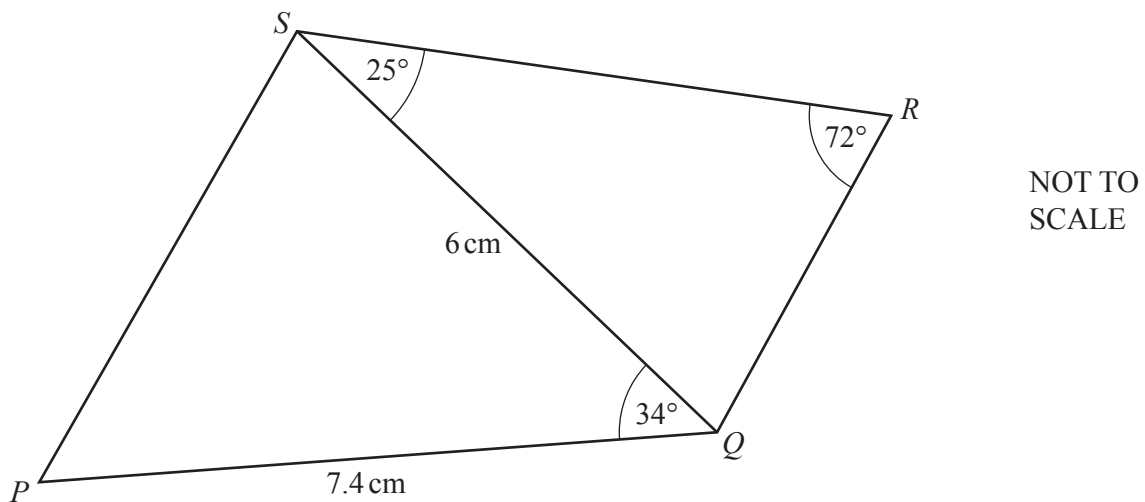
(i) 4 2 0 -2 -4 ...

..... [2]

(ii) 1 7 17 31 49 ...

..... [2]

8 (a)



The diagram shows a quadrilateral $PQRS$ formed from two triangles, PQS and QRS .

Calculate

(i) QR ,

$QR = \dots\dots\dots\text{ cm}$ [3]

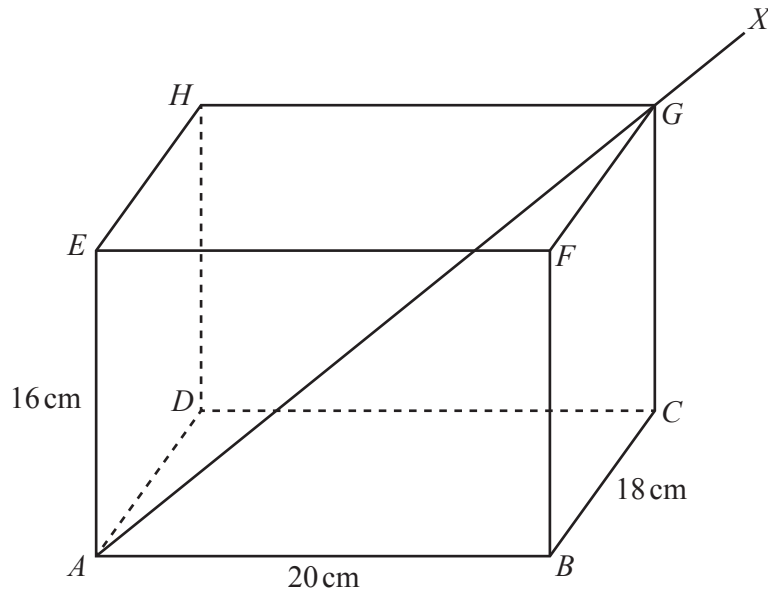
(ii) PS ,

$PS = \dots\dots\dots\text{ cm}$ [3]

(iii) the area of quadrilateral $PQRS$.

$\dots\dots\dots\text{ cm}^2$ [4]

(b)

NOT TO
SCALE

The diagram shows an open box $ABCDEFGH$ in the shape of a cuboid.

$AB = 20$ cm, $BC = 18$ cm and $AE = 16$ cm.

A thin rod AGX rests partly in the box as shown.

The rod is 40 cm long.

(i) Calculate GX , the length of the rod which is outside the box.

$GX = \dots\dots\dots$ cm [4]

(ii) Calculate the angle the rod makes with the base of the box.

$\dots\dots\dots$ [3]

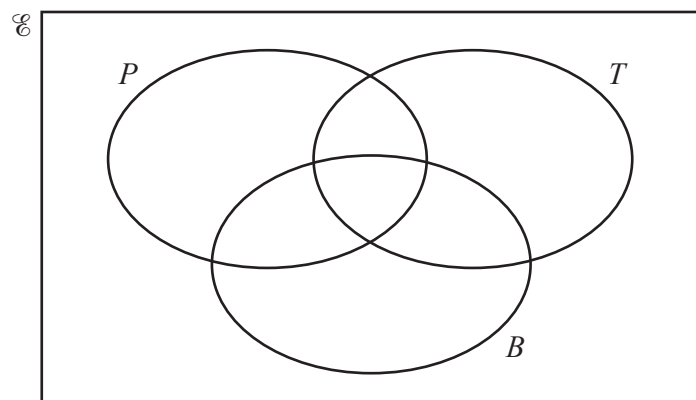
- 9 This year, 40 students have each travelled by one or more of plane (P), train (T) or boat (B).

- 7 have travelled only by plane.
 11 have travelled only by train.
 9 have travelled only by boat.

$$n(P \cap T) = 8$$

$$n(B \cap T) = 3$$

$$n(B \cap P) = 6$$



- (a) Complete the Venn diagram.

[3]

- (b) Find $n((P \cup B)')$.

..... [1]

- (c) Use set notation to complete the statement.

$$(P \cup T \cup B)' = \dots\dots\dots$$

[1]

- (d) Two students are chosen at random.

Calculate the probability that they both have travelled only by plane.

..... [2]

- (e) Two students are chosen at random from those who have travelled by train.

Calculate the probability that they both have also travelled by plane.

..... [2]

10

$$f(x) = 4x - 1$$

$$g(x) = x^2$$

$$h(x) = 3^{-x}$$

(a) Find in its simplest form

(i) $f(x-3)$,

..... [1]

(ii) $g(5x)$.

..... [1]

(b) Find $f^{-1}(x)$.

$$f^{-1}(x) = \dots\dots\dots [2]$$

(c) Find the value of $hh(1)$, correct to 4 significant figures.

..... [3]

(d) (i) Show that $g(3x-2) - h(-3)$ can be written as $9x^2 - 12x - 23$.

[2]

(ii) Use the quadratic formula to solve $9x^2 - 12x - 23 = 0$.
Give your answers correct to 2 decimal places.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [4]

(e) Find x when $f(61) = h(x)$.

$x = \dots\dots\dots$ [2]

11 A curve has equation $y = x^3 - 3x + 4$.

(a) Work out the coordinates of the two stationary points.

(..... , ...)

(..... , ...) [5]

(b) Determine whether each stationary point is a maximum or a minimum.
Give reasons for your answers.

[3]

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Cambridge IGCSE™

MATHEMATICS

0580/42

Paper 4 (Extended)

March 2020

MARK SCHEME

Maximum Mark: 130

Published

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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Maths-Specific Marking Principles	
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.
3	Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.
4	Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).
5	Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.
6	Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

Abbreviations

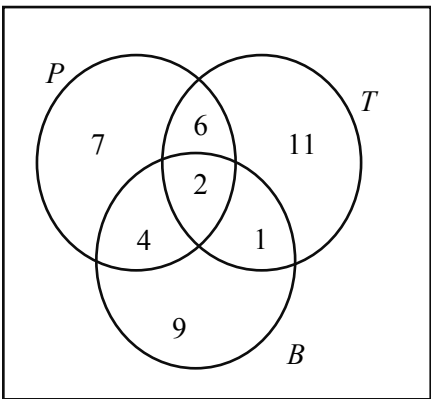
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	295	2	M1 for $[87 +] 4 \times 52$ oe
1(a)(ii)	29.5 or 29.49...	1	FT $\frac{87}{their(a)(i)} \times 100$
1(b)	11	2	M1 for $18 \times 4 [\pm 61]$ oe
1(c)	4160 cao nfww	2	M1 for $64 \div 0.0154$ or B1 for rounding <i>their</i> answer to nearest 10
1(d)	2.4[0] nfww	2	M1 for $\left(1 + \frac{12.5}{100}\right)x = 2.7[0]$ oe
1(e)	53 : 36	3	M2 for $265 : 180$ oe or for answer $36 : 53$ or 53 min: 36 min or M1 for 4h 25 [mins] or 265 [mins] seen
1(f)	6[.00] or 5.999...	3	M2 for $\sqrt[5]{\frac{736}{550}}$ or M1 for $736 = 550 \times (x)^5$
2(a)(i)	3 2.25 1	3	B1 for each
2(a)(ii)	Fully correct smooth curve	4	B3FT for 7 or 6 correct plots B2FT for 5 or 4 correct plots B1FT for 3 correct plots
2(a)(iii)	–0.6 to –0.51, 0.75 to 0.85, 1.7 to 1.85	3	B1 for each If 0 scored, SC1 for $y = 1.5$ drawn
2(a)(iv)	–3 or –2 or –1 or 0	1	
2(b)(i)	Tangent ruled at $x = 1$	1	
2(b)(ii)	4.4 to 5.6	2	Dep on tangent at $x = 1$ or close attempt M1 for rise/run for <i>their</i> line

Question	Answer	Marks	Partial Marks
2(b)(iii)	$y = (4.4 \text{ to } 5.6)x - (1.8 \text{ to } 2.2)$ or [y =] <i>their</i> (b)(ii) $x + \text{their}(y\text{-intercept})$	2	FT for any line but not horizontal or vertical line for 2 marks or B1 B1FT for $[m =] \text{their } 5$ or for <i>their</i> y -intercept
3(a)	187	2	M1 for $220 \times \left(1 - \frac{15}{100}\right)$ oe or B1 for 33 seen
3(b)	19.8	3	M2 for $29.7 \times \sqrt[3]{\frac{0.4}{1.35}}$ oe or M1 for $\sqrt[3]{\frac{0.4}{1.35}}$ or $\sqrt[3]{\frac{1.35}{0.4}}$ oe seen or for $\frac{29.7^3}{x^3} = \frac{1.35}{0.4}$ oe
3(c)	12.4 or 12.44...	3	M1 for $90 \times 75 \times h = 7 \times \text{figs } 12$ B1 for $1000 \text{ cm}^3 = 1 \text{ litre}$ soi
4(a)	32.9 or 32.91 to 32.92...	2	M1 for $\pi \times 1.65 \times 4.7 + \pi \times 1.65^2$
4(b)	69.4 or 69.44 to 69.45	2	M1 for $\cos = 1.65 \div 4.7$ oe
4(c)(i)	12.5 or 12.54 to 12.55	4	M3 for $\frac{1}{3} \times \pi \times 1.65^2 \times \sqrt{4.7^2 - 1.65^2}$ oe or M2 for $\sqrt{4.7^2 - 1.65^2}$ oe or for $4.7 \times \sin(\text{their } \mathbf{(b)})$ oe or M1 for $1.65^2 + h^2 = 4.7^2$ oe or for $\frac{h}{4.7} = \sin(\text{their } \mathbf{(b)})$ oe
4(c)(ii)	41 nfw	4	B3 for 41.7... to 41.9 or M2 for $\frac{4}{3} \times \pi \times 5^3 \div \text{their } 12.5$ or M1 for $\frac{4}{3} \times \pi \times 5^3$ After M2 scored, M1 for truncating <i>their</i> decimal number of cones seen to an integer answer
5(a)	$\frac{10x}{(x-3)(x+2)}$ or $\frac{10x}{x^2 - x - 6}$ final answer	4	M1 for common denominator $(x-3)(x+2)$ isw M1 for $(x+3)(x+2) - (x-2)(x-3)$ isw B1 for correct numerator in terms of x only

Question	Answer	Marks	Partial Marks
5(b)	14	2	M1 for $12 - \frac{k}{2} = 5$ or $2^{\frac{k}{2}} = \frac{2^{12}}{2^5}$ oe or $\frac{4096}{32}$ or $12 - 5$ or $2^{12} \div 2^{\frac{14}{2}}$ [= 32] seen
5(c)	$2y^3 - 3y^2 - 23y + 12$ final answer	3	B2 for correct unsimplified expanded expression or for simplified four-term expression of correct form with 3 terms correct or B1 for correct expansion of 2 of the brackets with at least 3 terms correct
5(d)	$[x =] \frac{3}{y-1}$ final answer	3	M1 for $xy = 3 + x$ M1 for $xy - x = 3$ or $x - \frac{x}{y} = \frac{3}{y}$ M1 for factorising and dividing
6(a)(i)	$\frac{1}{3}$ oe	1	
6(a)(ii)	100	1	FT <i>their (a)(i)</i> $\times 300$ to at least 3 sf or rounded to the nearest integer
6(b)(i)	$\frac{2}{15}$ oe	3	M2 for $4 \times \frac{1}{6} \times \frac{1}{5}$ oe or M1 for $k \left(\frac{1}{6} \times \frac{1}{5} \right)$ oe or list or indication of 4 correct pairs
6(b)(ii)	$\frac{3}{5}$ oe	3	M2 for $1 - \frac{4}{6} \times \frac{3}{5}$ or $2 \left(\frac{2}{6} \times \frac{4}{5} \right) + \frac{2}{6} \times \frac{1}{5}$ oe or $\frac{2}{6} + \left(\frac{4}{6} \times \frac{2}{5} \right)$ oe or M1 for $\frac{4}{6} \times \frac{3}{5}$ oe seen or $\frac{2}{6} \times \frac{4}{5} [\times 2]$ oe seen or $\frac{2}{6} \times \frac{1}{5}$ oe seen or correct identification of 18 pairs or space diagram oe
7(a)	$n - 5 + 3n + 10 > 105$ or better	B1	
	$n > 25$ final answer	B2	M1 for $4n > 100$

Question	Answer	Marks	Partial Marks
7(b)	4.8	3	M1 for $y = \frac{k}{x^2}$ or better M1 for $[y =] \frac{\text{their } k}{5^2}$ OR M2 for $y \times 5^2 = 7.5 \times 4^2$
7(c)(i)	$6 - 2n$ oe final answer	2	B1 for answer $6 - kn$ ($k \neq 0$) oe or answer $j - 2n$ oe or for correct expression shown in working and then spoilt
7(c)(ii)	$2n^2 - 1$ oe final answer	2	B1 for 2nd diff = 4 or a quadratic expression or for correct expression shown in working and then spoilt
8(a)(i)	2.67 or 2.666...	3	M2 for $\frac{6 \times \sin 25}{\sin 72}$ or M1 for implicit version
8(a)(ii)	4.14 or 4.140...	3	M1 for $6^2 + 7.4^2 - 2 \times 6 \times 7.4 \times \cos 34$ A1 for 17.1 to 17.2
8(a)(iii)	20.4 or 20.35 to 20.36...	4	B1 for angle $SQR = 83$ M1 for $\frac{1}{2} \times 6 \times \text{their (a)(i)} \times \sin \text{their } (180 - 72 - 25)$ oe M1 for $\frac{1}{2} \times 6 \times 7.4 \times \sin 34$ oe
8(b)(i)	8.7[0] or 8.695...	4	B3 for $\sqrt{980}$ oe or 31.3 or 31.30... or M3 for $40 - \sqrt{20^2 + 18^2 + 16^2}$ oe or M2 for $20^2 + 18^2 + 16^2$ oe or M1 for any correct attempt at 2-dimensional Pythagoras' e.g. $18^2 + 16^2$
8(b)(ii)	30.7 or 30.73 to 30.74...	3	M2 for $[\sin =] \frac{16}{\sqrt{20^2 + 18^2 + 16^2}}$ oe or B1 for identifying angle GAC

Question	Answer	Marks	Partial Marks
9(a)		3	B2 for 5 correct entries including '2' correctly placed at the intersection of the 3 sets or M1 for $k + 8 - k + 3 - k + 6 - k = 40 - (7 + 9 + 11)$ oe or for $k, 8 - k, 3 - k, 6 - k$, seen correctly placed on diagram with 7, 11 and 9 correctly placed
9(b)	11	1	
9(c)	$\emptyset$ or $\{ \}$	1	
9(d)	$\frac{7}{260}$ oe	2	M1 for $\frac{7}{40} \times \frac{6}{39}$ oe
9(e)	$\frac{14}{95}$ oe	2	FT their Venn diagram M1 for $\frac{8}{20} \times \frac{7}{19}$
10(a)(i)	$4x - 13$ final answer	1	
10(a)(ii)	$25x^2$ final answer	1	
10(b)	$\frac{x+1}{4}$ or $\frac{x}{4} + \frac{1}{4}$	2	M1 for correct first step $x = 4y - 1$ or $y + 1 = 4x$ or $\frac{y}{4} = x - \frac{1}{4}$
10(c)	0.6934 final answer	3	B2 for 0.69336... or $3^{-\frac{1}{3}}$ oe or 0.693 or M1 for $3^{-3^{-x}}$ oe
10(d)(i)	$(3x - 2)^2 - 3^{-(-3)}$	M1	
	$9x^2 - 6x - 6x + 4 - 27$ or $9x^2 - 12x + 4 - 27$ leading to $9x^2 - 12x - 23$	A1	with no errors seen

Question	Answer	Marks	Partial Marks
10(d)(ii)	$\frac{-(-12) \pm \sqrt{(-12)^2 - 4(9)(-23)}}{2 \times 9}$ or better	B2	B1 for $\sqrt{(-12)^2 - 4(9)(-23)}$ oe or $\frac{-(-12) + \sqrt{q}}{2 \times 9}$ oe or $\frac{-(-12) - \sqrt{q}}{2 \times 9}$ oe or both
	– 1.07, 2.40 final answers	B2	B1 for each If B0, SC1 for answers – 1.1 or –1.06 or –1.065... to – 1.065 and 2.4 or 2.39 or 2.398 to 2.398... or – 1.07 and 2.40 seen in working or for –2.40 and 1.07 as final answer
10(e)	–5 final answer	2	M1 for $243 = 3^{-x}$
11(a)	(1, 2) (–1, 6)	5	B2 for [derivative oe =] $3x^2 - 3$ or B1 for [derivative oe =] $3x^2$ or $f(x) - 3$ M1 for <i>their</i> derivative = 0 or recognition of $\frac{dy}{dx} = 0$ oe B1 for $[x =] -1, 1$ or for one coordinate pair
11(b)	(1, 2) minimum with reason (–1, 6) maximum with reason	3	Reasons could be e.g. a reasonable sketch correct use of 2 nd derivative = $6x = 6$, $6 > 0$, so (1, 2) minimum oe 2 nd derivative = $6x = -6$, $-6 < 0$ so (–1, 6) maximum oe, or finds gradient on each side of both correct stationary points with correct conclusion B2 for 1 correct with reason or M1 for showing [2 nd derivative =] $6x$ or gradients for one value on either side of one correct stationary point or for reasonable sketch of cubic