Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4935271234

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.

[Turn over

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]

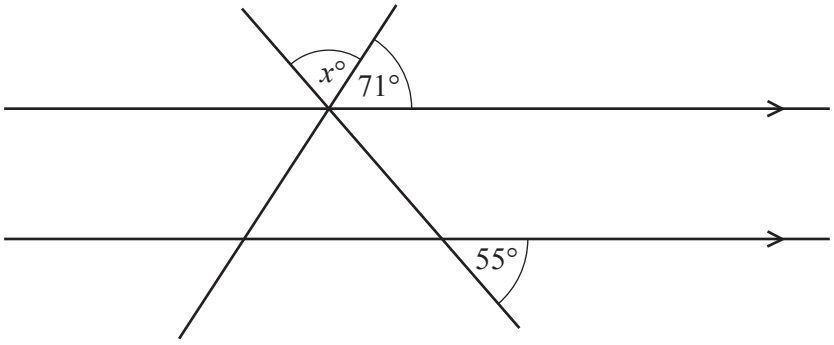
3 Write 32 cm as a fraction of 2 m.
Give your answer in its simplest form.

..... [2]

4 Divide \$200 in the ratio 7 : 3.

\$ ..... , \$ ..... [2]

5



NOT TO SCALE

The diagram shows two straight lines intersecting two parallel lines.

Find the value of x.

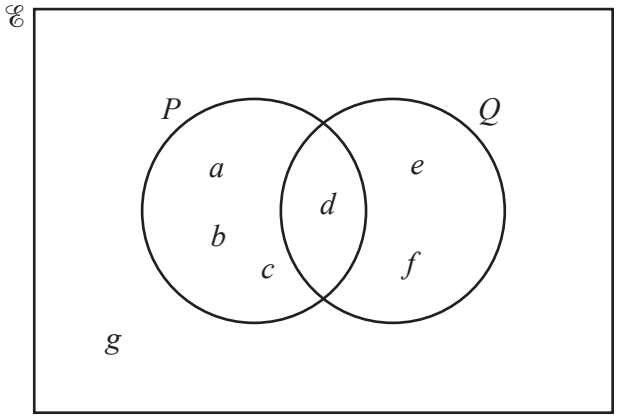
$x =$ ..... [2]

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 $\mathscr{E}$, P and Q.

Complete the statements.

(a) $P = \{$ ..... $\}$ [1]

(b) $n(P \cup Q) =$ ..... [1]

8 **(a)** 3, 9, 27, 81, …

Write down the next term in this sequence.

..... [1]

(b) 13, 17, 21, 25, …

Find the nth 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]

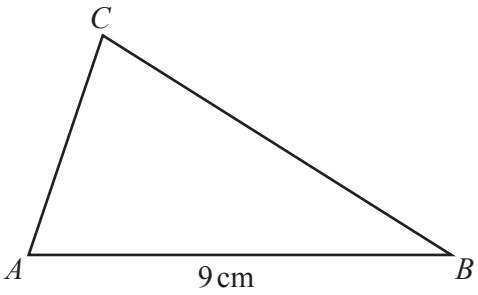
11 Solve the simultaneous equations.

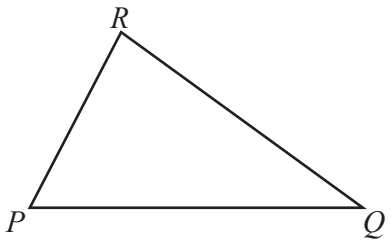
$$x-3y=7$$
$$2x-3y=11$$

$x =$ .....

$y =$ ..... [2]

12





NOT TO SCALE

Triangle PQR is similar to triangle ABC with $\frac{PR}{AC} = \frac{2}{3}$.

$AB = 9$ cm and the area of triangle ABC is 18 cm^2.

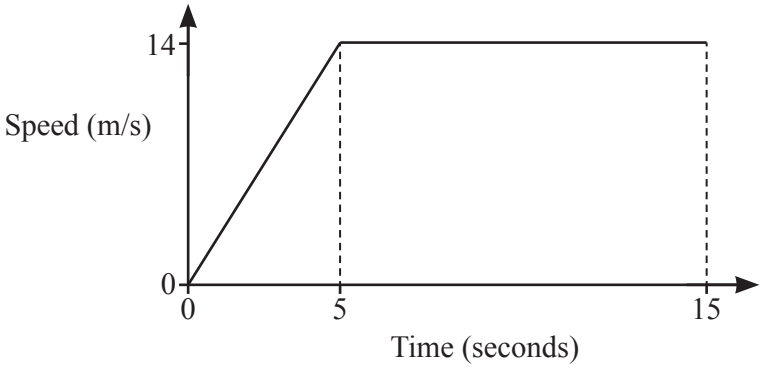
(a) Find the length of PQ.

..... 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.

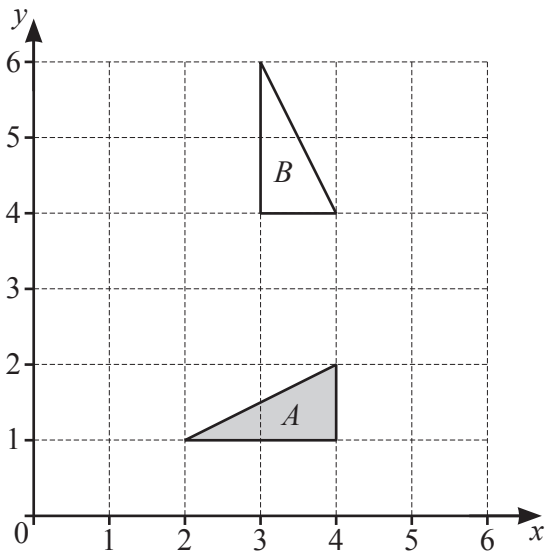
(a) Find the acceleration of the car during the first 5 seconds.

..... 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*.

.....

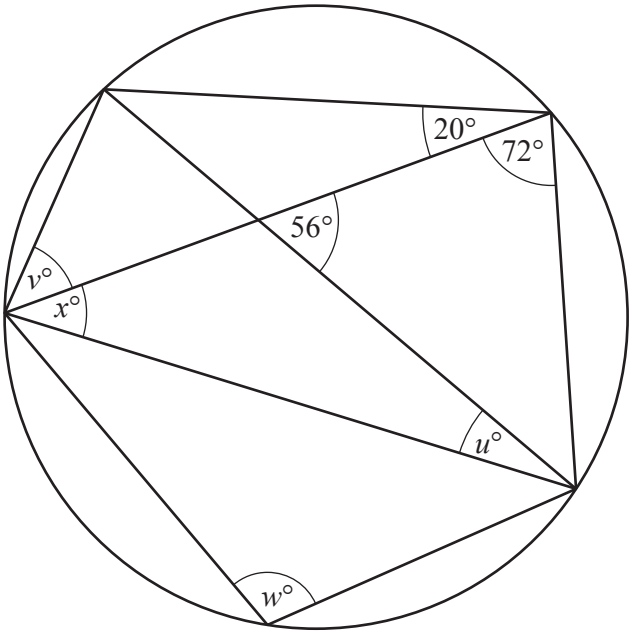
..... [3]

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.

$u =$ .....

$v =$ .....

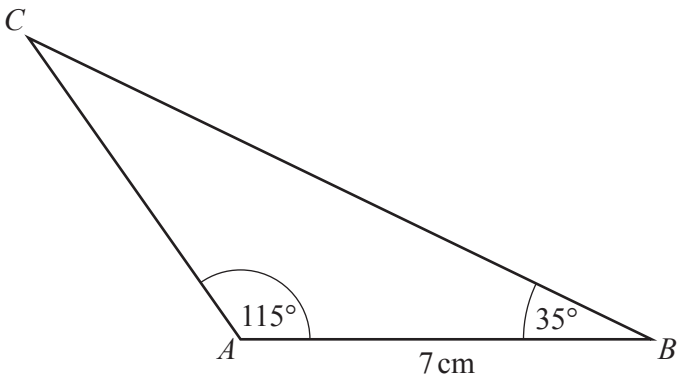
$w =$ .....

$x =$ ..... [4]

17 Simplify $\left(3125x^{3125}\right)^{\frac{1}{5}}$.

..... [2]

18



NOT TO SCALE

Calculate the length BC.

$BC =$ ..... cm [4]

19 Expand and simplify.

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

..... [3]

20 Factorise completely.

(a) $1+x-y-xy$

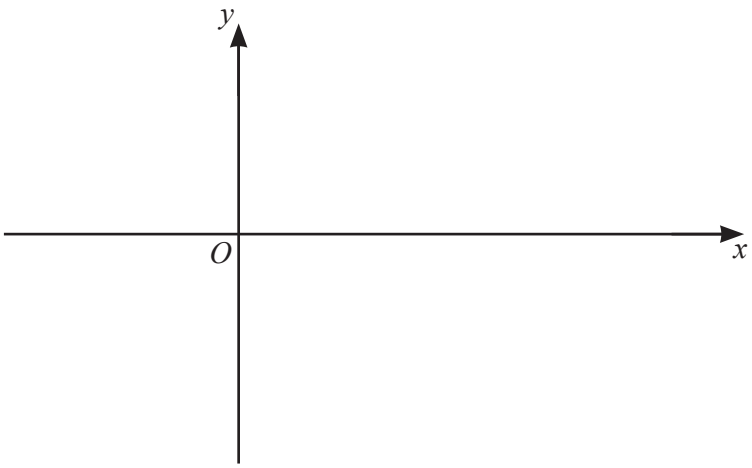
..... [2]

(b) $2x^3-18xy^2$

..... [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 $0° \leqslant x \leqslant 360°$. [2]

(b) Solve the equation $\cos x = -\frac{1}{2}$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... or $x =$ ..... [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.

$y =$ ..... [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.

..... 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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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.

[Turn over

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:

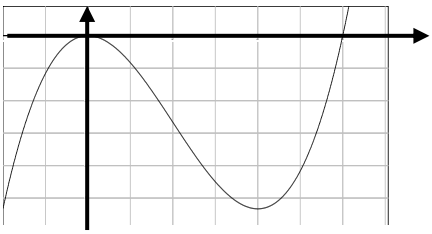
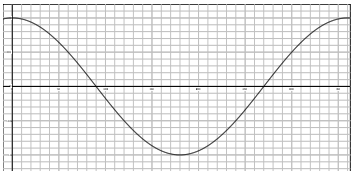
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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
nfww – 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 6*k*
	$1\frac{1}{6}$ 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

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 $\frac{7\sin 115}{\sin(\textit{their}\ \text{angle}\ C)}$ or **M1** for $\frac{\sin 115}{BC} = \frac{\sin(\textit{their}\ \text{angle}\ C)}{7}$ 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 nfww	**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 × *their* **(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

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 Assessment International Education

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CANDIDATE NAME									
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8266843104

MATHEMATICS **0580/22**

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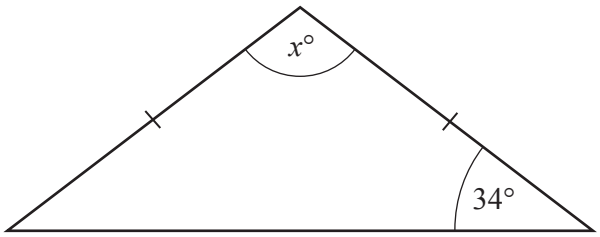
1



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.

[4]

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

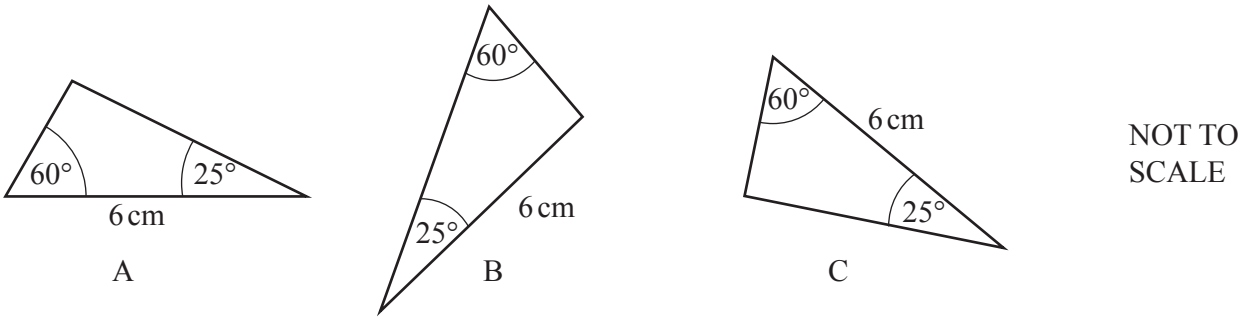
(a) Find the median.

..... 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) $\frac{4.5(\cos 30°)}{\sqrt{3}} - 2$

..... [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.

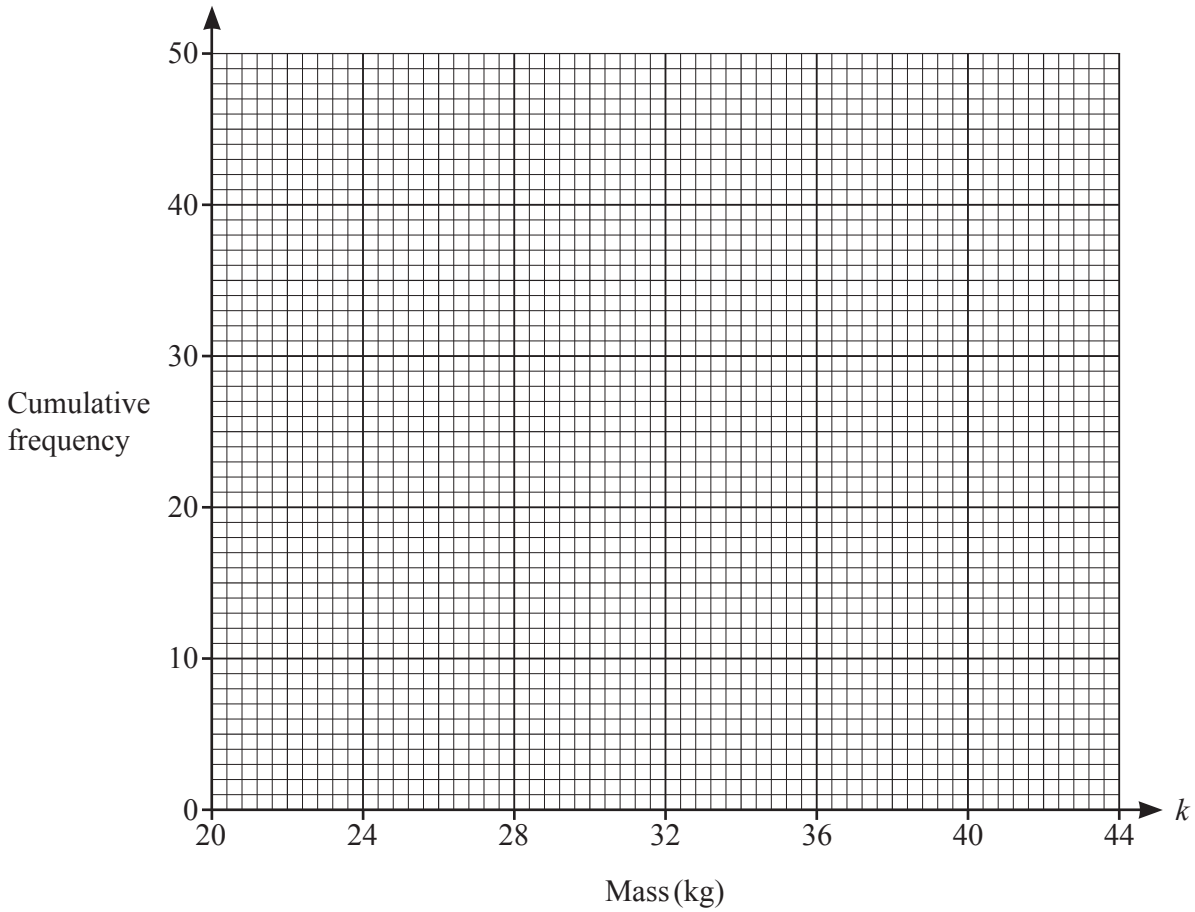
Write $x \div 315$ as a product of its prime factors.

..... [2]

13 The table shows information about the mass of each of 50 children.

Mass (k kg)	Cumulative Frequency
$k \leqslant 20$	0
$k \leqslant 22$	7
$k \leqslant 24$	23
$k \leqslant 28$	35
$k \leqslant 32$	43
$k \leqslant 36$	47
$k \leqslant 42$	50

(a) Draw a cumulative frequency diagram to show this information.

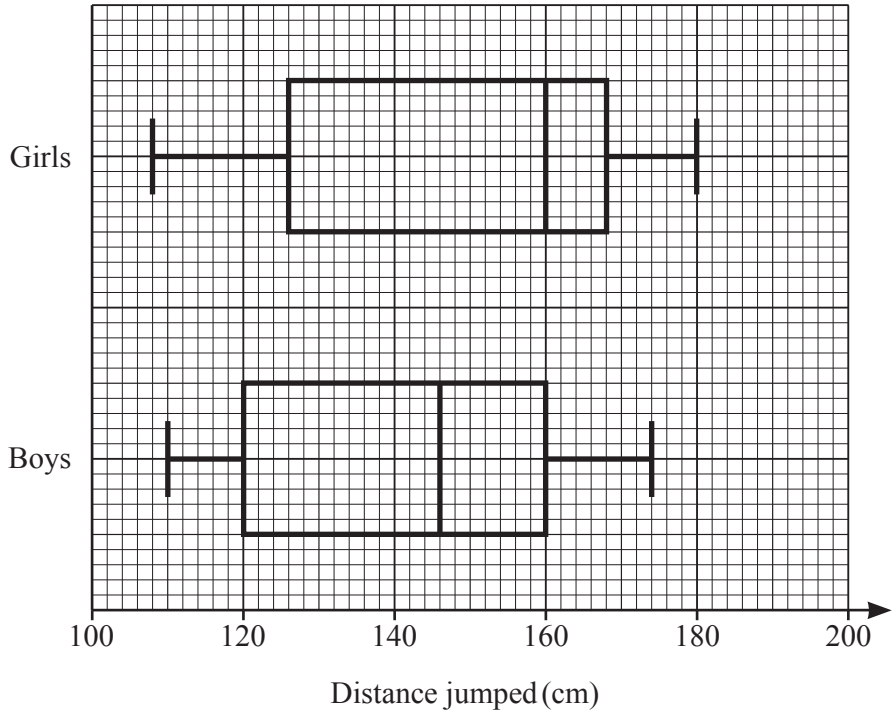


[3]

(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.

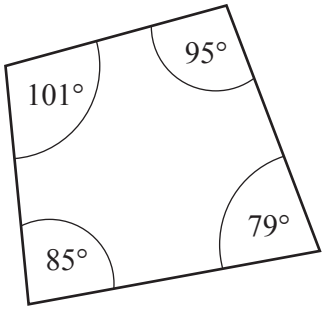


Each child who jumps a distance greater than 160 cm gets a certificate.

Work out an estimate of the total number of children who get a certificate.

..... [2]

15



NOT TO SCALE

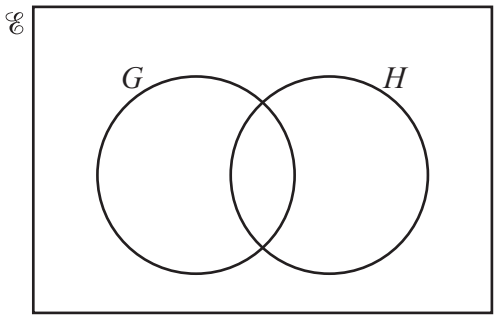
The diagram shows a quadrilateral.

Give a geometrical reason why this is a cyclic quadrilateral.

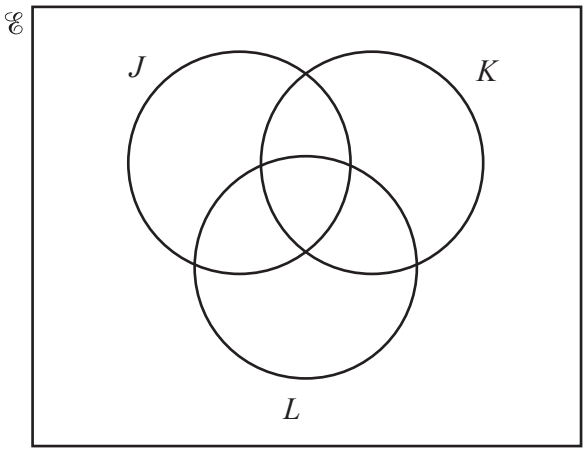
..... [1]

16 **(a)** Shade the region indicated in each Venn diagram.

$G \cap H'$

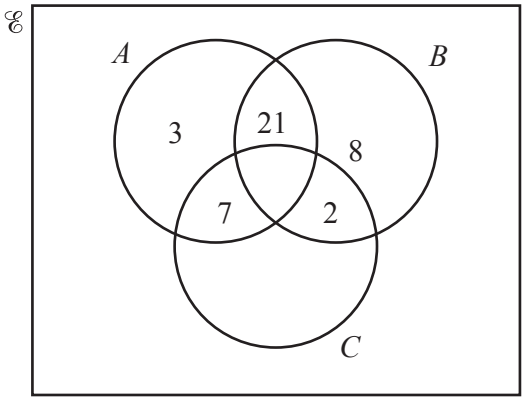


$(J \cup K') \cap L$



[2]

(b) The Venn diagram shows some information about the number of elements in sets A, B, C and $\mathscr{E}$.



Given the following information, complete the Venn diagram.

$n(A \cap B \cap C) = 1$
$n(A \cup B \cup C)' = 17$
$n(C) = 42$

[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.

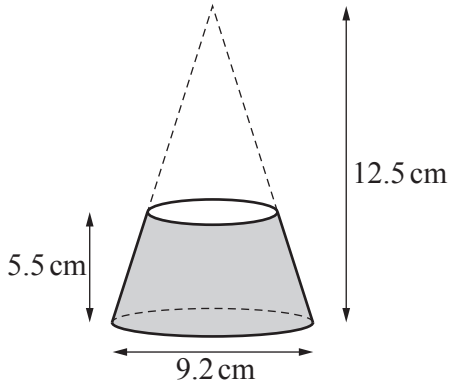
(a) $(81x^{16})^{\frac{3}{4}}$

..... [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 $56\,\text{cm}^3$ and $875\,\text{cm}^3$.
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.

$x =$ ..... or $x =$ ..... [7]

Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/22**

Paper 2 Extended **October/November 2022**

MARK SCHEME

Maximum Mark: 70

Published

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[Turn over

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:

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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).

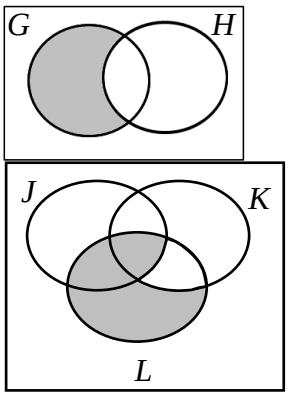
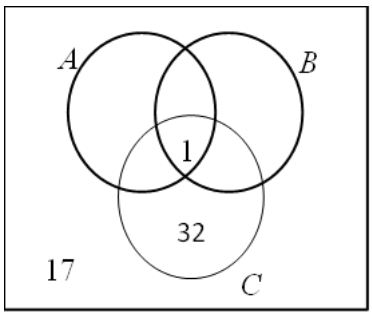
GENERIC MARKING PRINCIPLE 6:

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	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 *their* 7 points If 0 scored **SC1 FT** for 6 out of 7 points correctly plotted
13(b)	33 to 34.5	**1**	**FT** *their* 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**	**Al** 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)	[±] 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 $\frac{9.2}{12.5} = \frac{diameter}{12.5-5.5}$ oe or better **M1** for $\frac{1}{3}\times\pi\times\left(\frac{their 5.152}{2}\right)^2\times(12.5-5.5)$ 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 *their* quadratic to the form $[0 =] ax^2 + bx + c$
	Correct method to solve *their* 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**	

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2760866349

MATHEMATICS **0580/23**

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.

[Turn over

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]

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]

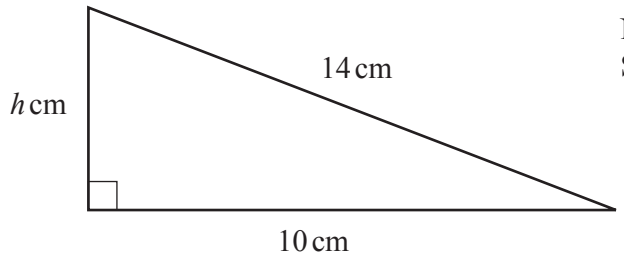
9 Solve the simultaneous equations.

$$3x - 2y = 21$$
$$5x + 2y = 51$$

$x =$ .....

$y =$ ..... [2]

10



The diagram shows a right-angled triangle.

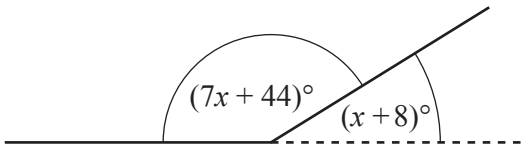
(a) Calculate the value of h.

$h =$ ..... [3]

(b) Find the perimeter of this triangle.

..... cm [1]

11



NOT TO SCALE

The diagram shows two sides of a regular polygon.
The interior angle of the polygon is $(7x + 44)°$ and the exterior angle is $(x + 8)°$.

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.

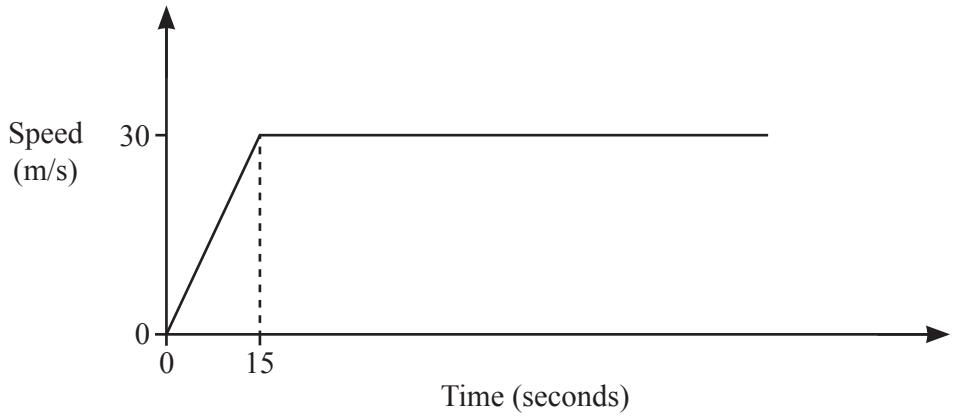
..... [2]

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 $y = mx + c$.

$y =$ ..... [3]

17 y is proportional to the square of $(x - 7)$.
When $x = 12$, $y = 2$.

Find y when $x = 17$.

$y =$ ..... [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.

..... cm [3]

19 $f(x) = 5x - 3,\ x > 1$

$g(x) = \dfrac{10}{x-2},\ x \neq 2$

(a) Find $gf(x)$.
Give your answer in its simplest form.

..... [2]

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

$g^{-1}(x) =$ ..... [3]

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

..... [1]

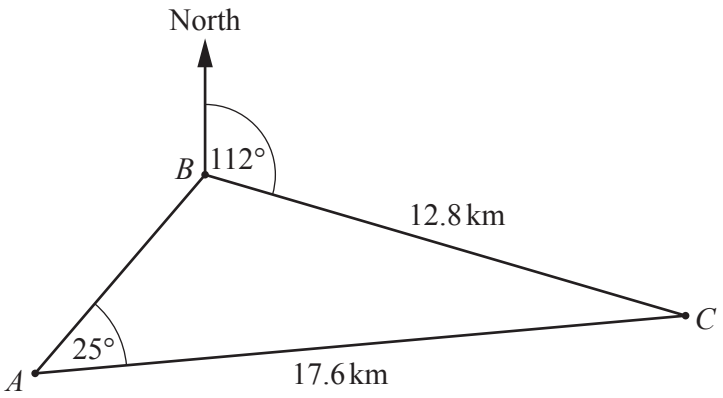
20 (a)

Sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(b) Solve $3 - 2\sin x = \frac{13}{4}$ for $0° \leqslant x \leqslant 360°$.

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

21



NOT TO SCALE

The diagram shows the positions of three ships A, B and C.
$AC = 17.6$ km, $BC = 12.8$ km and angle $BAC = 25°$.
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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MATHEMATICS **0580/23**

Paper 2 Extended **October/November 2022**

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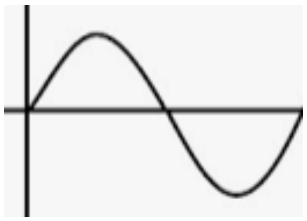
isw – ignore subsequent working
oe – or equivalent
SC – Special Case
nfww – not from wrong working
soi – seen or implied

Question	Answer	Marks	Partial Marks
1	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 + *their* **(a)**
11	15	**4**	**B2** for $x = 16$ **soi** or **M1** for $7x + 44 + x + 8 = 180$ or better **M1** for $360 \div$ (*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 $\frac{15\times30}{2}+30(k-15)[=\text{figs } 45]$ oe OR **B2** for 44 775 or 44.775 OR **M1** for $\frac{15\times30}{2}$ 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 grad = $-\frac{1}{4}$ oe soi **M1** for correct substitution shown of (–2, –5) into $y = (\textit{their } m)x + c$ oe ($\textit{their } m \neq 4$)
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	**B**1 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

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7920026899

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.

[Turn over

1 **(a)** Calculate the volume of

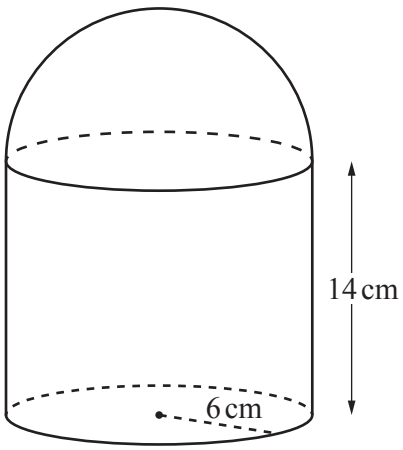
(i) a solid cylinder with radius 6 cm and height 14 cm,

..... cm^3 [2]

(ii) a solid hemisphere with radius 6 cm.
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm^3 [2]

(b)



NOT TO SCALE

The cylinder and hemisphere in **part (a)** are joined to form the solid in the diagram.
The solid is made of steel and 1 cm^3 of steel has a mass of 7.85 g.

(i) Show that 1 cm^3 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]

[Turn over

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]

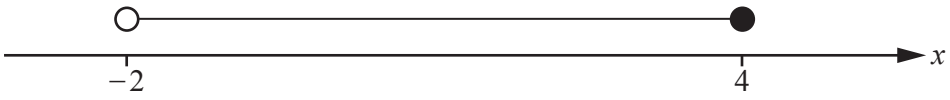
(e) Simplify $1.5 \times 10^{x} + 1.5 \times 10^{x-1}$ giving your answer in standard form.

..... [2]

(f) Write $0.3\dot{7}$ as a fraction.
You must show all your working.

..... [2]

3 **(a)**



Write down the inequality shown by the number line.

..... [1]

(b) $-3 \leqslant 2x+3 < 9$

(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]

[Turn over

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.

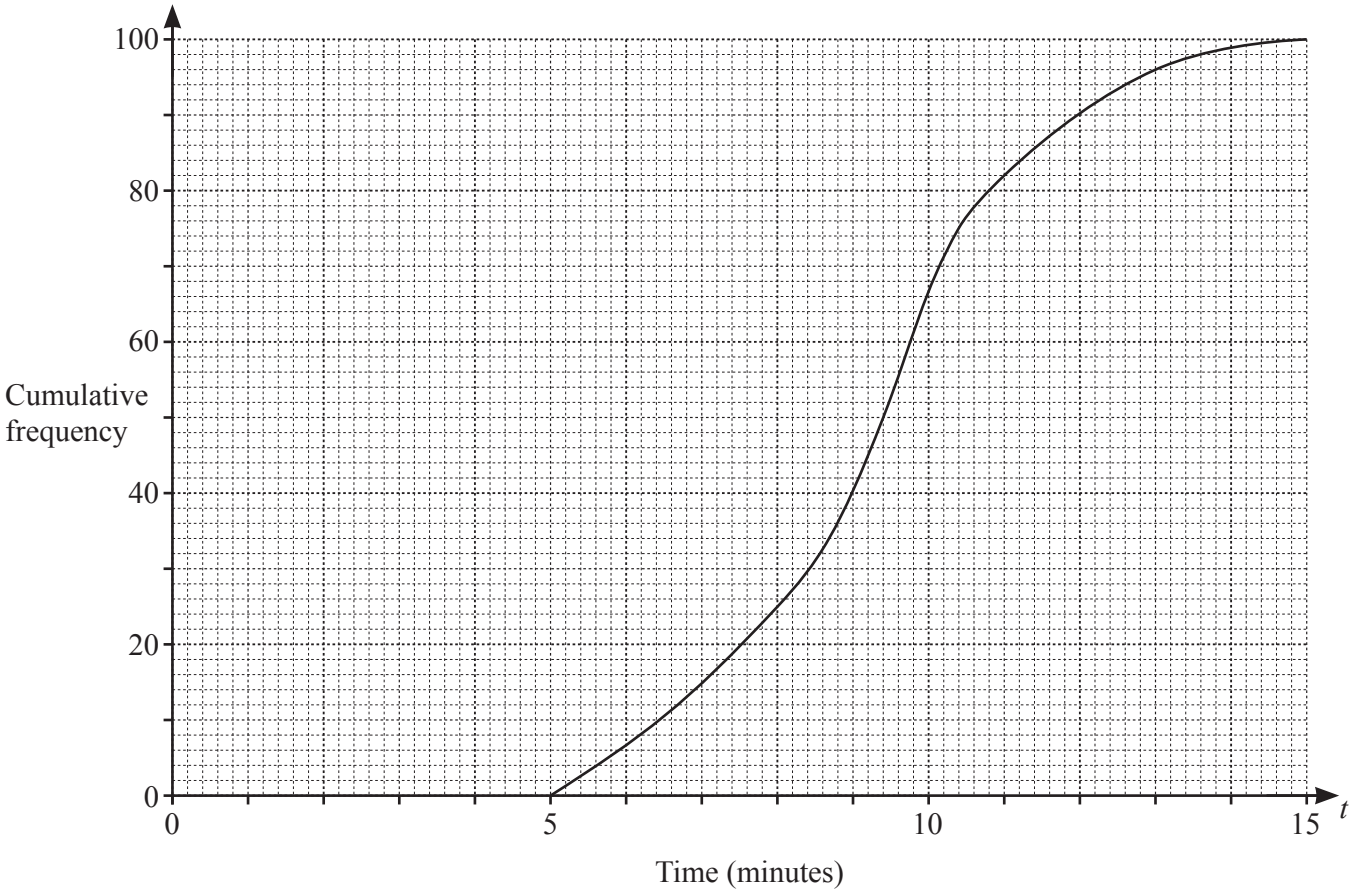
$ ..... [3]

(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)	$0 < d \leqslant 20$	$20 < d \leqslant 30$	$30 < d \leqslant 35$	$35 < d \leqslant 45$	$45 < d \leqslant 60$
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 $30 < d \leqslant 35$ is 12 cm.

Calculate the height of each of the other bars.

Distance (d metres)	Frequency	Height of bar (cm)
$0 < d \leqslant 20$	4	
$20 < d \leqslant 30$	38	
$30 < d \leqslant 35$	40	12
$35 < d \leqslant 45$	53	
$45 < d \leqslant 60$	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) $3\mathbf{q}$,

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

(ii) $\mathbf{p} - \mathbf{q}$,

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

(iii) $|\mathbf{p}|$.

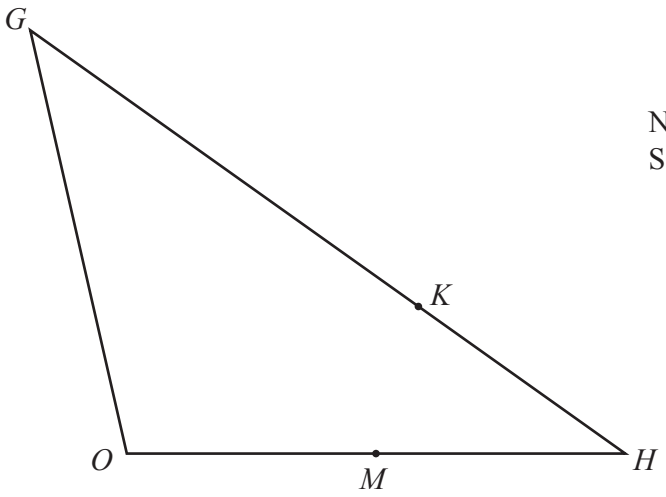
..... [2]

(b) B is the point (2, 7) and $\overrightarrow{AB} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$.

Find the coordinates of A.

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

(c)



NOT TO SCALE

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 **g** and **h**.
Give your answer in its simplest form.

$\overrightarrow{MK} =$ ..... [4]

[Turn over

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) $\left(\mathrm{f}(x)\right)^2 - \mathrm{ff}(x) = ax^2 + bx + c$

Find the values of a, b and c.

$a =$ .....

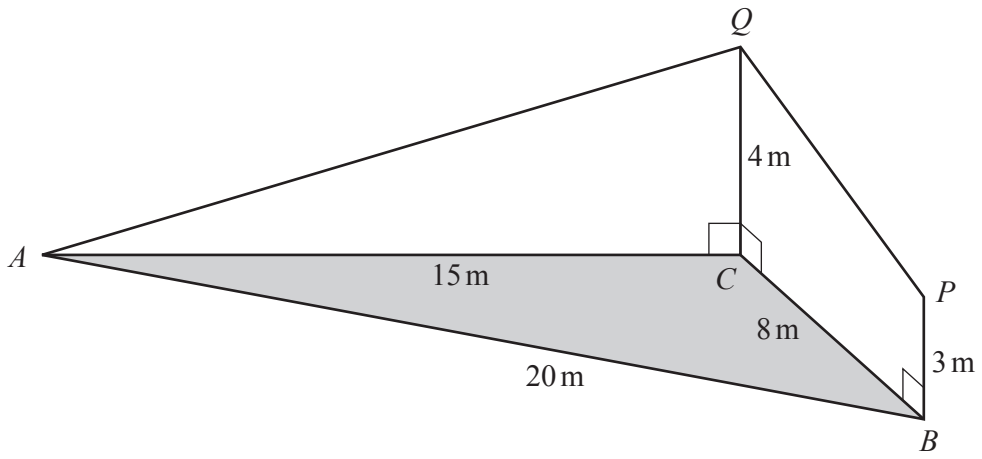
$b =$ .....

$\mathrm{c} =$ ..... [4]

(g) Find x when $\mathrm{h}^{-1}(x) = 10$.

$x =$ ..... [2]

8



NOT TO SCALE

The diagram shows triangle ABC on horizontal ground.
$AC = 15\,\text{m}$, $BC = 8\,\text{m}$ and $AB = 20\,\text{m}$.

BP and CQ are vertical poles of different heights.
$BP = 3\,\text{m}$ and $CQ = 4\,\text{m}$.
AQ and PQ are straight wires.

(a) Show that angle $ACB = 117.5°$, 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.

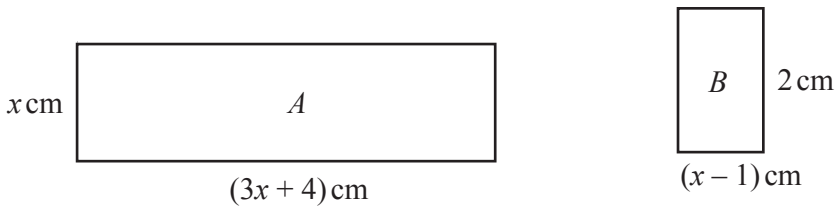
..... [3]

(e) Another straight wire connects A to the midpoint of PQ.

Calculate the angle between this wire and the horizontal ground.

..... [5]

9 (a)



The total of the areas of rectangles A and B is $20\,\text{cm}^2$.

(i) Show that $3x^2 + 6x - 22 = 0$.

[2]

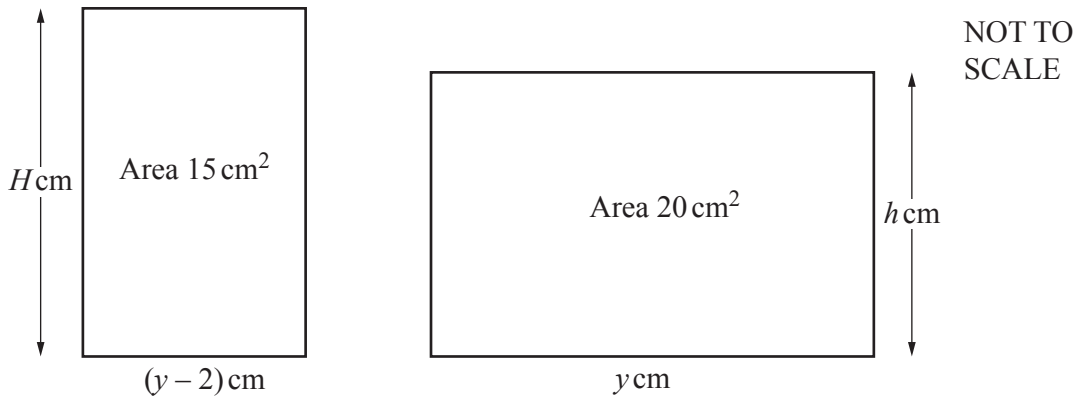
(ii) Solve the equation $3x^2 + 6x - 22 = 0$, giving your answers correct to 4 significant figures. You must show all your working.

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

(iii) Find the perimeter of rectangle B.

..... cm [1]

(b)

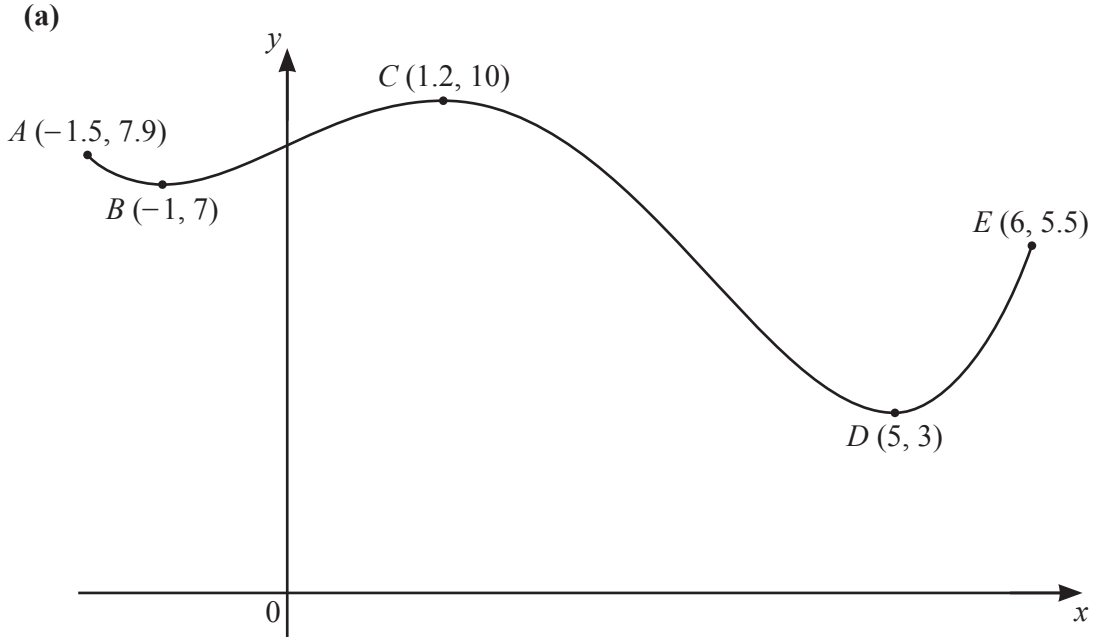


The diagram shows two rectangles where $H - h = 1$.

By forming a quadratic equation and factorising, find the value of y.

$y =$ ..... [7]

10 (a)



NOT TO SCALE

The diagram shows a sketch of the graph of $y = f(x)$ for $-1.5 \leqslant x \leqslant 6$.
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 $-1.5 \leqslant x \leqslant 6$.

Write down a possible integer value of k.

$k =$ ..... [1]

(ii) $f(x) = j$ has no solutions in the interval $-1.5 \leqslant x \leqslant 6$ when $j < a$ or $j > b$.

Find the maximum value of a and the minimum value of b.

$a =$ .....

$b =$ ..... [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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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.

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
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 ÷ 1000 [= 0.00785]	**M1**	
1(b)(ii)	16[.0] or 15.95 to 15.99	**2**	**FT** {*their* **(a)(i)** + *their* **(a)(ii)**} × 0.00785 evaluated to 3 sig fig or better **M1** for (*their* **(a)(i)** + *their* **(a)(ii)**) × 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 $\sqrt[3]{2000 - \textit{their}\left(50 \times \frac{4}{3} \times \pi \times 2^3\right)}$ 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 *their* area of cone = *their* 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)	$-2 < x \leqslant 4$ oe	**1**	
3(b)(i)	$-3 \leqslant x < 3$ final answer	**3**	**M2** for $-3 \leq x < k$ or for $k \leqslant x < 3$ or for $-6 \leqslant 2x < 6$ or for $-\frac{3}{2} - \frac{3}{2} \leqslant x < \frac{9}{2} - \frac{3}{2}$ or **M1** for $-3 - 3 \leqslant 2x < 9 - 3$ or for $-\frac{3}{2} \leqslant x + \frac{3}{2} < \frac{9}{2}$ After 0 scored SC1 for $-3 \leqslant x$ 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** $2^{their\,4}$
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)	$[\cos =] \frac{15^2 + 8^2 - 20^2}{2.15.8}$	**M2**	**M1** for $20^2 = 15^2 + 8^2 - 2.15.8\cos(\quad)$
	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 = $\frac{3.5}{\textit{their}\ 17.216...}$ 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 Assessment International Education

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7001125135

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		

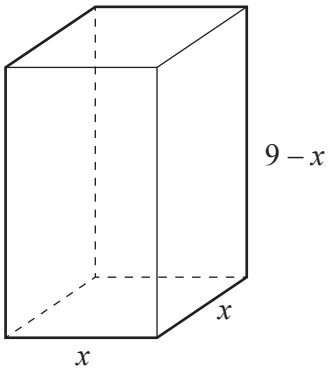
[2]

(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 $0 \leqslant x \leqslant 9$.

x	0	1	2	3	4	5	6	7	8	9
V	0	8		54	80	100	108	98	64	0

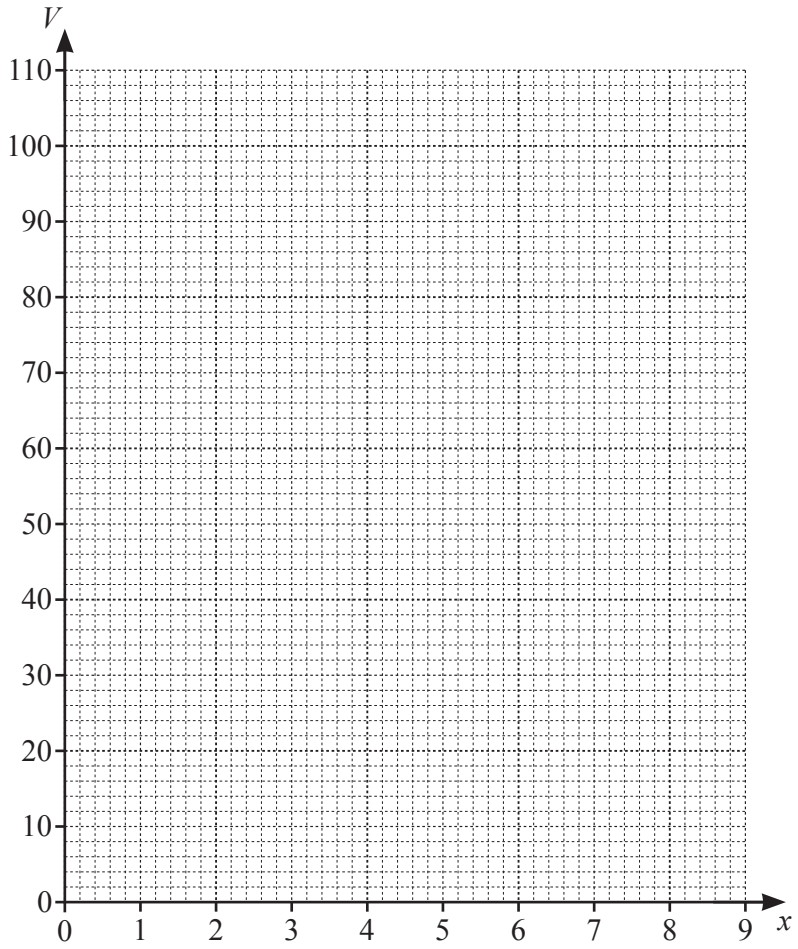
(i) Complete the table.

[1]

(ii) On the grid on the opposite page, draw the graph of $V = x^2(9-x)$ for $0 \leqslant x \leqslant 9$. [4]

(iii) Find the values of x when the volume of the cuboid is $44\,\text{cm}^3$.

$x =$ ..... or $x =$ ..... [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)	$80 < d \leqslant 100$	$100 < d \leqslant 150$	$150 < d \leqslant 200$	$200 < d \leqslant 300$	$300 < d \leqslant 400$
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)	$80 < d \leqslant 100$	$100 < d \leqslant 150$	$150 < d \leqslant 200$	$200 < d \leqslant 300$	$300 < d \leqslant 360$
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 $200 < d \leqslant 300$ is 2.6 cm.

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

$80 < d \leqslant 100$ ..... cm

$150 < d \leqslant 200$ ..... cm

$300 < d \leqslant 400$ ..... cm [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,

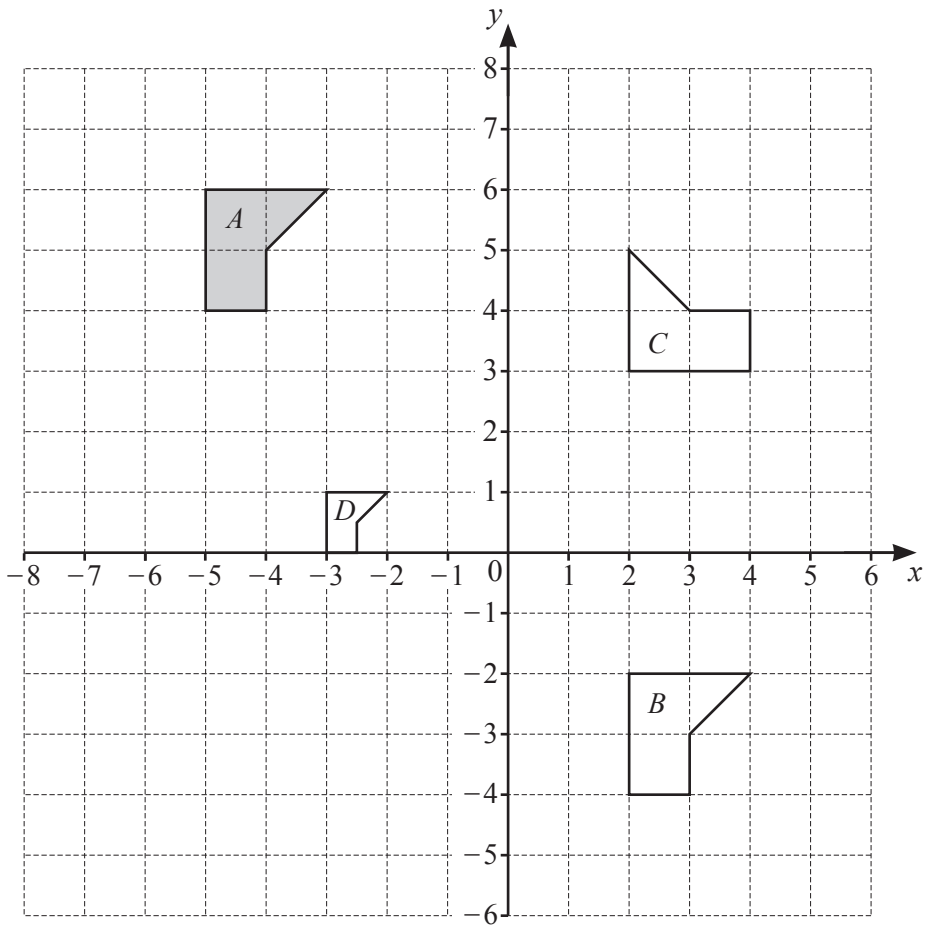
..... [2]

(ii) one car has travelled more than 200 km and the other car has travelled 100 km or less.

..... [3]

[Turn over

4



(a) Describe fully the **single** transformation that maps

(i) shape A onto shape B,

.....

..... [2]

(ii) shape A onto shape C,

.....

..... [3]

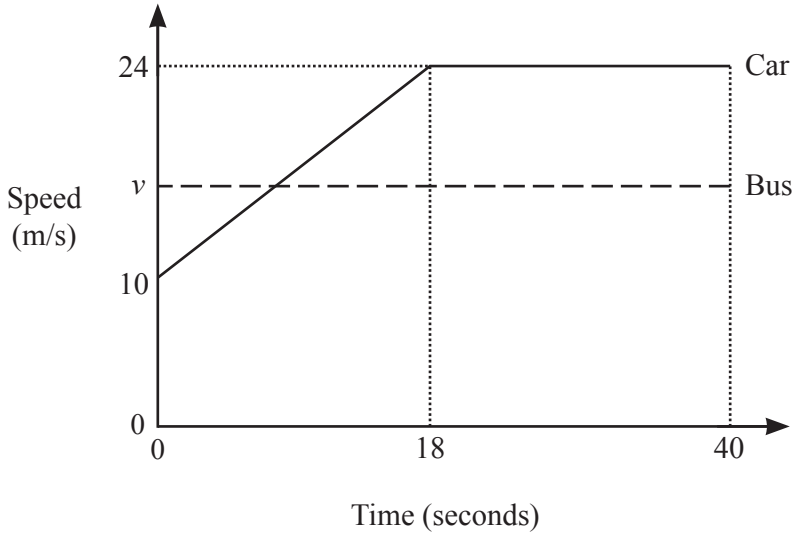
(iii) shape A onto shape D.

.....

..... [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]

[Turn over

6 **(a)** Solve.

$$4x + 15 = 9$$

$x =$ ..... [2]

(b) Factorise.

$$a^2 - 9$$

..... [1]

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

$$\frac{4a}{5} \div \frac{3ad}{10c}$$

..... [3]

(d) $5^n + 5^n + 5^n + 5^n + 5^n = 5^m$

Find an expression for m in terms of n.

$m =$ ..... [2]

(e) Solve by factorisation.

$$4x^2 + 8x - 5 = 0$$

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

(f) **(i)** y is directly proportional to $(x+3)^3$.
When $x = 2$, $y = 13.5$.

Find x when $y = 108$.

$x =$ ..... [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.

$n =$ ..... [2]

(g) Expand and simplify.

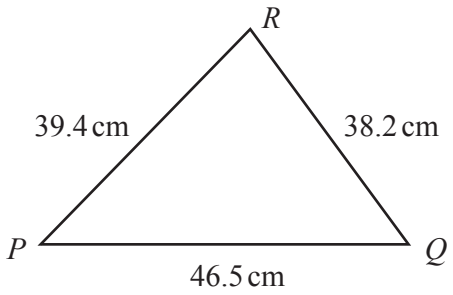
$$(2x+3)(x-1)(x+3)$$

..... [3]

(h) Find the derivative, $\frac{dy}{dx}$, of $y = 3x^2 + 4x - 1$.

..... [2]

7 **(a)**



NOT TO SCALE

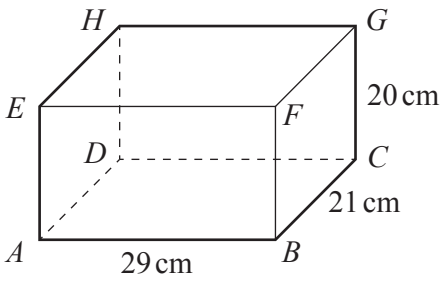
(i) Calculate angle QPR.

Angle QPR = ... [4]

(ii) Find the shortest distance from Q to PR.

..... cm [3]

(b) The diagram shows a cuboid.



NOT TO SCALE

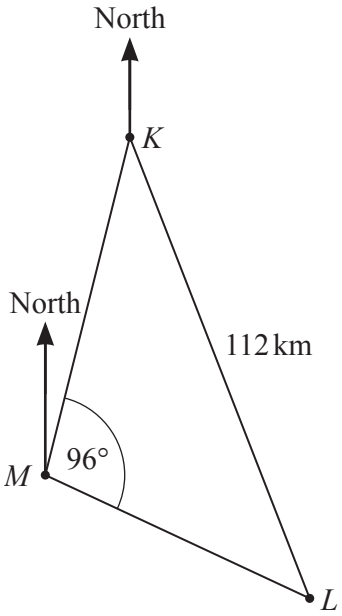
(i) Calculate the length AG.

AG = ... cm [3]

(ii) Calculate the angle between AG and the base $ABCD$.

..... [3]

(c)



NOT TO SCALE

The diagram shows the positions of a lighthouse, L, and two ships, K and M.
The bearing of L from K is 155° and $KL = 112\,\text{km}$.
The bearing of K from M is 010° and angle $KML = 96°$.

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.

$n =$ ..... [1]

(d) Points A, M and N form a triangle.

Find the area of the triangle.

..... [2]

9

(a) On the diagram, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(b) Solve the equation $5\sin x + 4 = 0$ for $0° \leqslant x \leqslant 360°$.

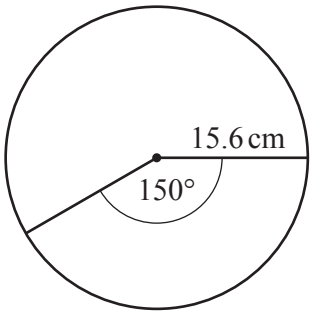
$x =$ ..... or $x =$ ..... [3]

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)



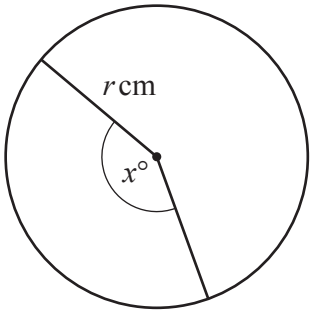
NOT TO SCALE

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 cm and minor sector angle $x°$.
The **perimeter** of the major sector is three times the **perimeter** of the minor sector.

Show that $x = \dfrac{90(\pi - 2)}{\pi}$.

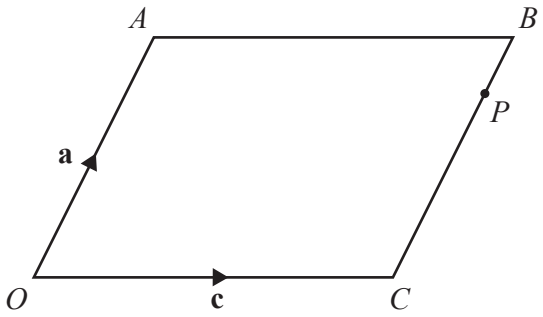
[4]

11 **(a)** $\left|\begin{pmatrix} 9m \\ 40m \end{pmatrix}\right| = \frac{205}{2}$

Find the two possible values of m.

$m =$ ..... or ..... [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 **a** and/or **c**, in their simplest form,

(a) $\overrightarrow{AC}$,

$\overrightarrow{AC} =$ ..... [1]

(b) $\overrightarrow{CP}$,

$\overrightarrow{CP} =$ ..... [1]

(c) $\overrightarrow{OP}$.

$\overrightarrow{OP} =$ ..... [1]

(ii) OP and AB are extended to meet at Q.

Find the position vector of Q.

..... [2]

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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).

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)	75	**2**	**M1** for $\frac{45}{3}$ [× k] where k is 1, 5 or 8
1(a)(ii)	2.332 oe	**2**	**M1** for 2.65 [million] × $\left(1-\frac{12}{100}\right)$ 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)	$x + 12$ $\frac{7x}{2} - 26$ oe final answer	**2**	**FT** *their* **(b)(i)** **B1** for $x + 12$ **B1** for *their* $\frac{7x}{2} - 26$

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 $36 \times$ *their*$6 - 2 \times$ (*their* $6)^2$

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×] $\frac{84}{200} \times \frac{7}{199}$ 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

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 soi long enough to be fit for purpose or correct size and orientation but wrong position

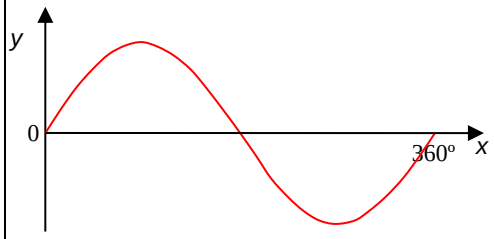
Question	Answer	Marks	Partial Marks
5(a)(i)	$\frac{14}{18}$ oe	**1**	
5(a)(ii)	17.5	**4**	**M3** for $\frac{1}{2}(10+24)18+22\times24\ -134 = 40v$ oe or **M2** for $\frac{1}{2}(10+24)18+22\times24$ oe or **B2** for [distance covered by bus =] 700 or **M1** for correct method for any partial area for the car or for $40v$
5(b)	92.8 or $92\frac{4}{5}$	**3**	**M1** for $\frac{figs162[4]}{their10\,min30\,sec}$ oe **M1** for correct conversion to km/h, e.g. $\times\frac{60}{1000}$

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 $108 =$ *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

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

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 $\frac{d}{46.5} = \sin(\textit{their}\ 52.01)$ oe or **M1** for recognition that the line from Q is perpendicular to PR
7(b)(i)	41[.0] or 41.01… nfww	**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] = $\frac{20}{\textit{their}\ AG}$ 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 $\frac{112 \times \sin(\textit{their}35)}{\sin(96)}$ oe or **M1** for the implicit form

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

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

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** + *their* **(b)(i)(b)**, 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 [$\overrightarrow{BQ}$ =] $\frac{1}{3}$ **c** or [$\overrightarrow{AQ}$ =] $\frac{4}{3}$ **c** or **M1** for a correct route or for answer **a** + k**c** oe**,** where $k > 1$

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8701010157

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.

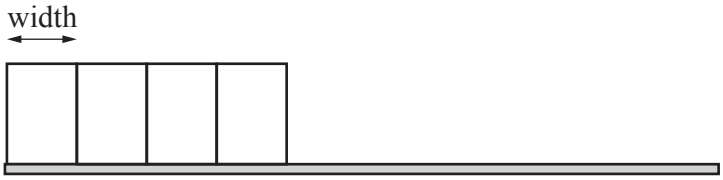
\$ ..... [2]

(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)



NOT TO SCALE

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) $\dfrac{18m^6}{3m^2}$

..... [2]

(iii) $\left(\dfrac{27x^9y^{27}}{64}\right)^{-\frac{1}{3}}$

..... [3]

(b) A sequence has nth term $3n^2$.

Write down the first 3 terms of this sequence.

..... , ... , ... [2]

(c) Find the nth term for each of these sequences.

(i) 13, 16, 19, 22, 25, …

..... [2]

(ii) 3, 17, 55, 129, 251, …

..... [2]

(d) Solve.

$$\frac{3x-22}{4} = 23$$

$x =$ ..... [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.

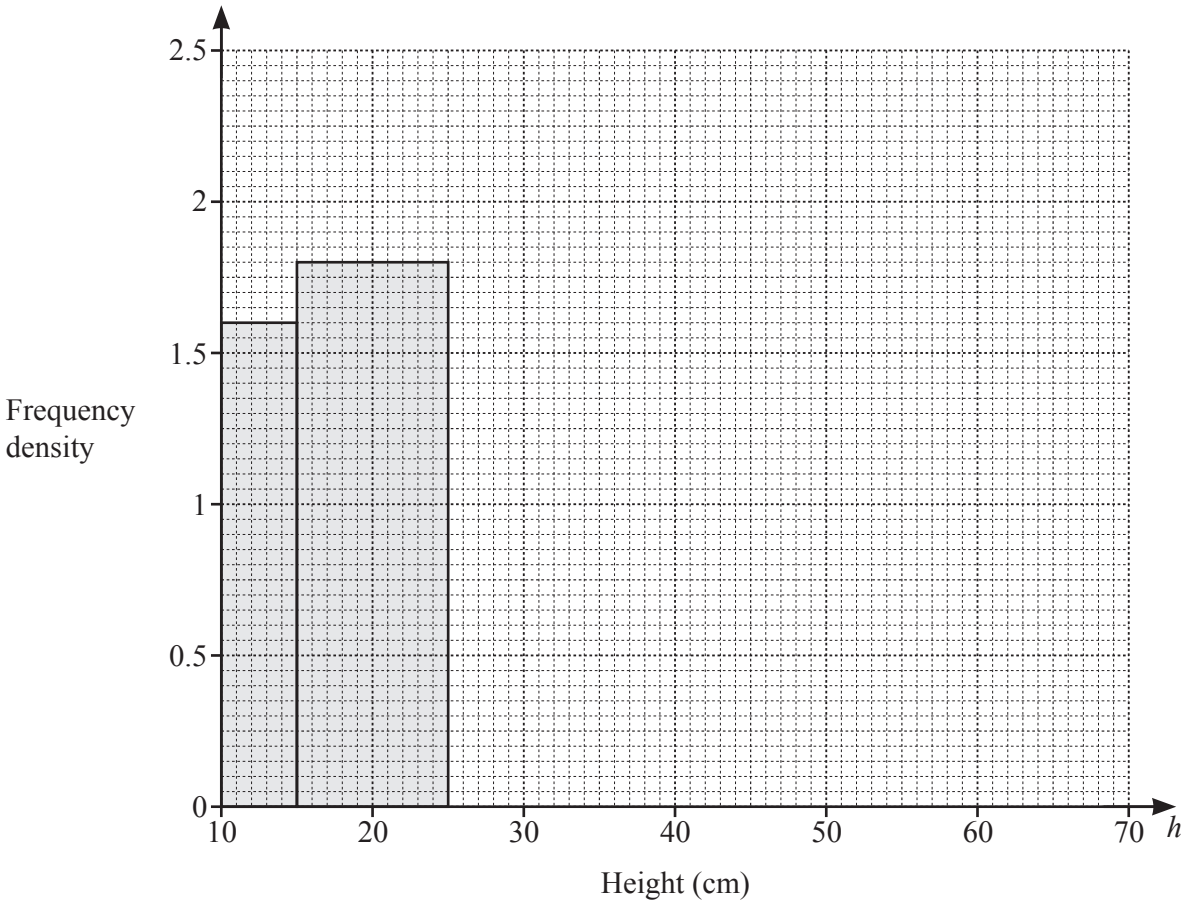
$x =$ ..... , $x =$ ..... [4]

[Turn over

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)	$10 < h \leqslant 15$	$15 < h \leqslant 25$	$25 < h \leqslant 40$	$40 < h \leqslant 60$	$60 < h \leqslant 70$
Frequency	8	18	28	33	13

(a) Complete the histogram to show this information.
The first two blocks have been drawn for you.

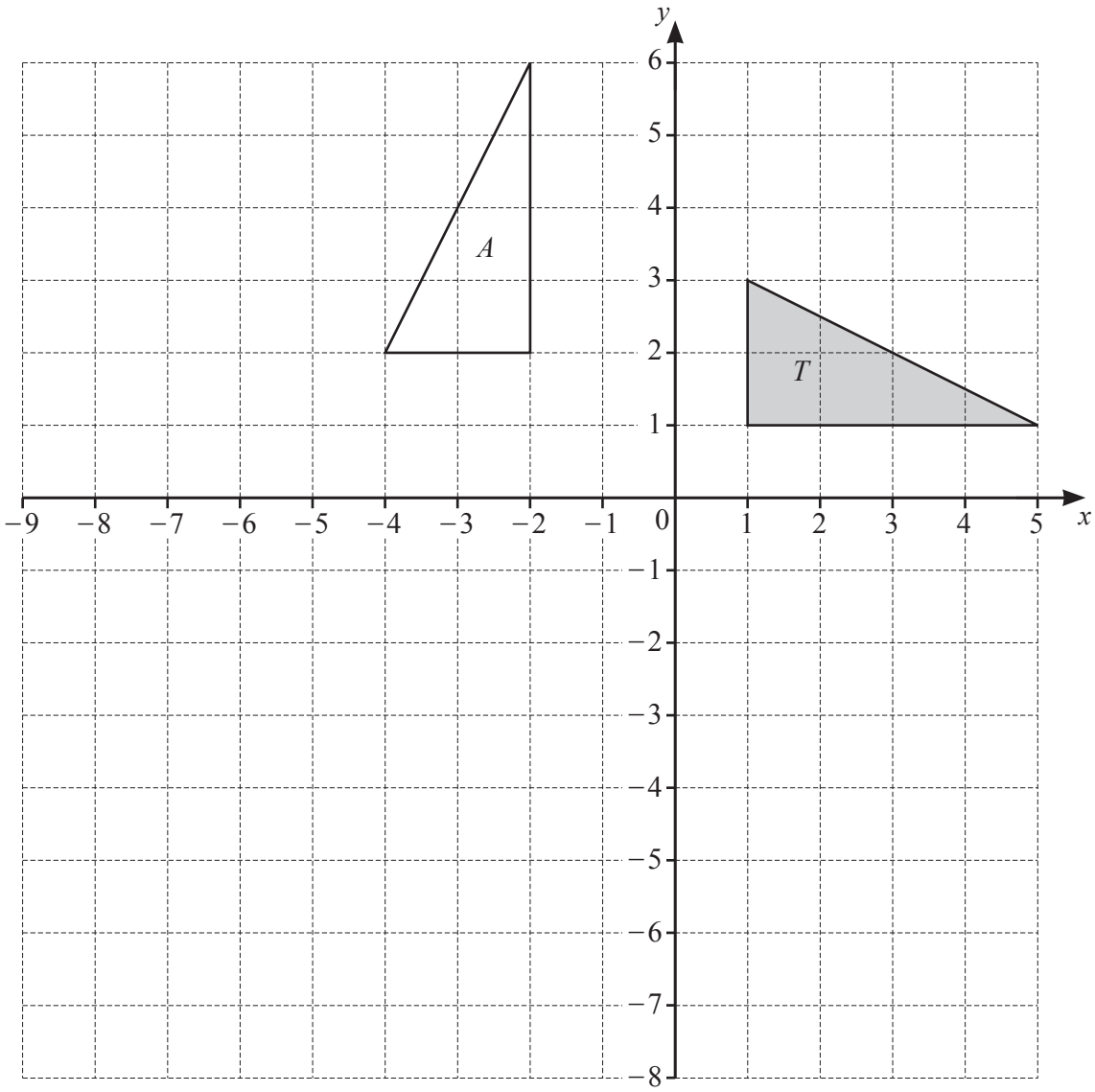


[3]

(b) Calculate an estimate of the mean height.

..... cm [4]

4



(a) Draw the reflection of triangle T in the line $y = -2$. [2]

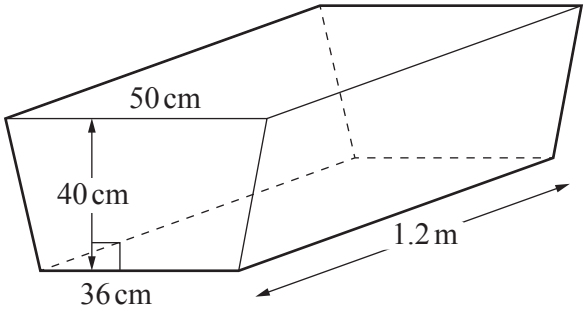
(b) Draw the enlargement of triangle T with scale factor $\frac{1}{2}$ and centre of enlargement $(-5, -3)$. [2]

(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.

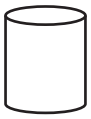
[3]

(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.

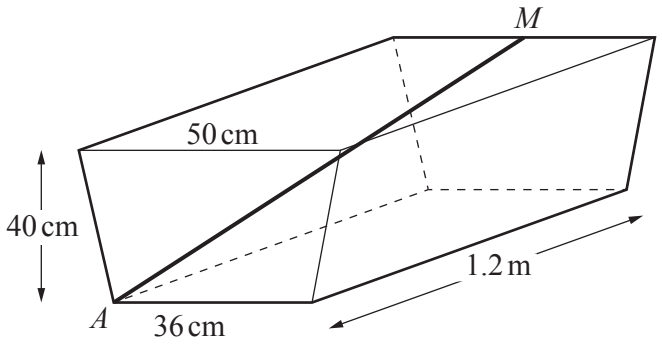
..... cm [3]

(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 $k = 3$.

$P =$ ..... [2]

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

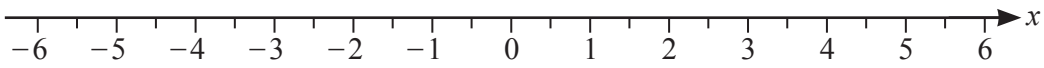
$k =$ ..... [3]

(b) **(i)** Solve.

$$x - 3 \leqslant 5x + 7$$

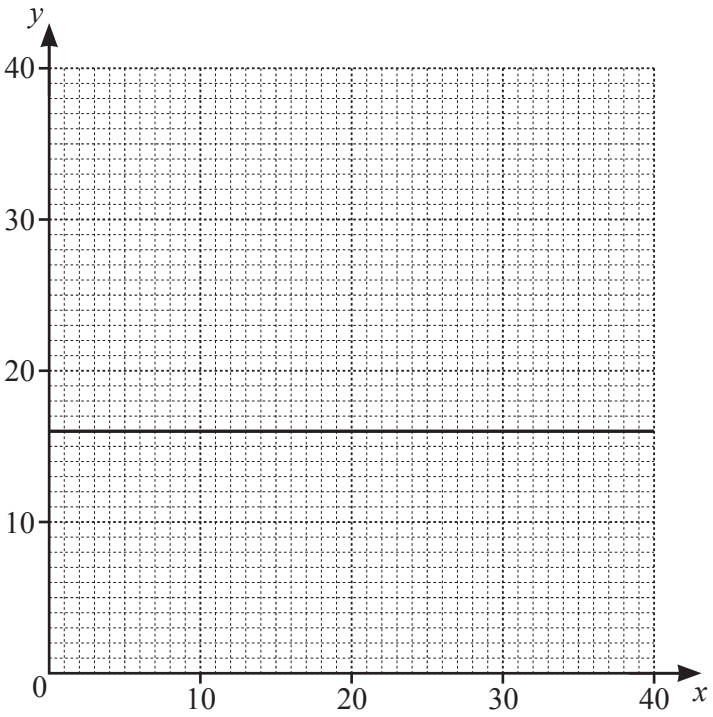
..... [2]

(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.

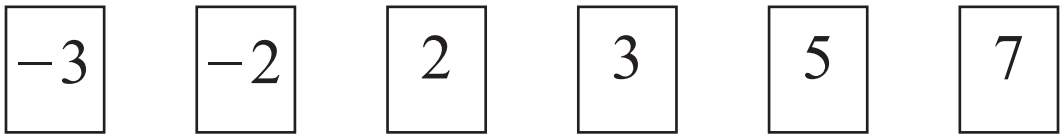
$y \geqslant 16$ $x > 2$ $2x + 3y \geqslant 72$ $y \leqslant 32 - x$

(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.



(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.

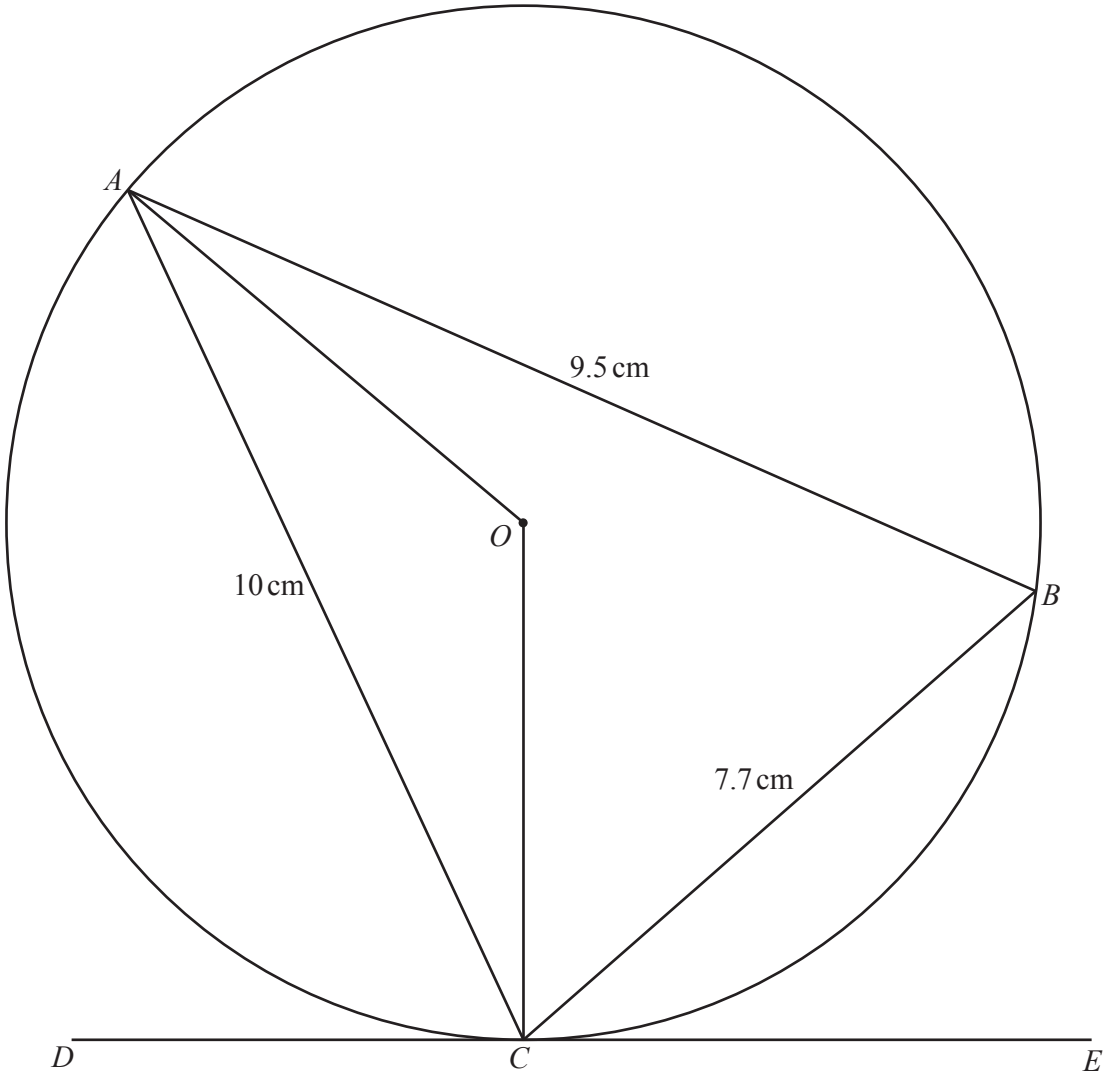
..... [3]

(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]

8



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 $ABC = 70.2°$, correct to 1 decimal place.

[4]

(b) Find

(i) angle AOC

Angle AOC = ... [1]

(ii) angle ACO

Angle ACO = ... [1]

(iii) angle ACD.

Angle ACD = ... [1]

(c) Calculate the radius, OC, of the circle.

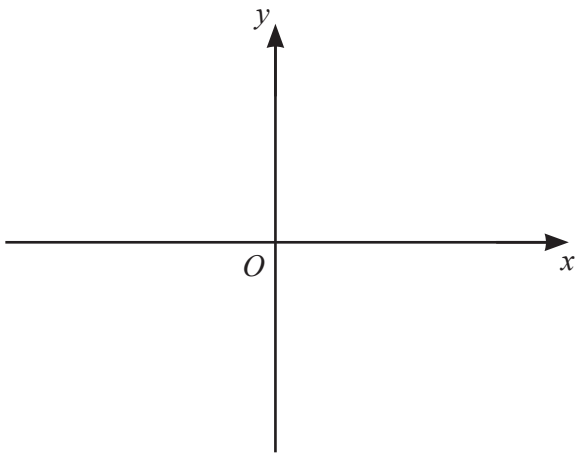
OC = ... cm [3]

(d) Calculate the area of triangle ABC as a percentage of the area of the circle.

..... % [4]

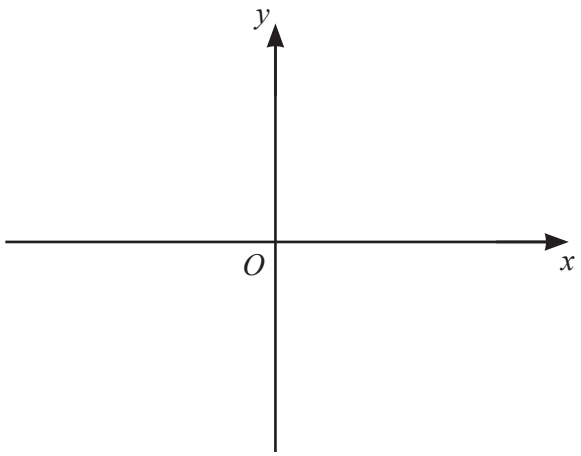
9 **(a)** Sketch the following graphs.
On each sketch, indicate any intercepts with the axes.

(i) $3x - 4y = 12$



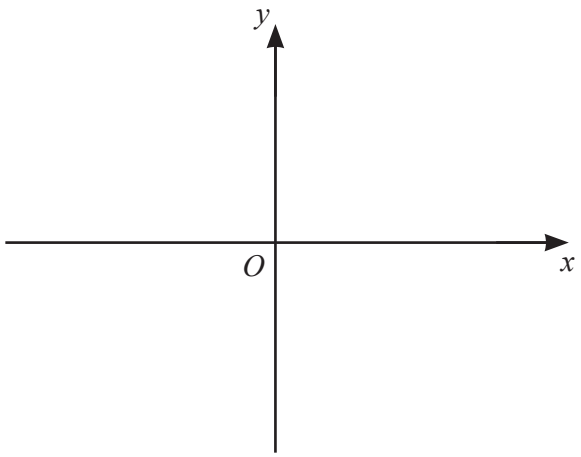
[2]

(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.

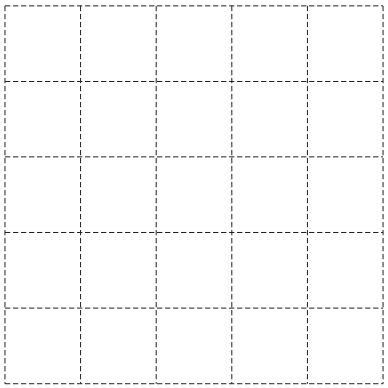
Find the coordinates of the two possible points where this tangent meets the graph.

(..... , ...)

(..... , ...) [5]

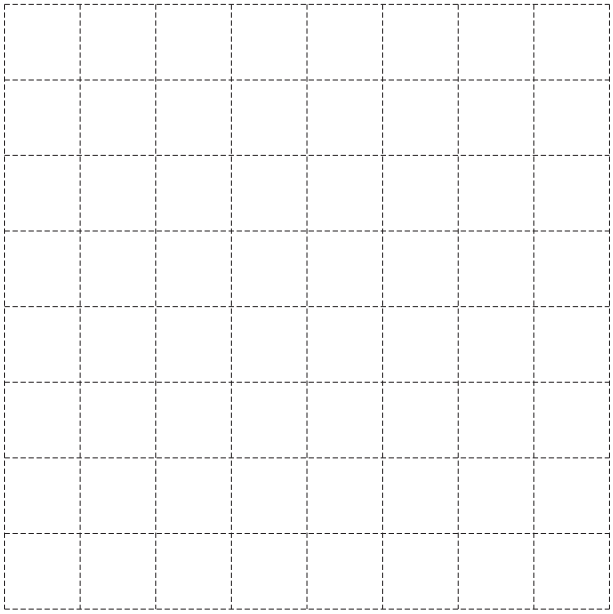
10 (a) $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

(i) On the grid, draw and label vector $2\mathbf{a}$.



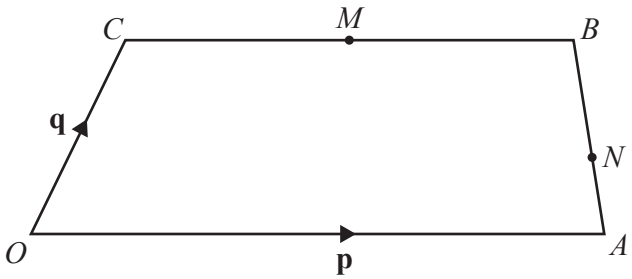
[1]

(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 **p** and/or **q**, in its simplest form

(a) $\overrightarrow{OB}$

$\overrightarrow{OB} =$ ..... [1]

(b) $\overrightarrow{AB}$

$\overrightarrow{AB} =$ ..... [2]

(c) $\overrightarrow{MN}$.

$\overrightarrow{MN} =$ ..... [3]

(ii) OA and MN are extended to meet at G.

Find the position vector of G in terms of **p**.

..... [2]

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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

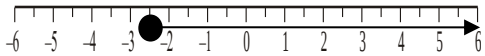
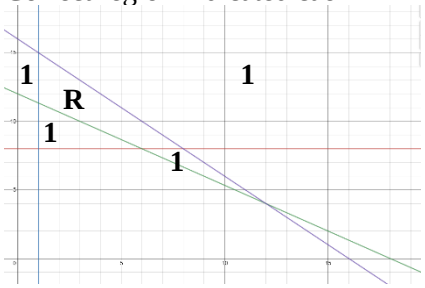
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)(i)	60.9 or 60.86 to 60.87	**1**	
1(a)(ii)	375	**2**	**M1** for $\frac{250}{12}$ [× 18] oe
1(a)(iii)	30 nfww	**3**	**M1** for figs2200 ÷ 800 [× 12]oe **M1** for 1500 ÷ 600 [× 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 $\frac{2.40\times\left(1+\frac{15}{100}\right)}{\textit{their}\textbf{(b)(i)}}\times 100$ [– 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 nfww	**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

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 $\frac{-8}{2\times3} \pm \sqrt{\frac{8^2}{4\times3^2} - \frac{(-20)}{3}}$ or better	**B2**	**B1** for $\sqrt{8^2 - 4(3)(-20)}$ oe or $\frac{-8+\sqrt{q}}{2\times3}$ oe or $\frac{-8-\sqrt{q}}{2\times3}$ 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

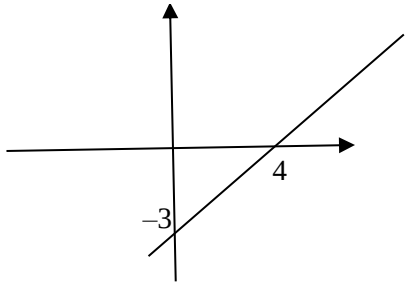
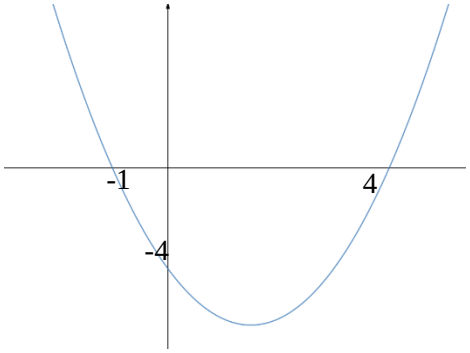
Question	Answer	Marks	Partial Marks
3(a)	Correct histogram	**3**	**B1** for each correct block If 0 scored, **SC1** for two of $\frac{28}{15}$, $\frac{33}{20}$, $\frac{13}{10}$ or 1.87 or 1.866 to 1.867, 1.65, 1.3
3(b)	38.65	**4**	**M1** for 12.5, 20, 32.5, 50, 65 soi **M1** for $\sum fx$ where x is 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

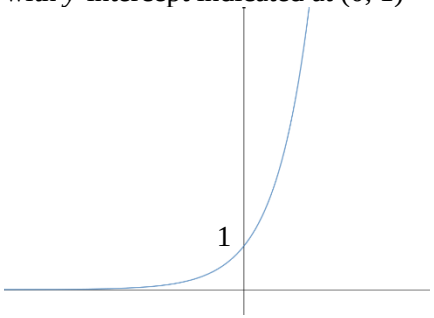
Question	Answer	Marks	Partial Marks
5(a)	$\left(\frac{(36+50)\times 40}{2}\right)\times 120$ oe or $\left(\frac{(0.36+0.5)\times 0.4}{2}\right)\times 1.2$ oe	**M2**	**M1** for $\frac{(36+50)\times 40}{2}$ oe or $\frac{(0.36+0.5)\times 0.4}{2}$ oe
	206400 ÷ 1000 = 206.4 or 0.2064 × 1000 = 206.4 nfww	**A1**	Must see an explicit conversion
5(b)	5 [minutes] 44 seconds	**3**	**B2** for 344 [seconds] oe 5.73…[mins] or **M1** for figs206.4 ÷ figs 6 oe
5(c)(i)	28[.0] or 27.96 to 27.97	**3**	**M2** for $[r^2=]\ \frac{\text{figs } 2064}{(figs84)\pi}$ or **M1** for $\pi r^2 \times figs84 = $ figs 2064
5(c)(ii)	140 cao	**2**	**M1** for $0.6h = 84$ oe ALT method **M1** for $\pi\times(their\ \textbf{(c)(i)})^2\times h = figs206400\div 0.6$ 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' $18^2 + 120^2$, $120^2 + 40^2$, $18^2 + 40^2$

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 $k^2 =$ ……. FT *their* first step **M1** for square root to final answer Max M2 for incorrect answer
6(b)(i)	$x \geqslant -2.5$ final answer	**2**	**M1** for $-4x \leqslant 7 + 3$ or better
6(b)(ii)		**1**	**FT** *their* 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 *their* region

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 $\frac{1}{18}$ oe
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 nfww	**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 $1 \leqslant k \leqslant 12$ 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 $\frac{1}{18}$

Question	Answer	Marks	Partial Marks
8(a)	[cos B =] $\frac{9.5^2+7.7^2-10^2}{2\times9.5\times7.7}$ oe	**M2**	**M1** for $10^2 = 9.5^2 + 7.7^2 - 2\times9.5\times7.7\cos B$ 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 – *their* **(b)(i)**) ÷ 2
8(b)(iii)	70.2	**1**	**FT** 90 – *their* **(b)(ii)**
8(c)	5.31 or 5.314 to 5.315	**3**	**M2** for $\frac{5}{\cos\ \textit{their}\,\textbf{(b)(ii)}}$ oe or **M1** for $\frac{5}{r} = \cos(\textit{their}\,\textbf{(b)(ii)})$ oe
8(d)	38.8 or 38.9 or 38.78 to 38.85	**4**	**M3** for $\frac{0.5\times9.5\times7.7\times\sin70.2}{\pi\times(\textit{their}\,\textbf{(c)})^2}$ [×100] OR **M1** for 0.5 × 9.5 × 7.7 × sin70.2 **M1** for $\pi\times(\textit{their}\,\textbf{(c)})^2$

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

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 *their* **(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 *their* **(b)(i)** = – 28 or **M1** for *their* **(b)(i)** = – 28

Question	Answer	Marks	Partial Marks
10(a)(i)	2**a** 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 *their* **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 $\frac{3}{8}\mathbf{p} - \frac{2}{3}$ (*their* **(b)(i)(b)**) oe or for $-\frac{3}{8}\mathbf{p} - \mathbf{q} + \mathbf{p} + \frac{1}{3}$ (*their* **(b)(i)(b)**) oe or **M1** for a correct route or for $[\overrightarrow{BN} =] -\frac{2}{3}$ (*their* **(b)(i)(b)**) or $[\overrightarrow{AN} =] \frac{1}{3}$ (*their* **(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**	**M1** for $\overrightarrow{AG} = \frac{3}{8}\mathbf{p} \div 2$ soi or for answer $k\mathbf{p}$ oe