Muhammad Shafiq ur Rehman (03247304567) Aitchison College

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8731750610

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2021**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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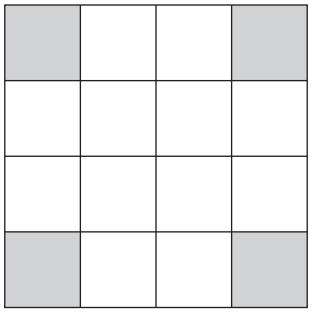
1



(a) Write down the order of rotational symmetry of this diagram.

..... [1]

(b) On the diagram, draw all the lines of symmetry. [2]

2 The probability that a train is late is 0.15 .

Write down the probability that the train is not late.

..... [1]

3 The stem-and-leaf diagram shows the number of hours that each of 16 students studied last week.

1	2	5	6	8	
2	0	1	1	7	9
3	2	3	4	5	
4	4	5	7		

Key: 1|2 represents 12 hours

Find

(a) the median,

..... h [1]

(b) the mode,

..... h [1]

(c) the range.

..... h [1]

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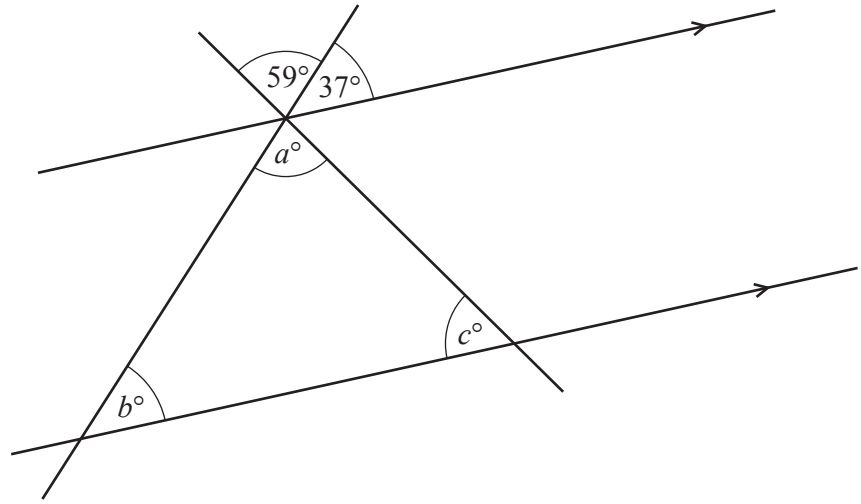
4



NOT TO SCALE

The diagram shows two parallel lines intersected by two straight lines.

Find the values of a, b and c.

$a =$ .....

$b =$ .....

$c =$ ..... [3]

5 Work out.

(a) $\begin{pmatrix} 6 \\ -5 \end{pmatrix} + \begin{pmatrix} 8 \\ -1 \end{pmatrix}$

( ) [1]

(b) $3\begin{pmatrix} -4 \\ 7 \end{pmatrix}$

( ) [1]

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6 **(a)** The nth term of a sequence is $n^2 + 3n$.

Find the first three terms of this sequence.

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

(b) These are the first five terms of a different sequence.

25 18 11 4 −3

Find the nth term of this sequence.

..... [2]

7 Solve the simultaneous equations.
You must show all your working.

$$2x + y = 3$$
$$x - 5y = 40$$

$x =$ .....

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

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8 **Without using a calculator**, work out $1\frac{3}{8} - \frac{5}{6}$.

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

..... [3]

9 A is the point $(5, -5)$ and B is the point $(9, 3)$.

(a) Find the coordinates of the midpoint of AB.

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

(b) Find the length of AB.

..... [3]

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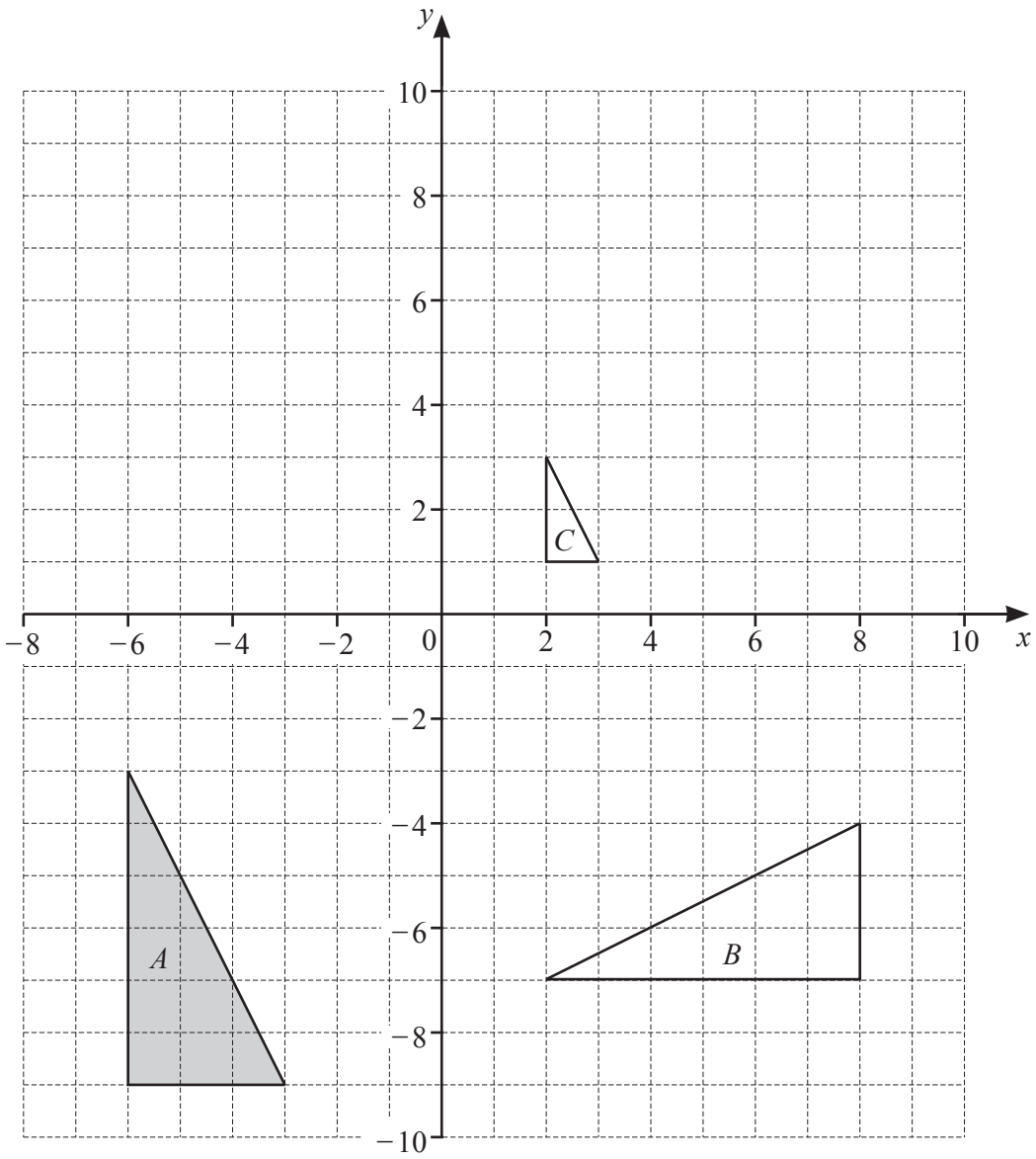
10



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

(i) triangle A onto triangle B,

.....

..... [3]

(ii) triangle A onto triangle C.

.....

..... [3]

(b) Draw the image of triangle A after a translation by the vector $\begin{pmatrix} 2 \\ 10 \end{pmatrix}$. [2]

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11 **(a)** Simplify fully.

$$(4ab^5)^4$$

..... [2]

(b) $2p^{\frac{1}{3}} = 6$

Find the value of p.

$p =$ ..... [1]

(c) $81^2 \div 3^t = 9$

Find the value of t.

$t =$ ..... [2]

12 The profit a company makes decreases exponentially at a rate of 0.9% per year.
In 2014, the profit was \$9500.

Calculate the profit in 2019.

\$ ..... [2]

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13 On a map, a lake has an area of $32\,cm^2$.
The scale of the map is 1 : 24 000.

Calculate the actual area of the lake.
Give your answer in km^2.

..... km^2 [2]

14 y is directly proportional to the square root of $(x-3)$.
When $x = 28$, $y = 20$.

Find y when $x = 39$.

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

15 Make h the subject of the formula $2mh = g(1-h)$.

$h =$ ..... [4]

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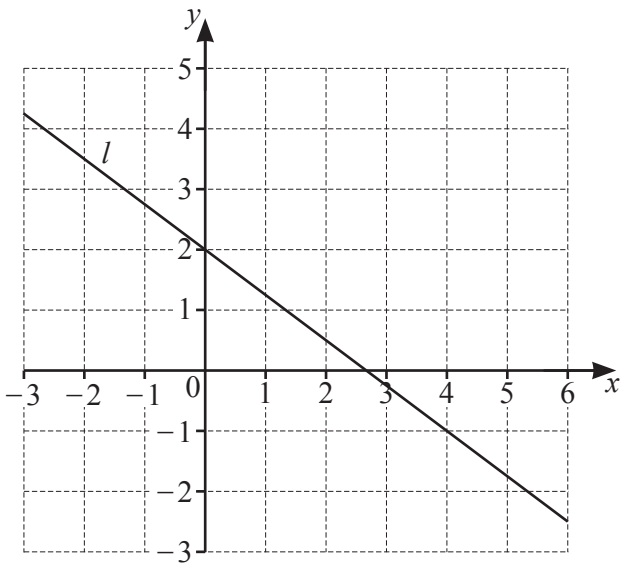
16



(a) Find the gradient of line l.

..... [2]

(b) Find the equation of line l in the form $y = mx + c$.

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

(c) Find the equation of the line that is perpendicular to line l and passes through the point $(12, -7)$. Give your answer in the form $y = mx + c$.

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

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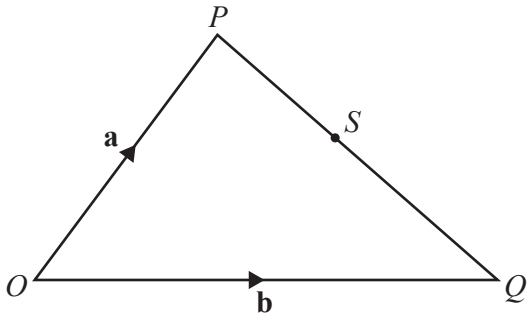
17 A bag contains 3 blue buttons, 8 white buttons and 5 red buttons.
Two buttons are picked at random from the bag, without replacement.

Work out the probability that the two buttons are either both red or both white.

..... [3]

18



NOT TO SCALE

S is a point on PQ such that $PS : SQ = 4 : 5$.

Find $\overrightarrow{OS}$, in terms of **a** and **b**, in its simplest form.

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

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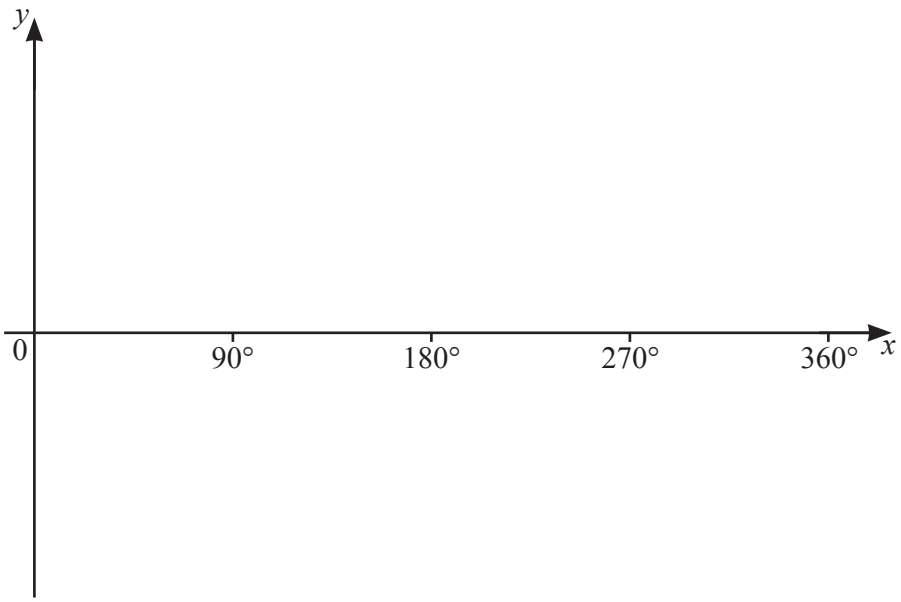
19 **(a)** Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Solve the equation $5\tan x = 1$ for $0° \leqslant x \leqslant 360°$.

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

20 The distance between two towns is 600 km, correct to the nearest 10 km.
A car takes 8 hours 40 minutes, correct to the nearest 10 minutes, to travel this distance.

Calculate the lower bound for the average speed of the car in km/h.

..... km/h [3]

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MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 70

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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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.

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

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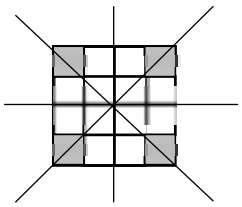
Question	Answer	Marks	Partial Marks
1(a)	4	**1**	
1(b)		**2**	**B1** for 2 or 3 correct lines drawn or for 4 correct lines and one wrong extra line
2	0.85 oe	**1**	
3(a)	28	**1**	
3(b)	21	**1**	
3(c)	35	**1**	
4	[a =] 59 [b =] 37 [c =] 84	**3**	**B1** for each If 0 scored **SC1** for *their* ($a + b + c$) = 180 if $a, b, c > 0$
5(a)	$\begin{pmatrix} 14 \\ -6 \end{pmatrix}$	**1**	
5(b)	$\begin{pmatrix} -12 \\ 21 \end{pmatrix}$	**1**	
6(a)	4 10 18	**2**	**B1** for 2 correct
6(b)	$32 - 7n$ oe final answer	**2**	**B1** for $32 - kn$ oe $k \neq 0$ *or* $j - 7n$ oe or $32 - 7n$ seen then spoilt
7	correctly eliminating 1 variable	**M1**	
	$x = 5$	**A1**	
	$y = -7$	**A1**	If M0 scored **SC1** for two values satisfying one of the original equations

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Question	Answer	Marks	Partial Marks
8	$\frac{11}{8}$ [$-\frac{5}{6}$] $\frac{3}{8}+\frac{1}{6}$	**B1**	Correct step for dealing with mixed number Allow $\frac{11k}{8k}$
	$\frac{33}{24}$ and $\frac{20}{24}$ $\frac{9}{24}$ and $\frac{4}{24}$	**M1**	Correct method to find common denominator e.g. 1 $\frac{9}{24}$ and $\frac{20}{24}$
	$\frac{13}{24}$ cao	**A1**	
9(a)	(7, − 1)	**2**	**B1** for each
9(b)	8.94 or 8.944…	**3**	**M2** for $\sqrt{(9-5)^2+(3--5)^2}$ oe or **M1** for $(9-5)^2+(3--5)^2$ oe
10(a)(i)	Rotation 90° anticlockwise oe (0, − 1)	**3**	**B1** for each
10(a)(ii)	enlargement [s.f.] $\frac{1}{3}$ (6, 6)	**3**	**B1** for each
10(b)	triangle at (− 4, 7) (− 4, 1) (− 1, 1)	**2**	**B1** for translation by $\begin{pmatrix}k\\10\end{pmatrix}$ or $\begin{pmatrix}2\\k\end{pmatrix}$
11(a)	$256a^4b^{20}$ final answer	**2**	**B1** for two correct elements in final answer
11(b)	27	**1**	
11(c)	6	**2**	**M1** for $3^k \div 3^t = 3^2$ or $3^8 \div 3^t = 3^k$ oe or better or $3^t = 729$ oe
12	9080 or 9080.13	**2**	**M1** for $9500\times\left(1-\frac{0.9}{100}\right)^5$
13	1.8432	**2**	**M1** for $\frac{32\times24000\times24000}{100000\times100000}$ oe If 0 scored, **SC1** for figs 184[32]... as answer

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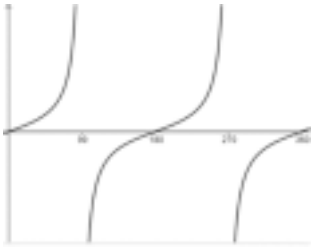
Question	Answer	Marks	Partial Marks
14	24	**3**	**M1** for $y = k\sqrt{x-3}$ oe **M1** for $y = their\ k\sqrt{39-3}$ oe
15	$\frac{g}{2m+g}$ final answer	**4**	**M1** for expanding brackets or $\div g$ **M1** for isolating terms in h **M1** for factorising **M1** for dividing by bracket to isolate h Incorrect/unsimplified final answer scores max 3 marks
16(a)	$-\frac{3}{4}$ or -0.75	**2**	**M1** for correct rise over run or **B1** for answer $\frac{3}{4}$ oe
16(b)	$[y=]-\frac{3}{4}x+2$ oe	**2**	**FT** $[y=]$*their* **(a)**$x+2$ oe **B1** for $[y=]$*their* **(a)**$x+c$ or $[y=]mx+2$.
16(c)	$[y=]\frac{4}{3}x-23$ oe	**3**	**M1** for gradient $\frac{-1}{their\ \textbf{(a)}}$ **M1** for $(12, -7)$ substituted into $y = their\ mx+c$
17	$\frac{19}{60}$ oe	**3**	**M2** for $\frac{8}{16}\times\frac{7}{15}+\frac{5}{16}\times\frac{4}{15}$ or **M1** for $\frac{8}{16}\times\frac{7}{15}$ or $\frac{5}{16}\times\frac{4}{15}$ If 0 scored **SC1** for $\frac{89}{256}$ oe
18	$\frac{5}{9}$ **a** + $\frac{4}{9}$ **b**	**2**	**M1** for $\frac{4}{9}$ (**b** – **a**) or $\frac{5}{9}$ (**a** – **b**) or a correct route
19(a)	Correct sketch 	**2**	**1** for one correct branch or correct sketch but with branches joined
19(b)	11.3 or 11.30 to 11.31 and 191.3 or 191.30 to 191.31	**2**	**B1** for each If 0 scored **SC1** for two answers with a difference of 180°

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Question	Answer	Marks	Partial Marks
20	68 nfww	**3**	**M2** for $\frac{600-5}{8\text{h}40 \text{ to} 8\text{h}50}$ or $\frac{590 \textit{ to } 600}{8\text{h}40 + 5[\text{m}]}$ oe or **M1** for 600 – 5 oe or 8h 40 + 5[m] oe or 520 + 5 oe[m] seen

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2021**

1 hour 30 minutes

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1 The probability that Jane wins a game is $\frac{7}{10}$.

(a) Find the probability that Jane does not win the game.

..... [1]

(b) Jane plays this game 50 times.

Find the number of times she is expected to win the game.

..... [1]

2 Calculate $\sqrt[4]{0.0256}$.

..... [1]

3 Emma has 15 mathematics questions to complete.
The stem-and-leaf diagram shows the time, in minutes, it takes her to complete each question.

0	3	5	6	7	7	8	8
1	1	2	2	3	6	6	6
2	0						

Key: 2 | 0 = 20 minutes

Complete the table.

Mode	..... min
Median	..... min
Range	..... min

[3]

4 Write down an expression for the range of k consecutive integers.

..... [1]

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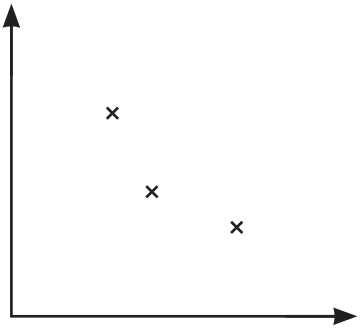
5 **(a)** Henrik draws this scatter diagram.



Put a ring around the **one** correct statement about this scatter diagram.

It shows no correlation.	It is not possible to tell if there is correlation as there are not enough points.	It shows negative correlation.	It shows positive correlation.

[1]

(b) Each of the four scatter diagrams shows the same set of data.
A line has been drawn on each diagram.

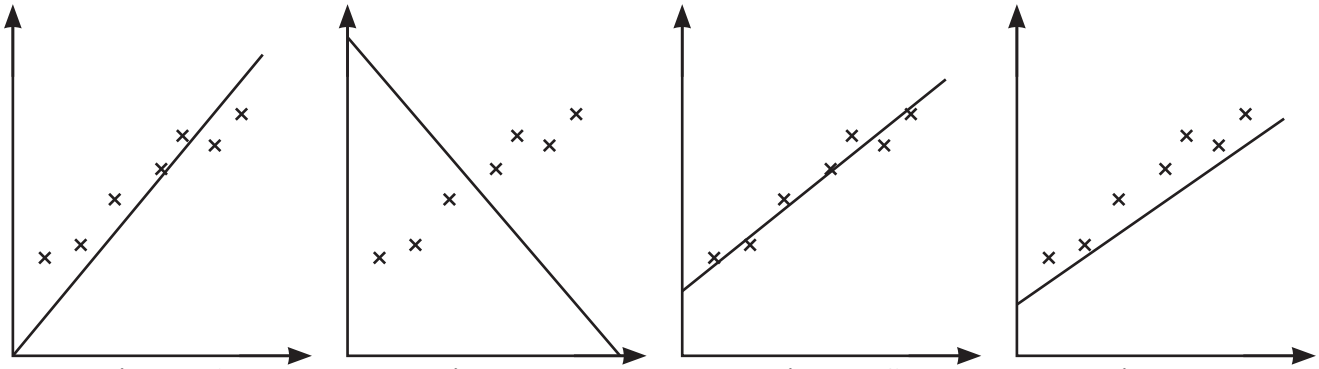


Diagram A Diagram B Diagram C Diagram D

Complete the statement.

The line in Diagram ..... is the most appropriate line of best fit. [1]

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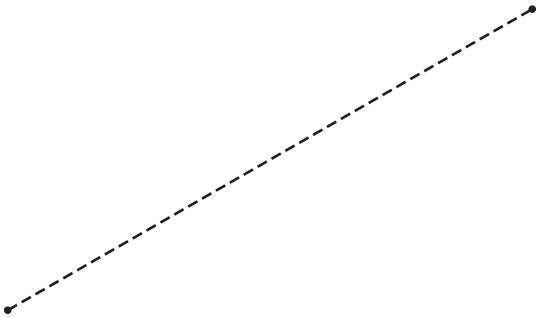
6 A rhombus has side length 6.5 cm.
The rhombus can be constructed by drawing two triangles.

Using a ruler and compasses only, construct the rhombus.
Leave in your construction arcs.
One diagonal of the rhombus has been drawn for you.



[2]

7 **(a)** Complete these statements.

The reciprocal of 0.2 is .....

A prime number between 90 and 100 is ..... [2]

(b)

$\frac{7}{5}$ 0.6 $\sqrt{7}$ 8 $\sqrt{9}$

From this list, write down an irrational number.

..... [1]

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8 $a = \dfrac{b^2}{5c}$

Find b when $a = 5.625$ and $c = 2$.

$b =$ ..... [2]

9 **Without using a calculator**, work out $\frac{2}{3} \div 1\frac{3}{7}$.

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

..... [3]

10 **(a)** Write 0.006 54 in standard form.

..... [1]

(b) The number 1.467×10^{102} is written as an ordinary number.

Write down the number of zeros that follow the digit 7.

..... [1]

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11 Write $0.\dot{0}\dot{4}$ as a fraction in its simplest form.

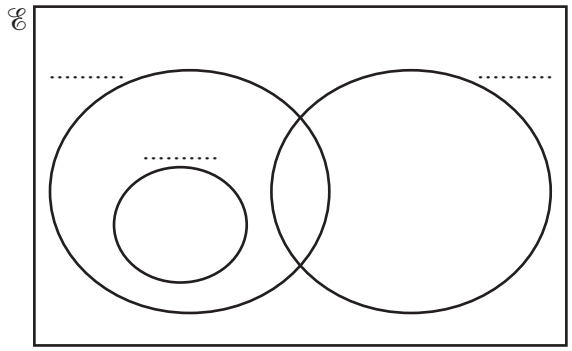
..... [1]

12 **(a)** $\mathscr{E}$ = {integers greater than 2}
A = {prime numbers}
B = {odd numbers}
C = {square numbers}

(i) Describe the type of numbers in the set $B' \cap C$.

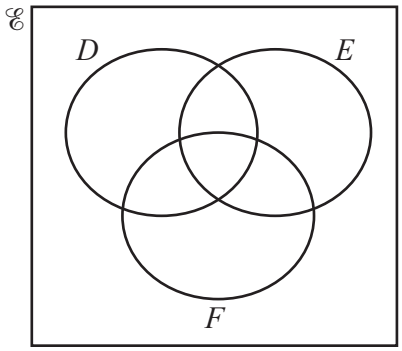
..... [1]

(ii) Complete the set labels on the Venn diagram.



[1]

(b)



Shade the region $D' \cup (E \cap F)'$. [1]

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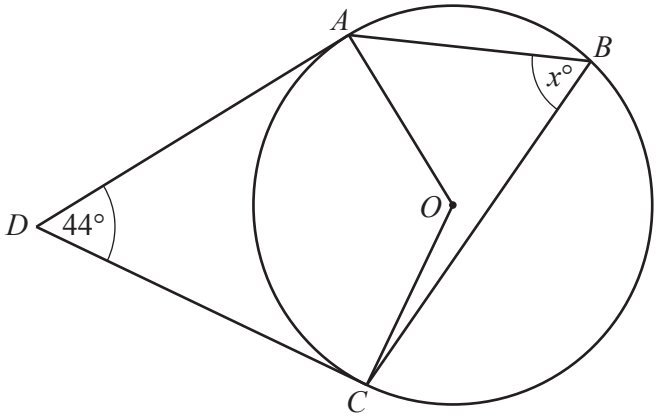
13



NOT TO SCALE

A, B and C are points on a circle, centre O.
DA and DC are tangents.
Angle $ADC = 44°$.

Work out the value of x.

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

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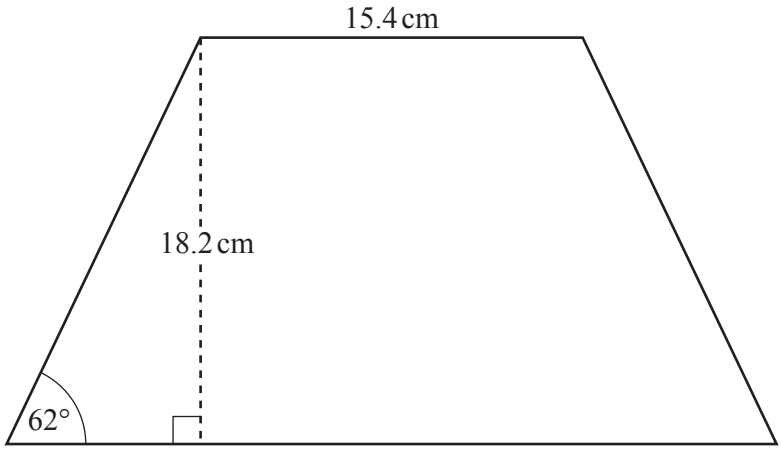
14



NOT TO SCALE

The diagram shows a trapezium.
The trapezium has one line of symmetry.

Work out the area of the trapezium.

..... cm^2 [4]

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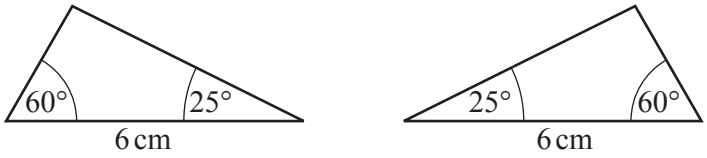
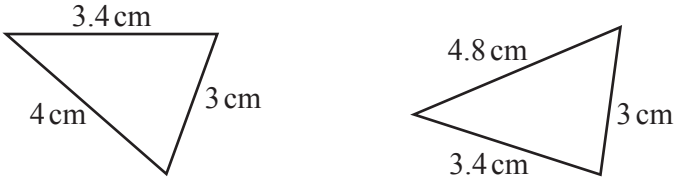
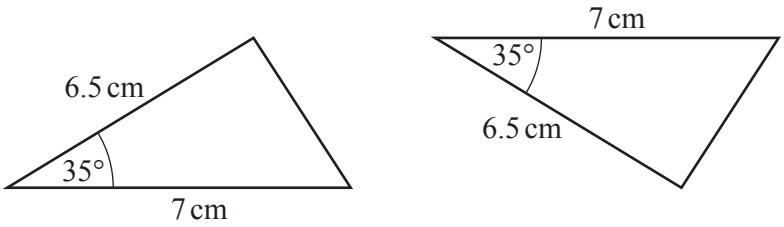
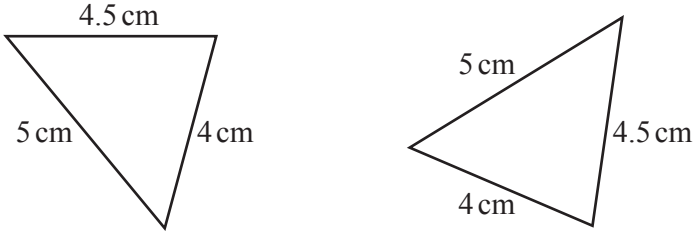
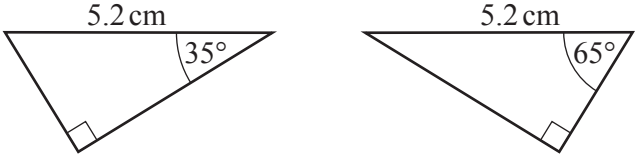
15 Complete the table showing information about the congruence of pairs of triangles.
The first two rows have been completed for you.
All diagrams are not to scale.

Pair of triangles	Congruent or not congruent	Congruence criterion
	Congruent	ASA
	Not congruent	None
		
		
		

[3]

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16 A is the point (5, 7) and B is the point (9, −1).

(a) Find the length AB.

..... [3]

(b) Find the equation of the line AB.

..... [3]

17 Find the gradient of the line that is perpendicular to the line $3y = 4x - 5$.

..... [2]

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18 $f(x) = x^2 - 25$ $g(x) = x + 4$

Solve $fg(x+1) = gf(x)$.

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

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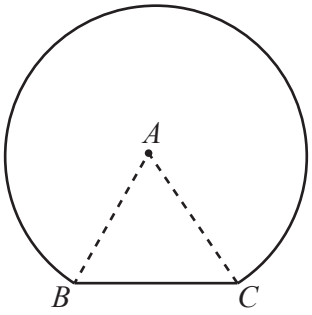
19 **(a)**



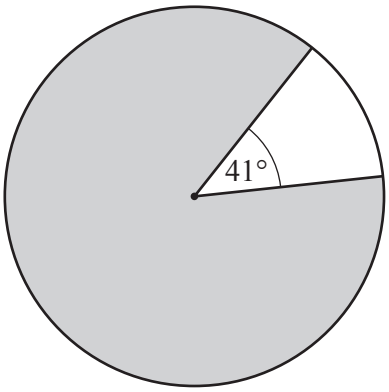
NOT TO SCALE

The diagram shows a shape made from an equilateral triangle ABC and a sector of a circle.
Points B and C lie on the circle, centre A.
The side length of the equilateral triangle is 12.4 cm.

Work out the perimeter of the shape.

..... cm [3]

(b)



NOT TO SCALE

The diagram shows two sectors of a circle.
The major sector is shaded.
The area of the major sector is 74.5 cm^2.

Calculate the radius of the circle.

..... cm [3]

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20 Expand and simplify.

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

..... [3]

21 The force of attraction, F Newtons, between two magnets is inversely proportional to the square of the distance, d cm, between the magnets.

When $d = 1.5$, $F = 48$.

(a) Find an expression for F in terms of d.

$F =$ ..... [2]

(b) When the distance between the two magnets is doubled the new force is n times the original force.

Work out the value of n.

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

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22 Simplify.

$$\frac{2x^2 - 5x - 12}{3x^2 - 12x}$$

..... [4]

23 Find all the solutions of $4\sin x = 3$ for $0° \leqslant x \leqslant 360°$.

..... [2]

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24 Solve.

$$\frac{1}{x+1}+\frac{9}{x+9}=1$$

$x =$ ..... or $x =$ ..... [5]

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 70

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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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.

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

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Question	Answer	Marks	Partial Marks
1(a)	$\frac{3}{10}$ oe	**1**	
1(b)	35	**1**	
2	0.4 or $\frac{2}{5}$	**1**	
3	Mode 16 Median 11 Range 17	**3**	**B1** for each
4	$k - 1$	**1**	
5(a)	It is not possible to tell if there is correlation as there are not enough points.	**1**	
5(b)	C	**1**	
6	Accurate construction of rhombus with sides 6.5 cm and correct construction arcs.	**2**	**B1** for accurate diagram with no/wrong arcs or for one triangle (6.5 cm, 6.5 cm, 8 cm) correctly constructed with correct arcs or for four correct arcs
7(a)	5 97	**2**	**B1** for each
7(b)	$\sqrt{7}$	**1**	
8	[±] 7.5 oe	**2**	**M1** for $5.625 = \frac{b^2}{2\times5}$ or better
9	$\frac{2}{3} \times \frac{7}{10}$ or $\frac{14}{21} \div \frac{30}{21}$ oe with common denominator	**M2**	**B1** for $\frac{10}{7}$ oe or **M1** for $\frac{2}{3} \times$ *their* $\frac{7}{10}$
	$\frac{7}{15}$ cao	**A1**	
10(a)	6.54×10^{-3}	**1**	
10(b)	99	**1**	
11	$\frac{4}{99}$ cao	**1**	
12(a)(i)	Even square numbers oe	**1**	

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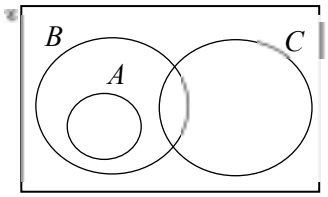
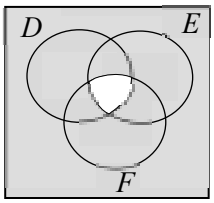
Question	Answer	Marks	Partial Marks
12(a)(ii)		1	
12(b)		1	
13	68	3	**M1** for correctly identifying 90° angle soi or *DAC* / *DCA* = 68 **M1** for [obtuse angle] *AOC* identified as $2x$ soi or x = *their DAC / DCA*
14	456 or 456.4…	4	**M2** for $\frac{18.2}{\tan 62}$ oe or **M1** for $\tan 62 = \frac{18.2}{x}$ oe **M1** for $\frac{1}{2}\left(\left(\text{their trapezium base}\right)+15.4\right)\times 18.2$ oe
15	Congruent SAS Congruent SSS Not congruent None	3	**B1** for each correct row
16(a)	8.94 or 8.944…	3	**M2** for $\sqrt{(9-5)^2+(-1-7)^2}$ oe or **M1** for $(9-5)^2+(-1-7)^2$ oe
16(b)	$y = -2x + 17$ oe final answer	3	**B2** for answer $-2x + 17$ OR **M1** for $\frac{-1-7}{9-5}$ oe **M1** for correct substitution of (5, 7) or (9, –1) into y = *their* $mx + c$ oe
17	$-\frac{3}{4}$ or – 0.75	2	**M1** for $y=\frac{4x-5}{3}$ or better or for $\frac{-1}{\text{their gradient}}$

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Question	Answer	Marks	Partial Marks
18	$[x =] -2.1$ oe	4	**M3** for $x^2 + 10x = x^2 - 21$ or better OR **M1** for $(x + 1 + 4)^2 - 25$ or better **M1** for $x^2 - 25 + 4$ or better If 0 scored **SC1** for answer $-\frac{11}{6}$ oe
19(a)	77.3 or 77.32 to 77.33…	3	**M2** for $\frac{360-60}{360}\times\pi\times12.4\times2$ oe $[\pm n \times 12.4]$ or **M1** for angle 60° or 300° soi or for $\frac{k}{360}\times\pi\times12.4\times2$ oe $[\pm n \times 12.4]$
19(b)	5.17 or 5.172 to 5.173…	3	**M2** for $\frac{74.5}{\pi}\times\frac{360}{360-41}=r^2$ oe or better or **M1** for $74.5=\frac{360-41}{360}\times\pi r^2$ oe or for $\sqrt{\frac{74.5}{\pi}\times\frac{360}{k}}$ oe
20	$2x^3 + 7x^2 - 7x - 30$ final answer	3	**B2** for unsimplified expansion with at most one error or for simplified four-term expression of correct form with three terms correct or **B1** for correct expansion of two brackets with at least three terms out of four correct
21(a)	$[F =]\frac{108}{d^2}$ final answer	2	**M1** for $F = \frac{k}{d^2}$ oe or better
21(b)	$[n =]\frac{1}{4}$ or 0.25	1	
22	$\frac{2x+3}{3x}$ final answer	4	**B2** for $(x-4)(2x+3)$ or **B1** for $(x + a)(2x + b)$ where $ab = -12$ or $2a + b = -5$ or $x(2x+3)-4(2x+3)$ or $2x(x-4)+3(x-4)$ **B1** for $3x(x-4)$
23	48.6 or 48.59… and 131.4 or 131.4…	2	**B1** for each If 0 scored **SC1** for two answers with a sum of 180°

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Question	Answer	Marks	Partial Marks
24	$x = 3$, $x = -3$ nfww	**5**	**M2** for $x + 9 + 9(x + 1) = (x + 1)(x + 9)$ oe or better or **M1** for $x + 9 + 9(x + 1)$ or $(x + 1)(x + 9)$ oe or better **B1** for $x^2 + x + 9x + 9$ seen **M1 dep** for $[0 =]x^2 - 9$ oe simplified or better

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2021**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

This document has **12** pages.

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1 Write down the number that is 23 less than -1.6 .

..... [1]

2 Write as a fraction in its simplest form.

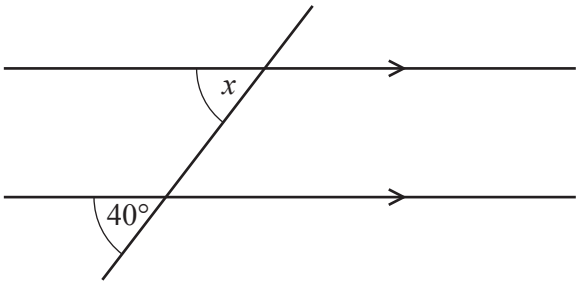
(a) 72%

..... [1]

(b) 0.004

..... [1]

3



NOT TO SCALE

The diagram shows a pair of parallel lines and a straight line.

Complete the statement with the correct geometrical reason.

$x = 40°$ because the angles are ..... [1]

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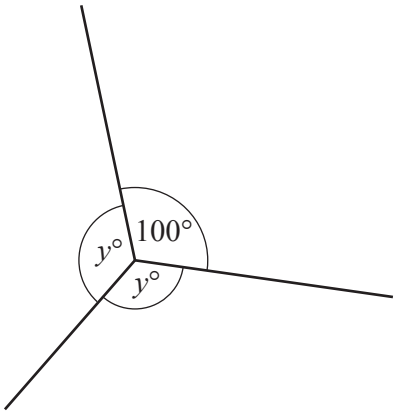
4



NOT TO SCALE

Find the value of y.

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

5 Jo invests \$600 for 7 years at a rate of 1.5% per year simple interest.

Calculate the total interest earned during the 7 years.

\$ ..... [2]

6 Maria buys n pencils that cost p cents each.
She pays with a \$$y$ note.

Find, in terms of n, p and y, the amount of change Maria receives.
Give your answer in cents.

..... cents [2]

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7 12 18 29 49 91 125

From the list of numbers, write down

(a) a cube number,

..... [1]

(b) a prime number.

..... [1]

8 Alex changes 190 euros (€) into pounds (£) when £1 = €1.1723 .

Calculate the amount Alex receives.
Give your answer correct to 2 decimal places.

£ ..... [2]

9 **Without using a calculator**, work out $1\frac{2}{3} \div 7\frac{1}{2}$.
You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

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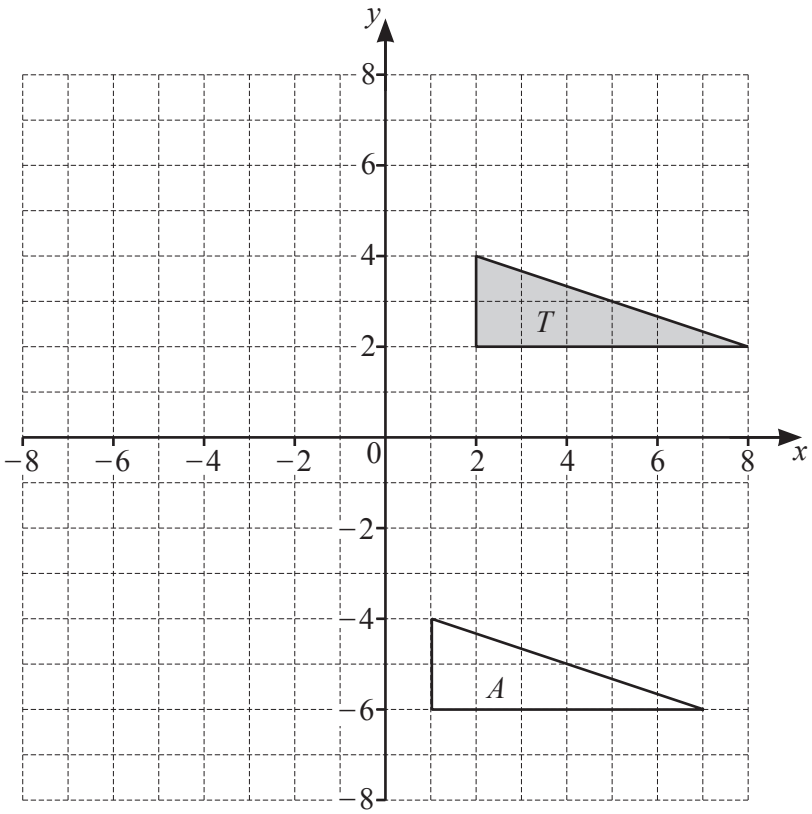
10



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

.....

..... [2]

(b) Draw the image of triangle T after an enlargement, scale factor $-\frac{1}{2}$, centre (0, 0). [2]

11 Simplify $3x^3 \times 4x^4$.

..... [2]

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12 x is an integer and $-3 \leqslant 2x-1 < 3$.

Find the values of x.

..... [2]

13 Expand and simplify.

$$6(t-q)-2(t-3q)$$

..... [2]

14 The magnitude of the vector $\begin{pmatrix} 20 \\ k \end{pmatrix}$ is 29.

Find the value of k.

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

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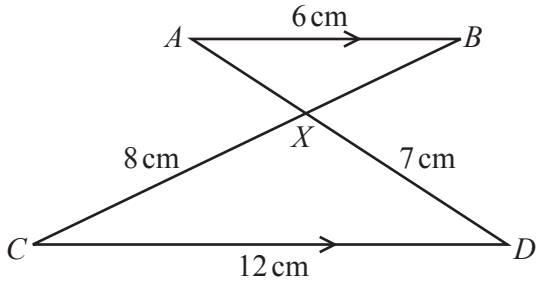
15



NOT TO SCALE

In the diagram, AB is parallel to CD.
AD and BC intersect at X.
$AB = 6\,\text{cm}$, $CD = 12\,\text{cm}$, $CX = 8\,\text{cm}$ and $DX = 7\,\text{cm}$.

(a) Complete the statement.

Triangle ABX is ..... to triangle DCX. [1]

(b) Work out the length of BX.

$BX =$ ..... cm [2]

(c) The area of triangle DCX is $26.906\,\text{cm}^2$.

Use this value to find the area of

(i) triangle ABX,

..... cm^2 [2]

(ii) triangle ACX.

..... cm^2 [1]

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16 The sides of a regular hexagon are 80 mm, correct to the nearest millimetre.

Calculate the lower bound of the perimeter of the hexagon.

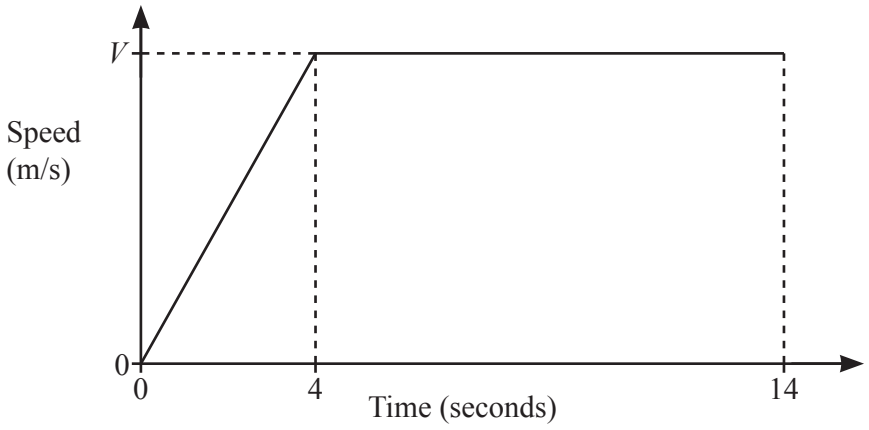
..... mm [2]

17 The interior angle of a regular polygon is 175°.

Calculate the number of sides.

..... [2]

18 A car starts from rest and accelerates at a rate of 3 m/s^2 for 4 seconds.
The car then travels at a constant speed for 10 seconds.



NOT TO SCALE

The diagram shows the speed–time graph for this journey.

(a) Find the value of V.

$V =$ ..... [1]

(b) Calculate the total distance travelled by the car during the 14 seconds.

..... m [2]

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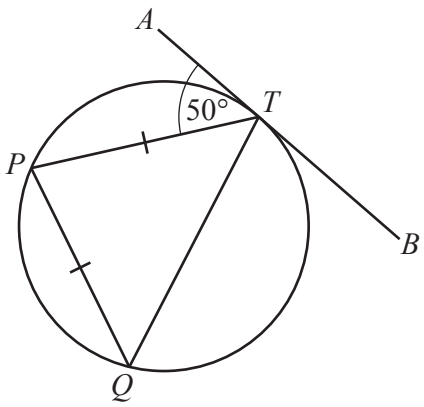
19 (a)



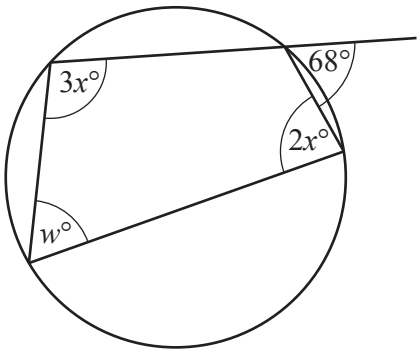
NOT TO SCALE

P, Q and T are points on a circle.
ATB is a tangent to the circle at T and $PT = PQ$.

Find angle TPQ.

Angle TPQ = ... [2]

(b)



NOT TO SCALE

The diagram shows a cyclic quadrilateral with an exterior angle of 68°.

Find the value of w and the value of x.

w = ...

x = ... [3]

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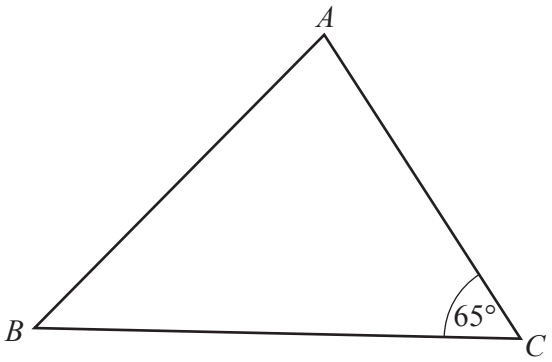
20 Simplify $2.1 \times 10^{p} + 2.1 \times 10^{p-1}$.
Give your answer in standard form.

..... [2]

21



NOT TO SCALE

The shortest distance from B to AC is 12.8 cm.

Calculate BC.

$BC =$ ..... cm [3]

22 z is inversely proportional to the square of $(y-2)$.
When $y = 5$, $z = 9$.

Find z in terms of y.

$z =$ ..... [2]

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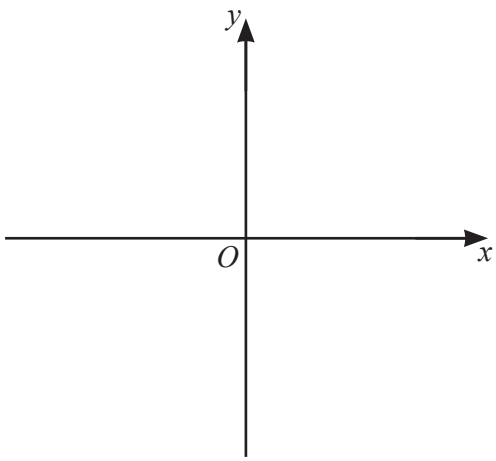
23 A triangle has sides of length 11 cm, 10 cm and 9 cm.

Calculate the largest angle in the triangle.

..... [4]

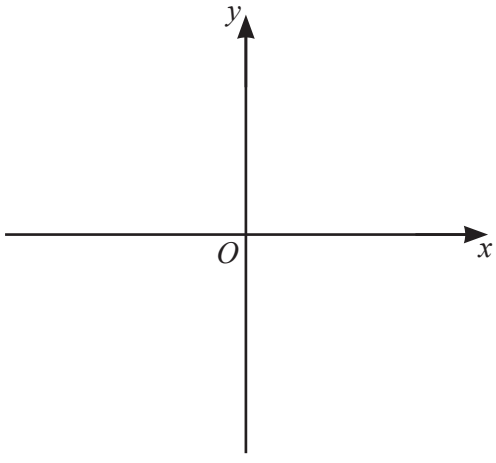
24 On the axes, sketch the graph of each of these functions.

(a) $y = \frac{2}{x}$



[2]

(b) $y = 2^{-x}$



[2]

Questions 25 and 26 are printed on the next page.

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25 Find the x-coordinates of the points on the graph of $y = x^5 - 5x^4$ where the gradient is 0.

..... [4]

26 Malik goes to a shop every day to buy bread.

On any day, the probability that Malik goes to the shop in the morning is 0.7 .

If he goes in the morning, the probability that there is bread for Malik to buy is 0.95 .
If he goes later, the probability that there is bread for Malik to buy is 0.6 .

Calculate the probability that, on any day, there is bread for Malik to buy.

..... [3]

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MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 70

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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

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[Turn over

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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.

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

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Question	Answer	Marks	Partial Marks
1	–24.6	**1**	
2(a)	$\frac{18}{25}$ cao	**1**	
2(b)	$\frac{1}{250}$ cao	**1**	
3	Corresponding	**1**	
4	130	**2**	**M1** for 360 – 100 or better
5	63	**2**	**M1** for $600\times\frac{1.5}{100}$ oe or better If **0** scored **SC1** for answer 663
6	$100y - np$	**2**	**B1** for $100y$ seen or for answer $[10^k]\, y - np$
7(a)	125	**1**	
7(b)	29	**1**	
8	162.07 cao	**2**	**M1** for 190 ÷ 1.1723
9	$\frac{5}{3}\times\frac{2}{15}$ oe or $\frac{10}{6}\div\frac{45}{6}$ oe with common denominator	**M2**	**B1** for $\frac{5}{3}$ oe or $\frac{15}{2}$ oe or **M1** for $\textit{their}\frac{5}{3}\times\textit{their}\frac{2}{15}$
	$\frac{2}{9}$ cao	**A1**	
10(a)	Translation $\begin{pmatrix}-1\\-8\end{pmatrix}$	**2**	**B1** for each
10(b)	Image at (–1, –1), (–4, –1), (–1, –2)	**2**	**B1** for image correct scale factor and orientation but wrong position or for enlargement scale factor $\frac{1}{2}$ centre (0, 0)
11	$12x^7$ final answer	**2**	**B1** for $12x^j$ or kx^7 $(j,k \neq 0)$ as final answer
12	–1, 0, 1 final answer	**2**	**B1** for $-1 \leqslant x < 2$ or two correct answers and no extras or three correct answers and one extra/wrong
13	$4t$ final answer	**2**	**B1** for $6t - 6q$ or $-2t + 6q$ or $2t - 6q$ or for $4t$ or $0q$ in the final answer

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Question	Answer	Marks	Partial Marks
14	[±] 21	**3**	**M2** for $29^2 - 20^2$ oe or better or **M1** for $20^2 + k^2 = 29^2$ oe
15(a)	Similar	**1**	
15(b)	4	**2**	**M1** for $\frac{12}{6} = \frac{8}{BX}$ oe or better If **0** scored **SC1** for answer 3.5
15(c)(i)	6.7265 or 6.73 or 6.726 to 6.727	**2**	**M1** for scale factor 2^2 or $\left(\frac{1}{2}\right)^2$ oe soi
15(c)(ii)	13.453 or 13.5 or 13.45 to 13.46	**1**	**FT** *their* **(c)(i)** × 2
16	477	**2**	**M1** for 80 – 0.5 oe or better seen
17	72	**2**	**M1** for $\frac{360}{180-175}$ oe or $\frac{180(n-2)}{n} = 175$ oe
18(a)	12	**1**	
18(b)	144	**2**	**FT** 12 × *their V* **M1** for any relevant area **FT** *their V*
19(a)	80	**2**	**B1** for angle $PQT = 50$
19(b)	[w =] 68 [x =] 36	**3**	**B1** for 68 **B2** for 36 or **M1** for $3x + 2x + 68 + 112 = 360$ or better
20	2.31×10^p	**2**	**B1** for $21 \times 10^{p-1}$ or 0.21×10^p or answer with figs 231
21	14.1 or 14.12...	**3**	**M2** for $\sin 65 = \frac{12.8}{BC}$ oe or better or **M1** for recognition that the line from B is perpendicular to AC
22	$\frac{81}{(y-2)^2}$ final answer	**2**	**M1** for $z = \frac{k}{(y-2)^2}$ oe or better

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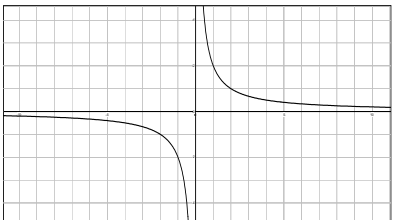
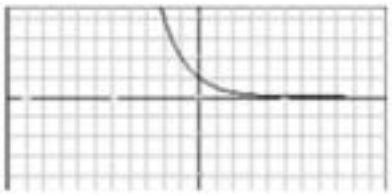
Question	Answer	Marks	Partial Marks
23	70.5 or 70.52 to 70.53	4	**B3** for 59(.0) or 58.99… or 50.5 or 50.47 to 50.48 OR **M2** for $\frac{10^2+9^2-11^2}{2\times10\times9}$ oe or equivalent expression for smaller angle or **M1** for $11^2=10^2+9^2-2\times10\times9\cos(...)$ oe or equivalent expression for smaller angle **A1** for $\frac{1}{3}$ oe
24(a)	Correct sketch 	2	**B1** for one correct branch or attempt at correct shape
24(b)	Correct sketch 	2	**B1** for correct shape but crossing x-axis or for correct shape but just drawn in one quadrant
25	0 and 4 final answer	4	**B3** for $5x^3(x-4)$ or better or **B2** for $5x^4-20x^3$ or **B1** for $5x^4$ or $-20x^3$
26	0.845 oe	3	**M2** for $0.7\times0.95+(1-0.7)\times0.6$ oe or **M1** for one of these products

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

1135083899

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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

DC (CE/CB) 200348/4
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[Turn over

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1 **(a)** The total cost of a taxi journey is calculated as

- \$0.50 per kilometre

plus

- \$0.40 per minute.

(i) Calculate the total cost of a journey of 32 km that takes 30 minutes.

\$ ..... [2]

(ii) The total cost of a journey of 100 km is \$98.

Show that the time taken is 2 hours.

[3]

(b) Three taxi drivers travel a total of 8190 km in the ratio 5 : 2 : 7.

Calculate the distance each driver travels.

Driver 1 ..... km

Driver 2 ..... km

Driver 3 ..... km [3]

(c) After midnight, the cost of any taxi journey increases by 45%.
One journey costs \$84.10 after midnight.

Calculate the cost of the same journey before midnight.

\$ ..... [2]

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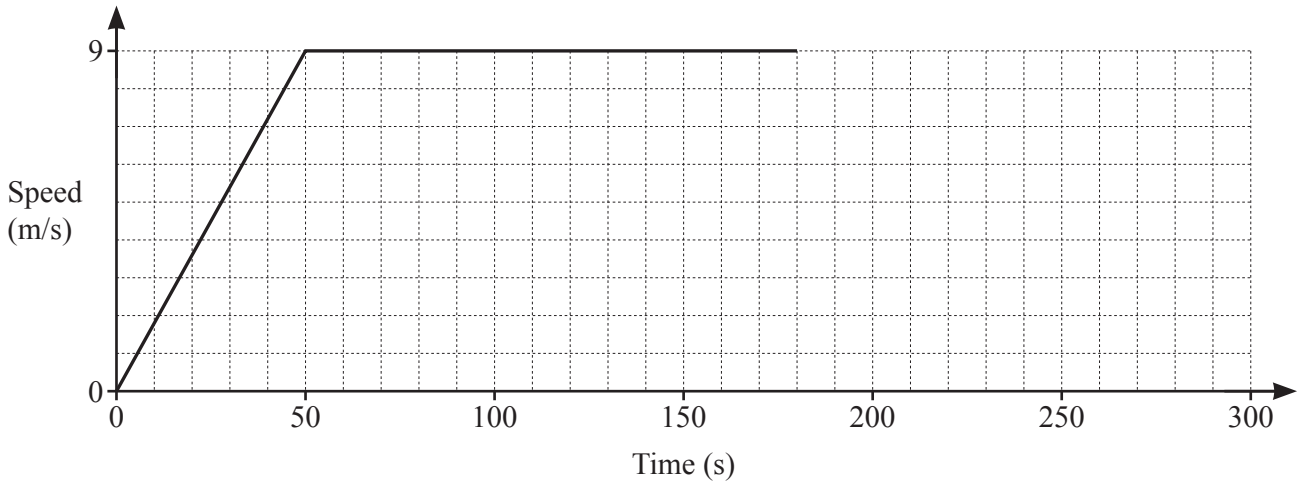
2 The diagram shows the speed−time graph for the first 180 seconds of a train journey.



(a) Find the acceleration, in m/s^2, of the train during the first 50 seconds.

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

(b) After 180 seconds, the train decelerates at a constant rate of 1944 **km/h^2**.

Show that the train decelerates for 60 seconds until it stops.

[2]

(c) Complete the speed−time graph. [1]

(d) Calculate the average speed of the train for the whole journey.

..... m/s [4]

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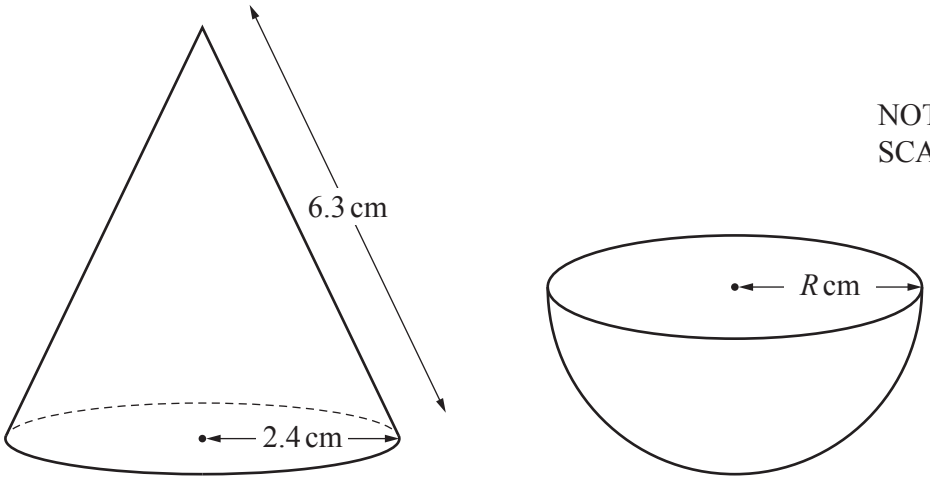
3 (a)



NOT TO SCALE

The diagram shows a solid cone and a solid hemisphere.
The cone has radius 2.4 cm and slant height 6.3 cm.
The hemisphere has radius R cm.
The **total** surface area of the cone is equal to the **total** surface area of the hemisphere.

Calculate the value of R.

[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]
[The curved surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

$R =$ ..... [4]

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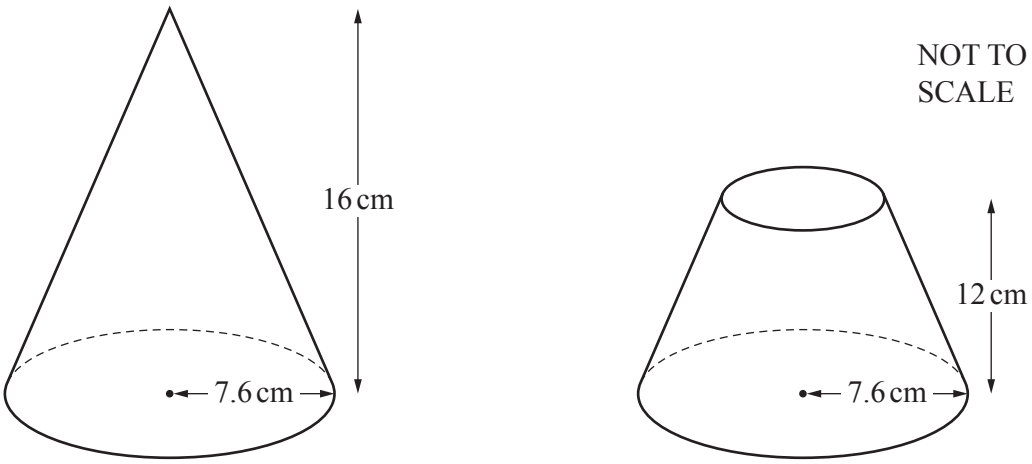
(b)



The diagram shows a solid cone with radius 7.6 cm and height 16 cm.
A cut is made parallel to the base of the cone and the top section is removed.
The remaining solid has height 12 cm, as shown in the diagram.

Calculate the volume of the remaining solid.

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

..... cm^3 [4]

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4 **(a)** The exchange rate is 1 euro = \$1.142 .

(i) Johann changes \$500 into euros.

Calculate the number of euros Johann receives.
Give your answer correct to the nearest euro.

..... euros [2]

(ii) Johann buys a computer for \$329.
The same computer costs 275 euros.

Calculate the difference in cost in dollars.

\$ ..... [2]

(b) Lucy spends $\frac{3}{8}$ of the money she has saved this month on a book that costs \$5.25 .

Calculate how much money Lucy has saved this month.

\$ ..... [2]

(c) Kamal invests \$6130 at a rate of r% per year compound interest.
The value of his investment at the end of 5 years is \$6669.

Calculate the value of r.

$r =$ ..... [3]

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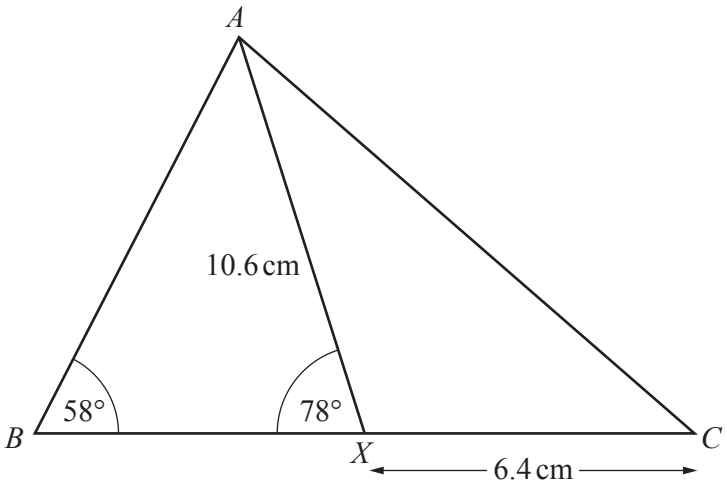
5



NOT TO SCALE

The diagram shows triangle ABC.
X is a point on BC.
$AX = 10.6$ cm, $XC = 6.4$ cm, angle $ABC = 58°$ and angle $AXB = 78°$.

(a) Calculate AC.

$AC =$ ..... cm [4]

(b) Calculate BX.

$BX =$ ..... cm [4]

(c) Calculate the area of triangle ABC.

..... cm^2 [3]

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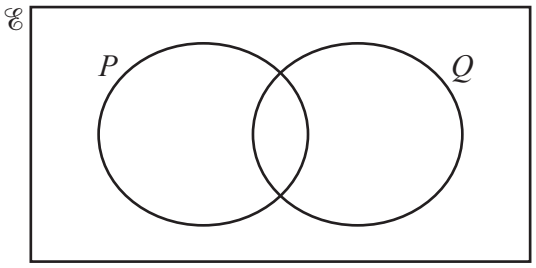
6 **(a)** In the Venn diagram, shade the region $P' \cup Q$.

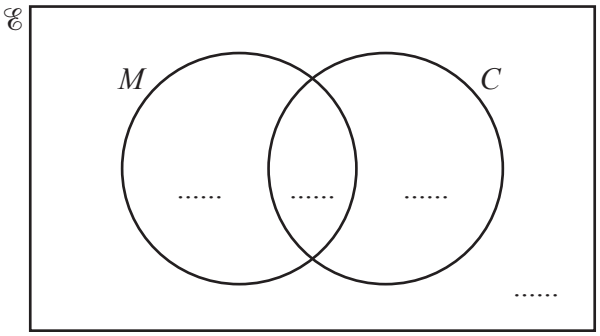


[1]

(b) There are 50 students in a group.

34 have a mobile phone (M).
39 have a computer (C).
5 have no mobile phone and no computer.

Complete the Venn diagram to show this information.



[2]

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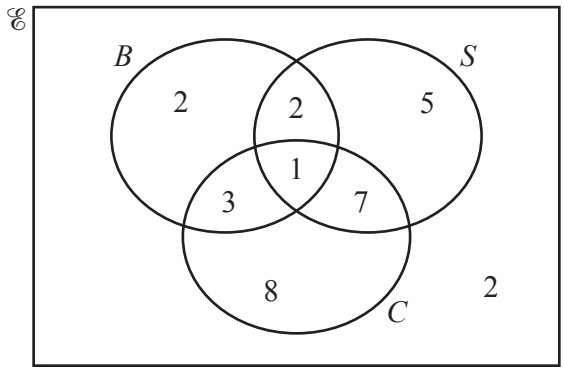
(c) The Venn diagram shows the number of students in a group of 30 who have brothers (B), sisters (S) or cousins (C).



(i) Write down the number of students who have brothers.

..... [1]

(ii) Write down the number of students who have cousins but do not have sisters.

..... [1]

(iii) Find $n(B \cup S \cup C)'$.

..... [1]

(iv) Use set notation to describe the set of students who have both cousins and sisters but do not have brothers.

..... [1]

(v) One student is picked at random from the 30 students.

Find the probability that this student has cousins.

..... [1]

(vi) Two students are picked at random from the students who have cousins.

Calculate the probability that both these students have brothers.

..... [3]

(vii) One student is picked at random from the 30 students.

Event A This student has sisters.
Event B This student has cousins but does not have brothers.

Explain why event A and event B are equally likely.

.....

..... [1]

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7 **(a)** Simplify.

$$\frac{x^2-25}{x^2-x-20}$$

..... [3]

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

$$\frac{x+5}{x}+\frac{x+8}{x-1}$$

..... [3]

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(c) A curve has equation $y = 2x^3 - 4x^2 + 6$.

(i) Find $\frac{dy}{dx}$, the derived function of y.

..... [2]

(ii) Calculate the gradient of the curve $y = 2x^3 - 4x^2 + 6$ at $x = 4$.

..... [2]

(iii) Find the coordinates of the two stationary points on the curve.

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

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8 **(a)** The table shows information about the mass, in kilograms, of each of 50 children.

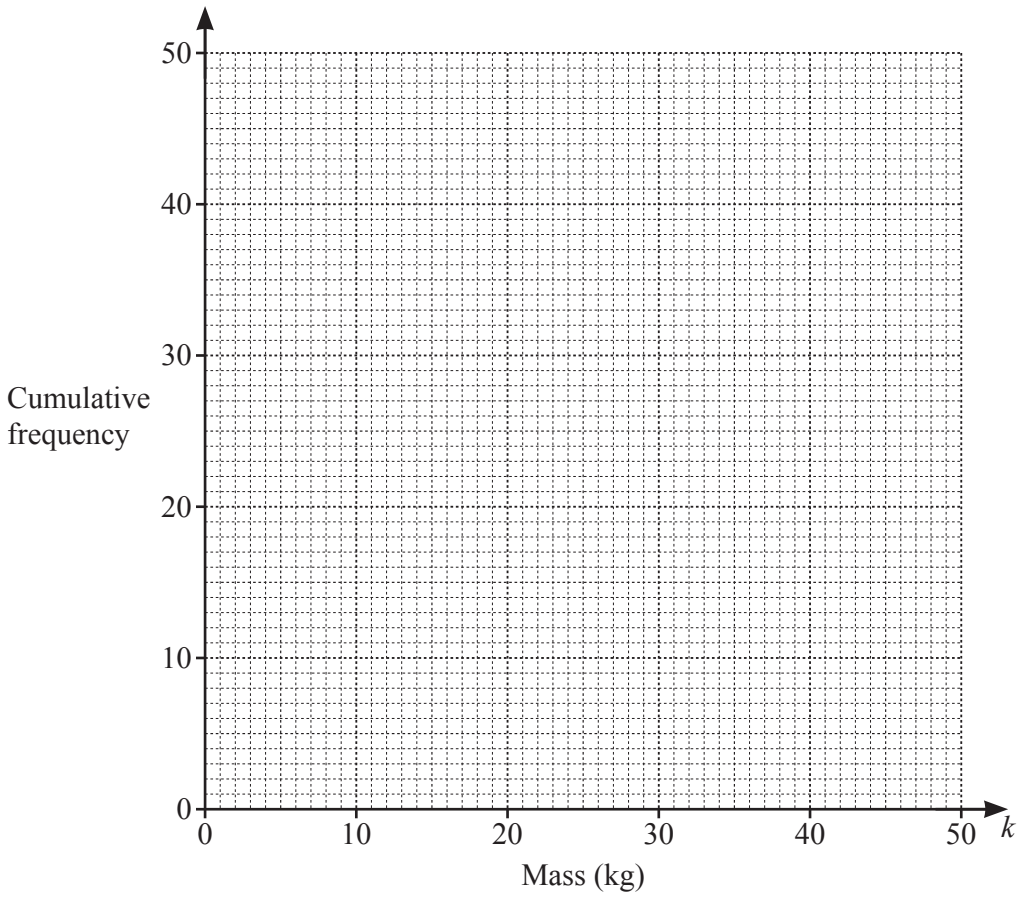
Mass (k kg)	$0 < k \leqslant 10$	$10 < k \leqslant 25$	$25 < k \leqslant 35$	$35 < k \leqslant 40$	$40 < k \leqslant 50$
Frequency	3	19	21	5	2

(i) Complete the cumulative frequency table.

Mass (k kg)	$k \leqslant 10$	$k \leqslant 25$	$k \leqslant 35$	$k \leqslant 40$	$k \leqslant 50$
Cumulative frequency					

[2]

(ii) On the grid, draw a cumulative frequency diagram to show this information.



[3]

(iii) Use your diagram to find an estimate of the number of children with a mass of 32 kg or less.

..... [1]

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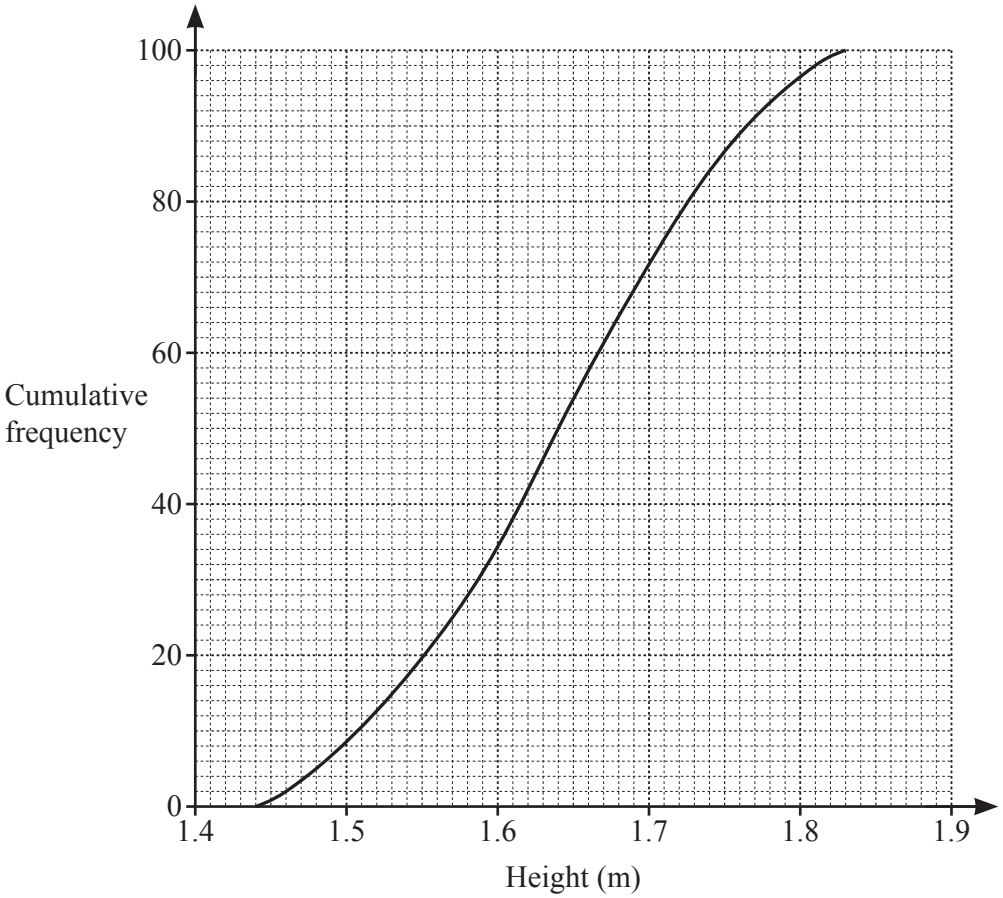
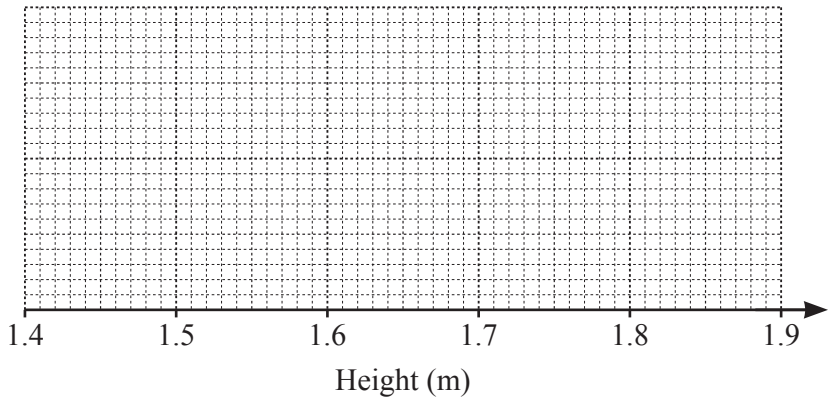
(b) This cumulative frequency diagram shows information about the height, in metres, of each of 100 students.



The height of the tallest student is 1.83 metres.
The height of the shortest student is 1.45 metres.



On this grid, draw a box-and-whisker plot for the heights of the 100 students. [4]

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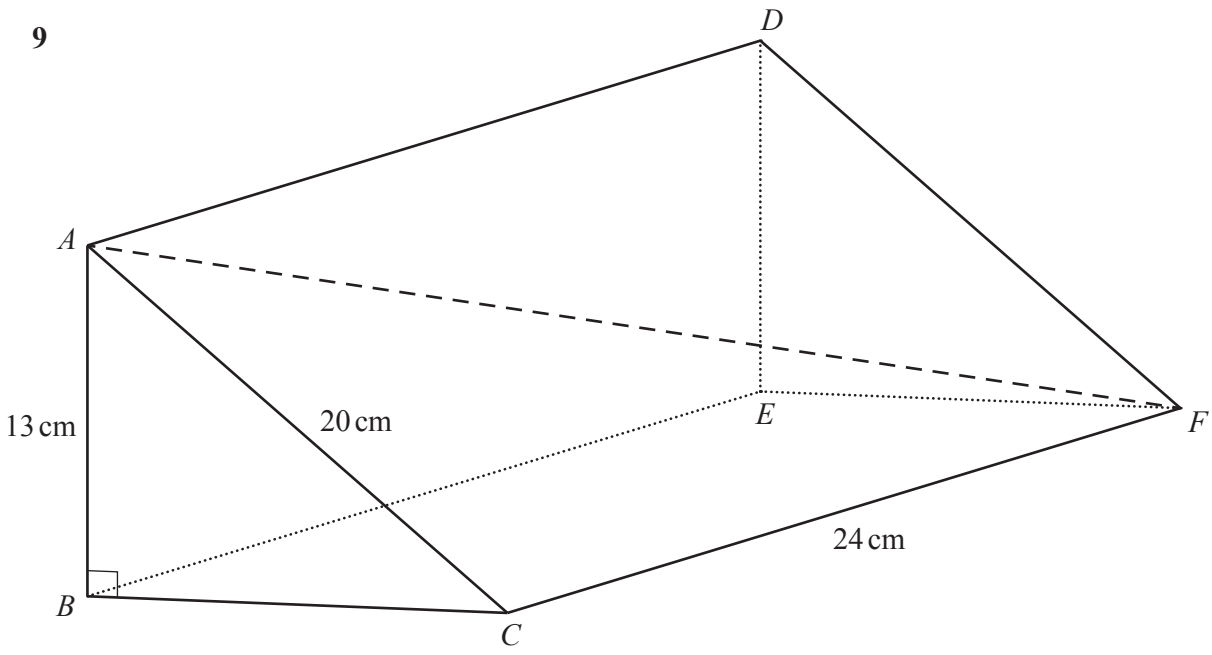
9



NOT TO SCALE

The diagram shows a prism, $ABCDEF$.
$AB = 13$ cm, $AC = 20$ cm, $CF = 24$ cm and angle $ABC = 90°$.

(a) Calculate the total surface area of the prism.

..... cm^2 [6]

(b) Calculate the volume of the prism.

..... cm^3 [1]

(c) Calculate the angle that AF makes with the base $BCFE$.

..... [4]

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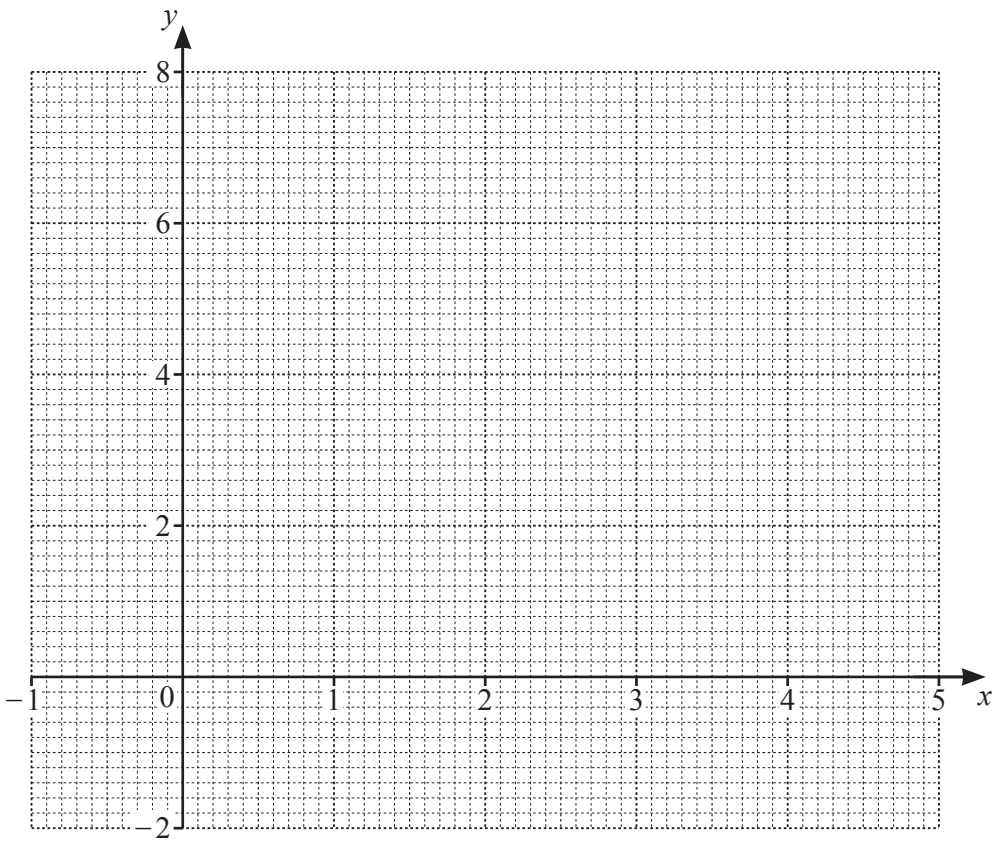
10 The table shows some values of $y = 3 + 4x - x^2$ for $-1 \leqslant x \leqslant 5$.

x	-1	-0.5	0	1	2	3	4	4.5	5
y	-2			6		6			-2

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = 3 + 4x - x^2$ for $-1 \leqslant x \leqslant 5$.



[4]

(c) Write down an **integer** value of k for which the equation $3 + 4x - x^2 = k$ has no solutions.

..... [1]

(d) By drawing a suitable straight line on the grid, solve the equation $-1 + \frac{9}{2}x - x^2 = 0$.

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

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[Turn over

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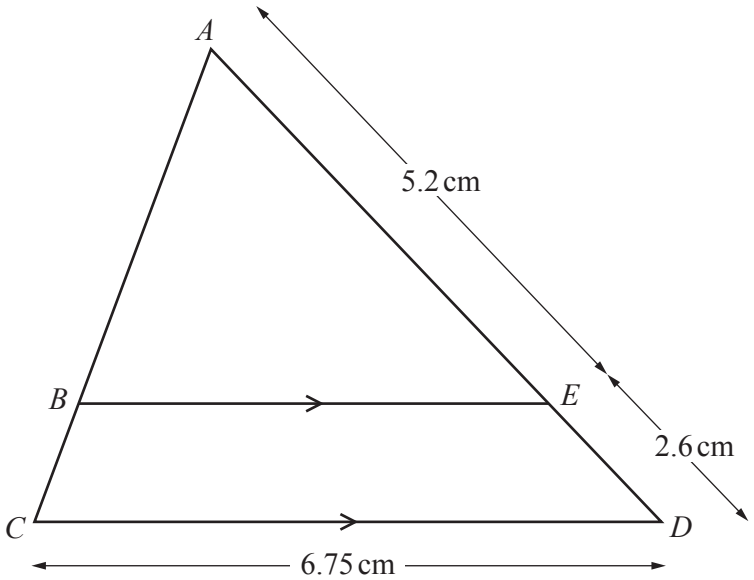
11 **(a)** Find the size of an exterior angle of a regular polygon with 18 sides.

..... [2]

(b)



NOT TO SCALE

In triangle ACD, B lies on AC and E lies on AD such that BE is parallel to CD.
$AE = 5.2$ cm and $ED = 2.6$ cm.

Calculate BE.

$BE =$ ..... cm [2]

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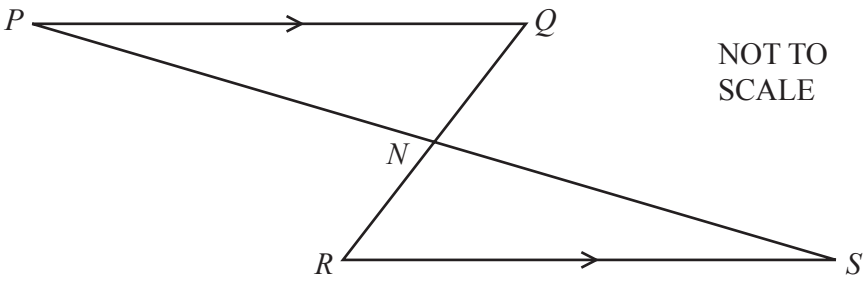
(c) Two solids are mathematically similar.
The smaller solid has height 2 cm and volume 32 cm^3.
The larger solid has volume 780 cm^3.

Calculate the height of the larger solid.

..... cm [3]

(d)



PQ is parallel to *RS*, *PNS* is a straight line and *N* is the midpoint of *RQ*.

Explain, giving reasons, why triangle *PQN* is congruent to triangle *SRN*.

.....

.....

.....

..... [4]

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12 $f(x) = 3 - 2x$ $g(x) = x^2 + 5$ $h(x) = x^3$

(a) Find $f(-5)$.

..... [1]

(b) Find $ff(x)$.
Give your answer in its simplest form.

..... [2]

(c) Solve $g(x) = f(x) + 37$.

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

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

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

(e) Find $hf(x) + g(x)$.
Give your answer in its simplest form.

..... [5]

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** printed pages.

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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.

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

Abbreviations

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

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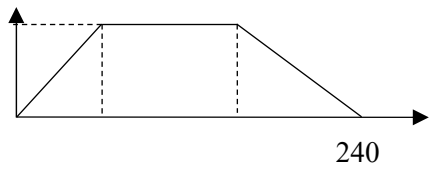
Question	Answer	Marks	Partial Marks
1(a)(i)	28	**2**	**M1** for $32 \times 0.50 + 30 \times 0.40$
1(a)(ii)	$98 - 100 \times 0.5$ $48 \div 0.4 = 120$ [minutes] = 2 [hrs]	**M3**	**M1** for $100 \times 0.50 + x \times 0.40 = 98$ **M1** for $50 + 0.4x = 98$ or $0.4x = 48$ **M1** for $x = \frac{48}{0.4}$ $x = 120$ [min] = 2 [hr] OR **M1** for $100 \times 0.5 [= 50]$ **M1** for $98 - 50 [= 48]$ **M1** for $48 \div 0.4 = 120$ [min] $= 2$ [hr]
1(b)	2925 1170 4095	**3**	**B2** for one correct answer or **M1** for $8190 \div (5 + 2 + 7)$
1(c)	58	**2**	**M1** for $\left(1 + \frac{45}{100}\right)k = 84.1$ oe
2(a)	0.18 or $\frac{9}{50}$	**1**	
2(b)	$1944 \times \frac{1000}{3600 \times 3600}$	**M1**	
	$9 \div 0.15 = 60$	**M1**	
2(c)		**1**	ruled line to axis with point of contact at 240
2(d)	6.9375	**4**	**M2** for area = $\frac{1}{2} \times (130 + 240) \times 9$ oe or **M1** for one correct partial area **M1dep** for *their* total area ÷ 240
3(a)	2.64 or 2.638…	**4**	**M3** for $[R^2 =] \frac{\pi \times 2.4^2 + \pi \times 2.4 \times 6.3}{\pi + 2\pi}$ oe or **M2** for $\pi \times 2.4^2 + \pi \times 2.4 \times 6.3 = \pi R^2 + \frac{1}{2} \times 4\pi R^2$ or **M1** for $[\pi \times 2.4^2] + \pi \times 2.4 \times 6.3$ oe or $[\pi R^2] + \frac{1}{2} \times 4\pi R^2$ oe

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Question	Answer	Marks	Partial Marks
3(b)	953 or 952.6 to 952.8	4	**M3** for $\frac{1}{3}\times\pi\times7.6^2\times16\times\left(1-\left(\frac{16-12}{16}\right)^3\right)$ or $\frac{1}{3}\times\pi\times7.6^2\times16-\frac{1}{3}\times\pi\times1.9^2\times(16-12)$ OR **B1** for top radius = 1.9 or $\left(\frac{16-12}{16}\right)^3$ oe **M2** for $\frac{1}{3}\times\pi\times7.6^2\times16-\frac{1}{3}\times\pi\times(their1.9)^2\times(16-12)$ or $\frac{1}{3}\times\pi\times7.6^2\times16\times\left(1-their\left(\frac{16-12}{16}\right)^3\right)$ or **M1** for $\frac{1}{3}\times\pi\times7.6^2\times16$ or for $\frac{1}{3}\times\pi\times(their1.9)^2\times(16-12)$
4(a)(i)	438 cao	2	**M1** for $\frac{500}{1.142}$
4(a)(ii)	14.95	2	**M1** for [329 –] 275×1.142 oe
4(b)	14	2	**M1** for $5.25\times\frac{8}{3}$ oe
4(c)	1.7[0] or 1.699…	3	**M2** for $\sqrt[5]{\frac{6669}{6130}}$ or **M1** for $6669 = 6130\ (k)^5$
5(a)	13.5 or 13.47…	4	**B1** for angle 102 seen **M2** for $\sqrt{10.6^2+6.4^2-2\times10.6\times6.4\times\cos(180-78)}$ OR **M1** for $10.6^2+6.4^2-2\times10.6\times6.4\times\cos(180-78)$ **A1** for 181.5…
5(b)	8.68 or 8.682 to 8.683 nfww	4	**B1** for angle = 44 **M2** for $\sin(180-58-78)\times\frac{10.6}{\sin58}$ oe or **M1** for $\frac{\sin(180-58-78)}{x}=\frac{\sin58}{10.6}$ oe

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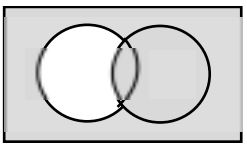
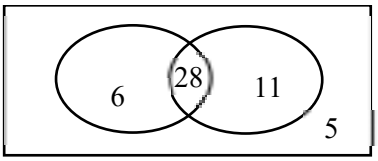
Question	Answer	Marks	Partial Marks
5(c)	78.2 or 78.17 to 78.19…	**3**	**M2** for $\frac{1}{2}\times 10.6\times(6.4+\textit{their}\ 8.68)\times\sin(78)$ oe OR **M1** for $\frac{1}{2}\times 10.6\times 6.4\times\sin(180-78)$ oe **M1** for $\frac{1}{2}\times 10.6\times\textit{their}\ 8.68\times\sin 78$ oe
6(a)		**1**	
6(b)		**2**	**B1** for 2 or 3 correct elements or **M1** for $34-x$, x and $39-x$ correctly placed on diagram and $x = 28$
6(c)(i)	8	**1**	
6(c)(ii)	11	**1**	
6(c)(iii)	2	**1**	
6(c)(iv)	$C\cap S\cap B'$ oe	**1**	
6(c)(v)	$\frac{19}{30}$ oe	**1**	
6(c)(vi)	$\frac{2}{57}$ oe	**3**	**M2** for $\frac{4}{19}\times\frac{3}{18}$ or **M1** for $\frac{4}{19}$ seen
6(c)(vii)	Equal numbers 15 or equal probability $\frac{15}{30}$ oe	**1**	
7(a)	$\frac{x+5}{x+4}$ final answer	**3**	**B1** for $(x-5)(x+5)$ **B1** for $(x-5)(x+4)$
7(b)	$\frac{2x^2+12x-5}{x(x-1)}$ or $\frac{2x^2+12x-5}{x^2-x}$ final answer	**3**	**B1** for common denominator $x(x-1)$ oe **B1** for $(x-1)(x+5)+x(x+8)$ or better
7(c)(i)	$6x^2-8x$ final answer	**2**	**B1** for each term in final answer or **M1** for correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
7(c)(ii)	64	**2**	**FT** *their* **(c)(i)** correctly evaluated provided at least 2 terms but not the original equation **M1** for substituting $x = 4$ into *their* **(c)(i)**
7(c)(iii)	(0, 6) $\left(\frac{4}{3}, \frac{98}{27}\right)$ oe	**4**	**M1** for *their* derivative = 0 or $\frac{dy}{dx} = 0$ soi **B1** for $x = 0$ and $x = \frac{4}{3}$ **M1dep** for substituting one of *their x* values into $y = 2x^3 - 4x^2 + 6$ soi
8(a)(i)	3 22 43 48 50	**2**	**B1** for 4 correct or **M1** for one error in adding.
8(a)(ii)	correct diagram	**3**	**B1FT** *their* **(a)(i)** for 5 correct heights **B1** for 5 points at upper ends of intervals on correct vertical line **B1FT dep on at least B1** for increasing curve through *their 5* points After 0 scored, **SC1** for 4 of *their* points correctly plotted
8(a)(iii)	35 to 38	**1**	
8(b)	Correct box-and-whisker diagram  1.45 1.57 1.64 1.71 1.83	**4**	**B1** for median 1.64 drawn **B1** for LQ 1.57 drawn **B1** for UQ 1.71 drawn If 0 scored **SC1** for 1.64, 1,57 or 1.71 seen
9(a)	1350 or 1354….	**6**	**M2** for $20^2 - 13^2$ or **M1** for $BC^2 + 13^2 = 20^2$ **A1** for $\sqrt{231}$ or 15.2 or 15.19 to 15.20 **M1** for 20×24 and 13×24 and *their* 15.2×24 **M1** for [½ ×] *their* 15.2×13
9(b)	2370 or 2369 to 2371… cao	**1**	
9(c)	24.6 or 24.58 to 24.59	**4**	**M3** for $\sin[...] = \frac{13}{\sqrt{20^2 + 24^2}}$ oe or **M2** for $\sqrt{20^2 + 24^2}$ or $\sqrt{24^2 + 20^2 - 13^2}$ or **M1** for $AF^2 = 20^2 + 24^2$ or $24^2 + 20^2 - 13^2$ or **M1** for correct angle identified
10(a)	0.75 3 7 3 0.75	**3**	**B2** for 4 or 3 correct or **B1** for 2 correct

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Question	Answer	Marks	Partial Marks
10(b)	correct curve 	**4**	**B3FT** for 8 or 9 correct plots **B2FT** for 6 or 7 correct plots **B1FT** for 4or 5 correct plots
10(c)	Accept any integer ≥ 8	**1**	
10(d)	line $y = 4 - \frac{1}{2}x$ ruled	**B3**	**B2** for $[y =]4 - \frac{1}{2}x$ identified or **B1** for ruled line with gradient $-\frac{1}{2}$ or **B1** for ruled line through (0, 4) but not $y = 4$
	0.2 to 0.3 4.2 to 4.3	**B1**	
11(a)	20	**2**	**M1** for $\frac{360}{18}$ or $180 - \frac{16\times180}{18}$
11(b)	4.5	**2**	**M1** for $\frac{BE}{6.75} = \frac{5.2}{5.2+2.6}$ oe
11(c)	5.8[0] or 5.798 to 5.799	**3**	**M2** for $2\times\sqrt[3]{\frac{780}{32}}$ oe or **M1** for $\sqrt[3]{\frac{780}{32}}$ or $\sqrt[3]{\frac{32}{780}}$ or $\frac{2^3}{l^3} = \frac{32}{780}$
11(d)	$QN = NR$ [given]	**B1**	
	Two correct pairs of angles with reasons from angle PQN = angle SRN alternate angle QPN = angle RSN alternate angle PNQ = angle SNR [vertically] opposite	**B2**	**B1** for any correct pair of angles with reason or two correct pairs of angles with no/wrong reasons
	ASA [implies congruent]	**B1**	dep on B1 B2

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Question	Answer	Marks	Partial Marks
12(a)	13	**1**	
12(b)	$4x - 3$ final answer	**2**	**M1** for $3-2(3-2x)$
12(c)	-7 5	**4**	**M1** for $x^2+2x-35\ [=0]$ or $x^2+2x=35$ **M2** for $(x+7)(x-5)$ or $x(x-5)+7(x-5)$ or $x(x+7)-5(x+7)$ or **M1** for $(x+a)(x+b)$ where a, b are integers with $ab = -35$ or $a+b=2$
12(d)	$\frac{3-x}{2}$ oe final answer	**2**	**M1** for a correct first step: $x=3-2y$ or $y-3=-2x$, $2x=3-y$ or $\frac{y}{2}=\frac{3}{2}-x$
12(e)	$32-54x+37x^2-8x^3$ final answer	**5**	**B4** for $27-36x-18x+24x^2+12x^2-8x^3+x^2+5$ oe OR **B1** for $(3-2x)^3+x^2+5$ and **B2** for expansion of the 3 brackets, allow one error or **B1** for correct expansion of 2 of the brackets with at least 3 terms correct

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8362605305

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

This document has **16** pages.

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[Turn over

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1 **(a)** A 2.5-litre tin of paint costs \$13.50 .
In a sale, the cost is reduced by 14%.

(i) Work out the sale price of this tin of paint.

\$ ..... [2]

(ii) Work out the cost of buying 42.5 litres of paint at this sale price.

\$ ..... [2]

(b) Henri buys some paint in the ratio red paint : white paint : green paint = 2 : 8 : 5.

(i) Find the percentage of this paint that is white.

..... % [1]

(ii) Henri buys a total of 22.5 litres of paint.

Find the number of litres of green paint he buys.

..... litres [2]

(c) Maria paints a rectangular wall.
The length of the wall is 20.5 m and the height is 2.4 m, both correct to 1 decimal place.

One litre of paint covers an area of exactly 10 m^2.

Calculate the smallest number of 2.5-litre tins of paint she will need to be sure all the wall is painted.
Show all your working.

..... [4]

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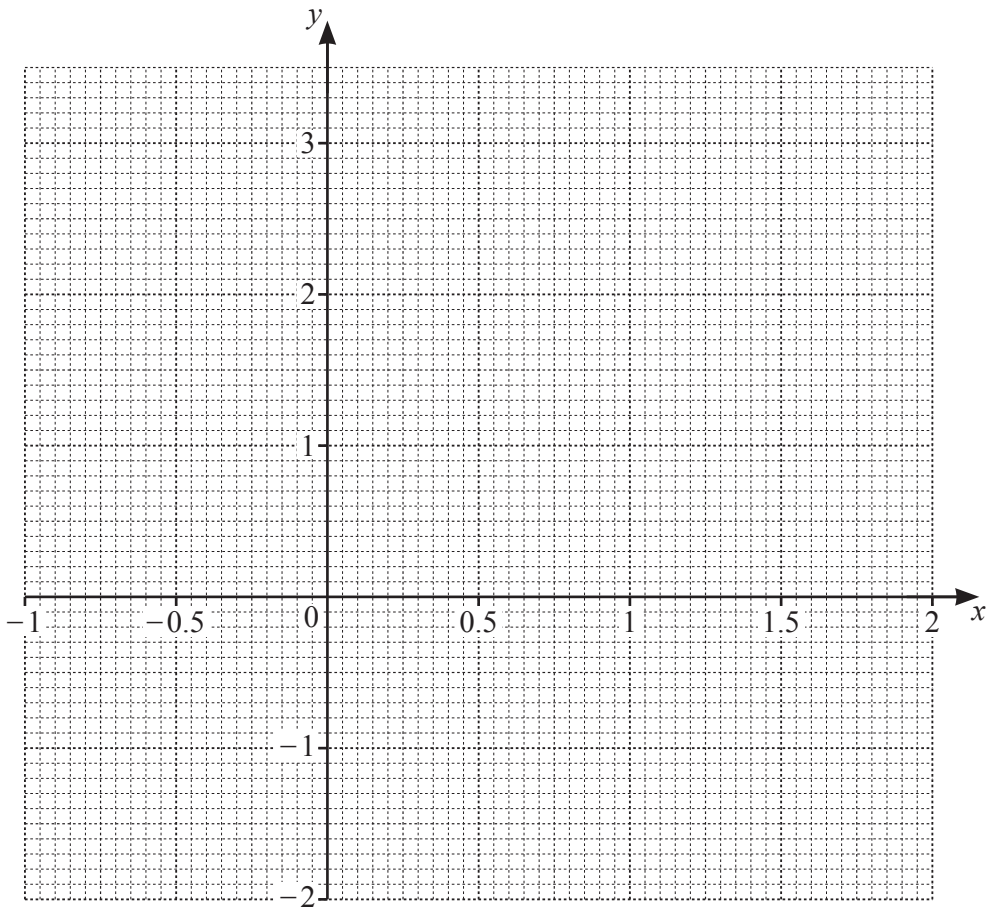
2 The table shows some values for $y = 2 \times 0.5^x - 1$.

x	-1	-0.5	0	0.5	1	1.5	2
y	3	1.83		0.41	0	-0.29	

(a) (i) Complete the table. [2]

(ii) On the grid, draw the graph of $y = 2 \times 0.5^x - 1$ for $-1 \leqslant x \leqslant 2$.



[4]

(b) By drawing a suitable straight line, solve the equation $2 \times 0.5^x + 2x - 3.5 = 0$ for $-1 \leqslant x \leqslant 2$.

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

(c) There are no solutions to the equation $2 \times 0.5^x - 1 = k$ where k is an integer.

Complete the following statements.

The highest possible value of k is .....

The equation of the asymptote to the graph of $y = 2 \times 0.5^x - 1$ is ..... [2]

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3 **(a)** Simplify, giving your answer as a single power of 7.

(i) $7^5 \times 7^6$

..... [1]

(ii) $7^{15} \div 7^5$

..... [1]

(iii) $42 + 7$

..... [1]

(b) Simplify.

$(5x^2 \times 2xy^4)^3$

..... [3]

(c) $P = 2^5 \times 3^3 \times 7$ $Q = 540$

(i) Find the highest common factor (HCF) of P and Q.

..... [2]

(ii) Find the lowest common multiple (LCM) of P and Q.

..... [2]

(iii) $P \times R$ is a cube number, where R is an integer.

Find the smallest possible value of R.

..... [2]

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(d) Factorise the following completely.

(i) $x^2 - 3x - 28$

..... [2]

(ii) $7(a+2b)^2 + 4a(a+2b)$

..... [2]

(e) $3^{2x-1} = \frac{1}{9^x} \times 3^{2y-x}$

Find an expression for y in terms of x.

$y =$ ..... [4]

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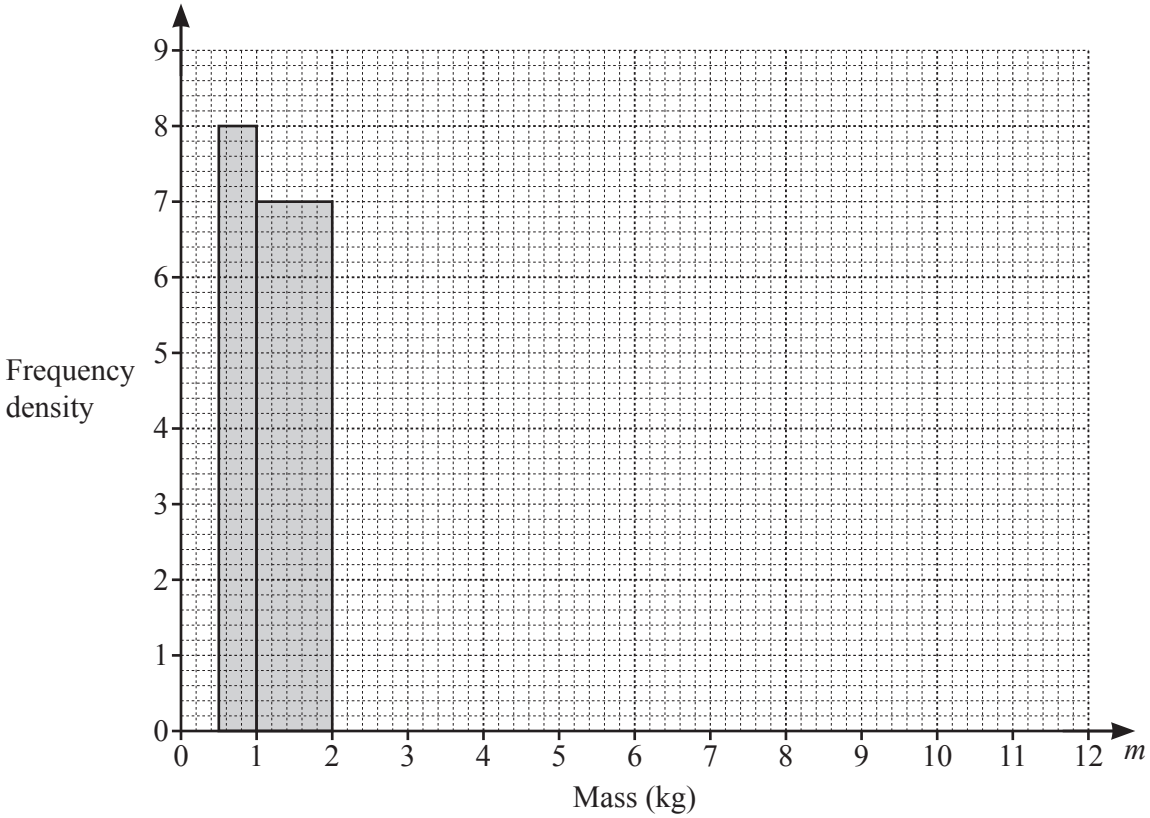
4 **(a)** The mass, m kg, of each of 40 parcels in a warehouse is recorded.
The table shows information about the masses of these parcels.

Mass (m kg)	$0.5 < m \leqslant 1$	$1 < m \leqslant 2$	$2 < m \leqslant 4$	$4 < m \leqslant 7$	$7 < m \leqslant 12$
Frequency	4	7	15	10	4

(i) Complete the histogram to show this information.



[3]

(ii) Calculate an estimate of the mean mass of the parcels.

..... kg [4]

(iii) A parcel is picked at random from the 40 parcels.

Find the probability that this parcel has a mass of 2 kg or less.

..... [1]

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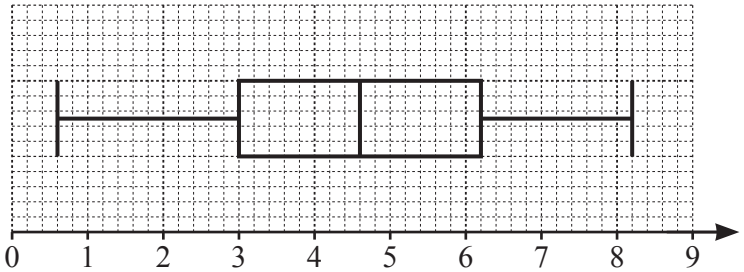
(iv) Two parcels are picked at random without replacement from those with a mass **greater than** 2 kg.

Work out the probability that one of them has a mass greater than 7 kg and the other has a mass of 4 kg or less.

..... [3]

(b) A van delivers parcels from a different warehouse.
The box-and-whisker plot shows information about the masses of the parcels in the van.



(i) Find the median.

..... kg [1]

(ii) Find the interquartile range.

..... kg [1]

(iii) Two parcels are removed from the van at the first delivery.
The masses of these parcels are 2.4 kg and 5.8 kg.

Describe the effect that removing these parcels has on the median mass of the remaining parcels.
Give a reason for your answer.

.....

..... [2]

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5 **(a)** $\mathbf{a} = \begin{pmatrix} -3 \\ 8 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ -5 \end{pmatrix}$

(i) Find

(a) $\mathbf{b} - \mathbf{a}$,

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

(b) $2\mathbf{a} + \mathbf{b}$,

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(c) $|\mathbf{b}|$.

..... [2]

(ii) $\mathbf{a} + k\mathbf{b} = \begin{pmatrix} 13 \\ m \end{pmatrix}$, where k and m are integers.

Find the value of k and the value of m.

$k =$ .....

$m =$ ..... [3]

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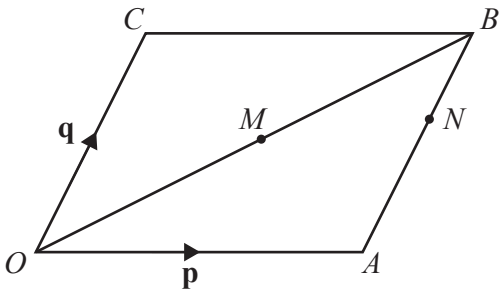
(b)



NOT TO SCALE

$OABC$ is a parallelogram and O is the origin.
M is the midpoint of OB.
N is the point on AB such that $AN : NB = 3 : 2$.
$\overrightarrow{OA} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$.

(i) Find, in terms of **p** and **q**, in its simplest form.

(a) $\overrightarrow{OB}$

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

(b) $\overrightarrow{CM}$

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

(c) $\overrightarrow{MN}$

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

(ii) CB and ON are extended to meet at D.

Find the position vector of D in terms of **p** and **q**.
Give your answer in its simplest form.

..... [3]

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[Turn over

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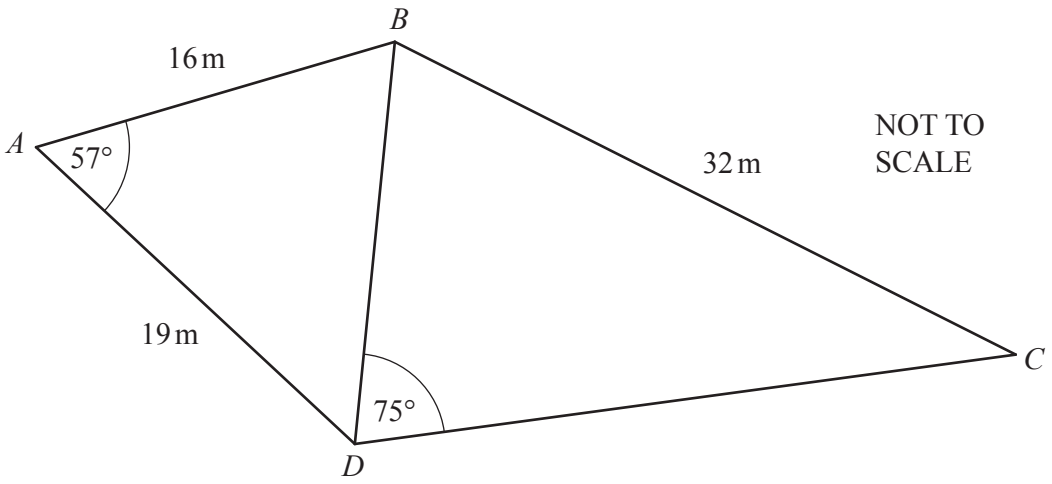
6



The diagram shows a quadrilateral *ABCD* made from two triangles, *ABD* and *BCD*.

(a) Show that $BD = 16.9$ m, correct to 1 decimal place.

[3]

(b) Calculate angle *CBD*.

Angle *CBD* = ... [4]

(c) Find the area of the quadrilateral *ABCD*.

..... m^2 [3]

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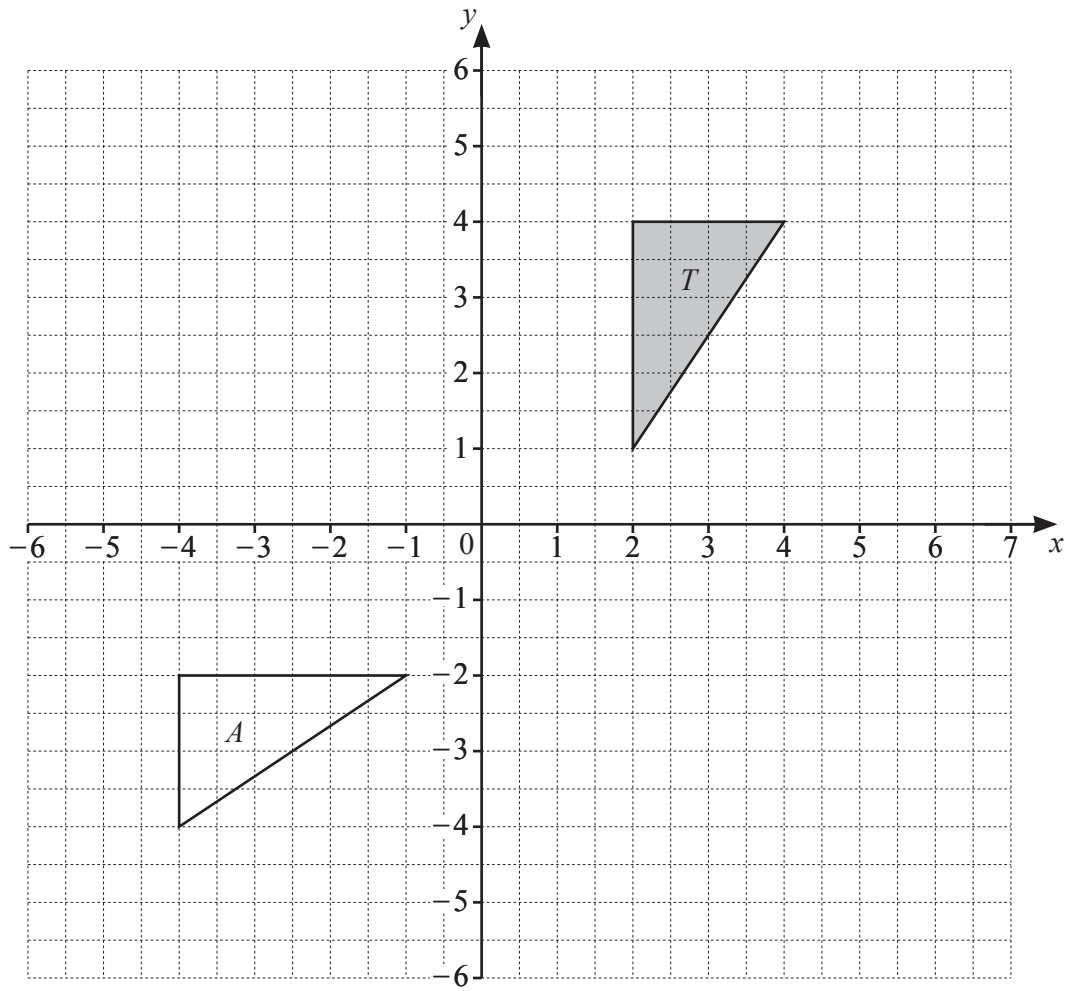
(d) Find the shortest distance from B to AD.

..... m [3]

7



(a) On the grid, draw the image of

(i) triangle T after a translation by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$, [2]

(ii) triangle T after a rotation, 90° clockwise, about the origin, [2]

(iii) triangle T after an enlargement, scale factor $-\frac{1}{2}$, centre $(-2, 3)$. [2]

(b) Describe fully the **single** transformation that maps triangle T onto triangle A.

.....

..... [2]

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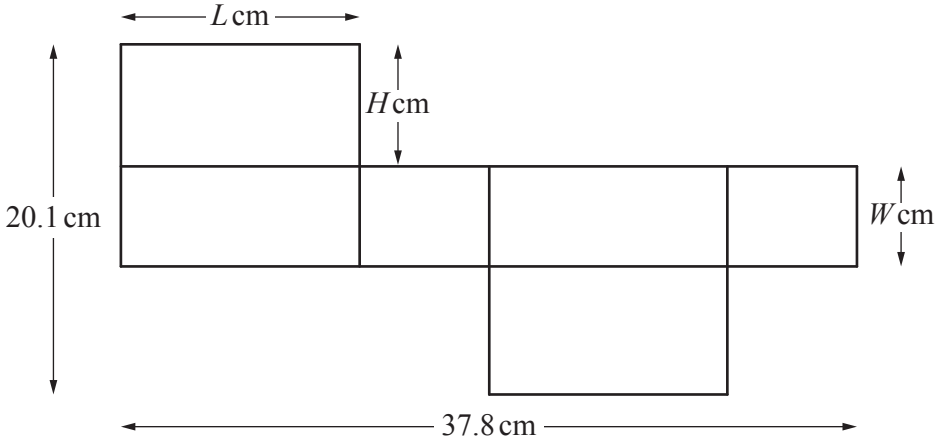
8 **(a)** A cuboid has length L cm, width W cm and height H cm.



NOT TO SCALE

The diagram shows the net of this cuboid.
The ratio $W : L = 1 : 2$.

Find the value of L, the value of W and the value of H.

$L =$ .....

$W =$ .....

$H =$ ..... [5]

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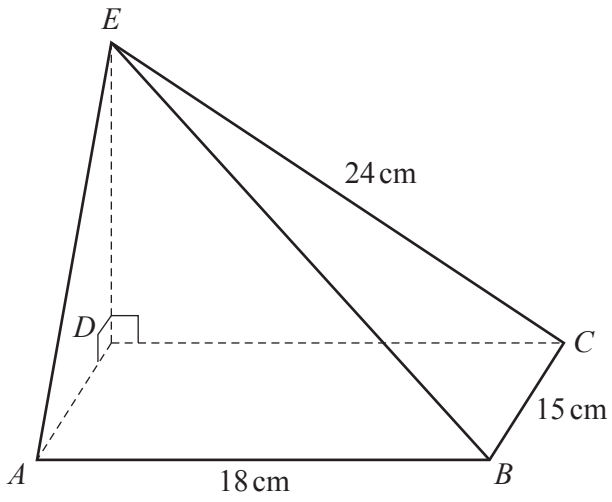
(b)



NOT TO SCALE

The diagram shows a solid pyramid with a rectangular base $ABCD$.
E is vertically above D.
Angle EDC = angle EDA = 90°.
AB = 18 cm, BC = 15 cm and EC = 24 cm.

(i) The pyramid is made of wood and has a mass of 800 g.

Calculate the density of the wood.
Give the units of your answer.

[The volume, V, of a pyramid is $V = \frac{1}{3} \times$ area of base $\times$ height.]
[Density = mass ÷ volume]

.... [5]

(ii) Calculate the angle between BE and the base of the pyramid.

..... [4]

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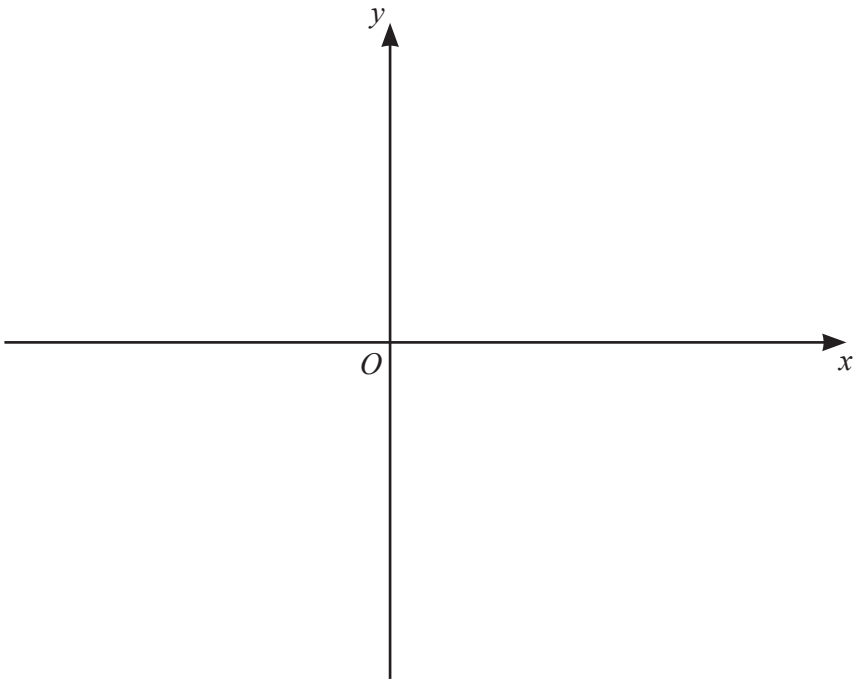
9 **(a)** **(i)** The equation $y = x^3 - 4x^2 + 4x$ can be written as $y = x(x-a)^2$.

Find the value of a.

$a =$ ..... [2]

(ii) On the axes, sketch the graph of $y = x^3 - 4x^2 + 4x$, indicating the values where the graph meets the axes.



[4]

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(b) Find the equation of the tangent to the graph of $y = x^3 - 4x^2 + 4x$ at $x = 4$.
Give your answer in the form $y = mx + c$.

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

Question 10 is printed on the next page.

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10 The table shows four sequences A, B, C and D.

Sequence	1st term	2nd term	3rd term	4th term	5th term		nth term
A	1	8	27	64			
B	5	11	17	23			
C	0.25	0.5	1	2	4		
D	4.75	10.5	16	21			

Complete the table.

[9]

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MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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

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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.

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

Abbreviations

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

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Question	Answer	Marks	Partial Marks
1(a)(i)	11.61 final answer	**2**	**M1** for $13.5[0] \times \left(1-\frac{14}{100}\right)$ oe or **B1** for 1.89
1(a)(ii)	197.37 final answer	**2**	**FT** 17 × *their* (a)(i) exact or correct to nearest cent **M1** for 42.5 ÷ 2.5
1(b)(i)	53.3 or 53.33…	**1**	
1(b)(ii)	7.5	**2**	**M1** for 22.5 ÷ (2 + 8 + 5) oe soi
1(c)	20.55×2.45 oe	**M2**	**M1** for 20.5 + 0.05 oe seen or 2.4 + 0.05 oe seen If 0 scored, **SC1** here for 20.45×2.35 oe
	3 nfww	**A2**	**M1** for *their* area ÷ 10 ÷ 2.5 oe
2(a)(i)	1, –0.5 oe	**2**	**B1** for each
2(a)(ii)	Correct curve	**4**	**B3FT** for 6 or 7 correct plots or **B2FT** for 4 or 5 correct plots or **B1FT** for 2 or 3 correct plots
2(b)	$y = 2.5 - 2x$ ruled	**B2**	**B1** for $y = k - 2x$ or $y = px + 2.5$ ruled ($p \neq 0$) or for [$y =$] $2.5 - 2x$ oe identified
	1.3 to 1.4	**B1**	
2(c)	–1	**B1**	
	$y = -1$	**B1**	**FT** *their k* (must be negative)
3(a)(i)	7^{11} cao	**1**	
3(a)(ii)	7^{10} cao	**1**	
3(a)(iii)	7^2 cao	**1**	If answers 11, 10 and 2 in **(a)** then allow **SC1** in this part
3(b)	$1000x^9y^{12}$ final answer	**3**	**B2** for correct answer seen or answer of the form $1000x^9y^k$ or $1000x^ky^{12}$ or kx^9y^{12} or **B1** for answer with one correct element in product or $(10x^3y^4)^{[3]}$ seen
3(c)(i)	108	**2**	**M1** for [540 =] 2^2 [×] 3^3 [×] 5 or **B1** for 108 oe not in prime factor form e.g. $2^2 \times 3 \times 9$

Question	Answer	Marks	Partial Marks
3(c)(ii)	30 240	**2**	**M1** for $(540 \times 2^5 \times 3^3 \times 7) \div$ *their* **(c)(i)** oe or **B1** for answer 30 240 oe not in prime factor form e.g. $2^5 \times 3^3 \times 35$
3(c)(iii)	98	**2**	**B1** for 592 704 seen or $2^6 \times 3^3 \times 7^3$ seen or 2×7^2 oe seen
3(d)(i)	$(x - 7)(x + 4)$ final answer	**2**	**M1** for $x(x - 7) + 4(x - 7)$ or $x(x + 4) - 7(x + 4)$ or better or for $(x + a)(x + b)$ where $ab = -28$ or $a + b = -3$
3(d)(ii)	$(a + 2b)(11a + 14b)$ final answer	**2**	**M1** for $(a + 2b)(7(a + 2b) + 4a)$ or $(a + pb)(11a + qb)$ where $pq = 28$ or $11p + q = 36$ If 0 scored, **SC1** for $a + 2b$ $(11a + 14b)$
3(e)	$[y =]\frac{5x-1}{2}$ oe final answer	**4**	**B2** for $2x - 1 = -2x + 2y - x$ oe or **B1** for $9^x = 3^{2x}$ or better **M1dep** for correct rearrangement of *their* 5 term 'linear' equation in y and x to make y the subject
4(a)(i)	Correct histogram	**3**	**B1** for each correct block If 0 scored**, SC1** for any two of fds 7.5, 3.33…, 0.8 oe soi
4(a)(ii)	3.7875 or 3.79 or 3.787 or 3.788	**4**	**M1** for 0.75, 1.5, 3, 5.5, 9.5 soi **M1** for Σfx **M1 dep** for *their* $\Sigma fx \div 40$
4(a)(iii)	$\frac{11}{40}$ oe	**1**	
4(a)(iv)	$\frac{30}{203}$ oe	**3**	**M2** for $[2 \times]\frac{4}{29} \times \frac{15}{28}$ oe or **M1** for $\frac{4}{29}$ or $\frac{15}{29}$ oe seen After 0 scored, **SC1** for $[2\times]\left(\frac{4}{40} \times \frac{26}{39}\right)$ oe or for answer $\frac{120}{841}$ oe
4(b)(i)	4.6	**1**	
4(b)(ii)	3.2	**1**	

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Question	Answer	Marks	Partial Marks
4(b)(iii)	[median] remains the same oe and one is below [the median/middle] and one is above oe	**2**	**B1** for each statement
5(a)(i)(a)	$\begin{pmatrix}5\\-13\end{pmatrix}$ final answer	**1**	
5(a)(i)(b)	$\begin{pmatrix}-4\\11\end{pmatrix}$ final answer	**2**	**B1** for answer $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\11\end{pmatrix}$ or $\begin{pmatrix}-6\\16\end{pmatrix}$ seen
5(a)(i)(c)	5.39 or 5.385…	**2**	**M1** for $2^2 + ([-]5)^2$
5(a)(ii)	[k =] 8 [m =] – 32	**3**	**B2** for $k = 8$ or $m = -32$ or **M1** for $-3 + 2k = 13$ oe or for $m = -5 \times$ *their* $k + 8$ correctly evaluated
5(b)(i)(a)	$\mathbf{p} + \mathbf{q}$ final answer	**1**	
5(b)(i)(b)	$\frac{1}{2}\mathbf{p} - \frac{1}{2}\mathbf{q}$ **or** $\frac{1}{2}(\mathbf{p} - \mathbf{q})$ or $\frac{\mathbf{p}-\mathbf{q}}{2}$ final answer	**2**	**M1** for unsimplified answer or any correct vector route for $\overrightarrow{CM}$, e.g. $-\mathbf{q} + \frac{1}{2}$ *their* **(b)(i)(a)**
5(b)(i)(c)	$\frac{1}{2}\mathbf{p} + \frac{1}{10}\mathbf{q}$ or $\frac{5\mathbf{p}+\mathbf{q}}{10}$ final answer	**2**	**M1** for unsimplified answer or any correct vector route for $\overrightarrow{MN}$
5(b)(ii)	$\frac{5}{3}\mathbf{p} + \mathbf{q}$ or $\frac{5\mathbf{p}+3\mathbf{q}}{3}$ final answer	**3**	**B2** for unsimplified correct answer OR **M1** for $\mathbf{p} + \frac{3}{5}\mathbf{q}$ seen **B1** for final answer of form $k\mathbf{p} + \mathbf{q}$ ($k > 1$) or final answer $\frac{5}{3}\mathbf{p} + j\mathbf{q}$ oe (any j)
6(a)	$\sqrt{16^2 + 19^2 - 2\times16\times19\cos 57}$ oe	**M2**	or **M1** for $16^2 + 19^2 - 2\times16\times19\cos 57$ **A1** for 285.8 to 285.9
	16.90 to 16.91	**A1**	

Question	Answer	Marks	Partial Marks
6(b)	74.3 or 74.30 to 74.33	**4**	**M2** for [sin ... =] $\frac{16.9\times\sin 75}{32}$ oe or **M1** for $\frac{16.9}{\sin C}=\frac{32}{\sin 75}$ oe **B1** for [angle *BCD* =] 30.7 or 30.67 to 30.69… or **M1dep** for 105 – *their* angle *BCD*
6(c)	388 or 387.7 to 387.9… nfww	**3**	**M1** for $\frac{1}{2}\times 16\times 19\times\sin 57$ oe **M1** for $\frac{1}{2}\times 16.9\times 32\times\sin$ *their* **(b)** oe
6(d)	13.4 or 13.41 to 13.42 nfww	**3**	**M2** for $\frac{x}{16}=\sin 57$ oe or **M1** for distance required is perpendicular to *AD* soi
7(a)(i)	Triangle at (4, 0) (4, 3) (6, 3)	**2**	**B1** for translation by $\begin{pmatrix}2\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-1\end{pmatrix}$ If 0 scored **SC1** for triangle at (3, 0.5) (3, 3.5) (5, 3.5)
7(a)(ii)	Triangle at (1, –2) (4, –4) (4, –2)	**2**	**B1** for rotation 90 clockwise wrong centre or for rotation 90 anticlockwise about the origin
7(a)(iii)	Triangle at (–4, 4) (–4, 2.5) (–5, 2.5)	**2**	**B1** for enlargement SF $-\frac{1}{2}$ with wrong centre or for enlargement SF $\frac{1}{2}$ with centre (–2, 3)
7(b)	Reflection $y = -x$ oe	**2**	**B1** for each
8(a)	[*L* =] 11.8 [*W* =] 5.9 [*H* =] 7.1	**5**	**M1** for $L = 2W$ oe soi **M1** for $W + 2H = 20.1$ oe **M1** for $2L + 2H = 37.8$ oe **B1** for at least one correct answer
8(b)(i)	0.559 to 0.56[0…]	**B4**	**M2** for $\frac{1}{3}\times 18\times 15\times\sqrt{24^2-18^2}$ isw conversion or **M1** for $h^2 + 18^2 = 24^2$ oe or better **M1** for figs 800 ÷ figs *their* volume isw
	g/cm^3 or g cm^{-3} final answer	**B1**	

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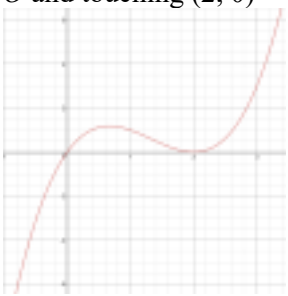
Question	Answer	Marks	Partial Marks
8(b)(ii)	34.1 or 34.11 to 34.12	**4**	**M3** for tan [ ] = $\frac{\sqrt{24^2-18^2}}{\sqrt{18^2+15^2}}$ oe or **M2** for $\sqrt{18^2+15^2}$ isw or $\sqrt{24^2+15^2}$ isw or **M1** for 18^2+15^2 isw or 24^2+15^2 isw or **M1** for indicating required angle is *EBD*
9(a)(i)	2	**2**	**M1** for $x(x^2-4x+4)$ or $x(x-2)^2$ or $(x^2-2x)(x-2)$ or $x^3-2ax^2+a^2x$
9(a)(ii)	Correct sketch with curve passing through *O* and touching (2, 0) 	**4**	**B1** for any positive cubic **B1** for sketch through or touching *O* **B1** for sketch with min or max touching *x*-axis once only but not at (0, 0) **B1FT** *their* **(a)(i)** for sketch with min or max touching *x*-axis at (*their* 2, 0) and *their* 2 is labelled or clearly indicated
9(b)	$y = 20x - 64$ final answer nfww	**7**	**B6** for equivalent correct equation OR **B2** for $3x^2-8x+4$ isw or **B1** for $3x^2$ or $-8x$ seen **M2dep** for [grad =] 20 soi nfww or **M1dep** for substituting 4 into *their* derivative isw **B1** for (4, 16) soi **M1dep** for 16 = *their* $20 \times 4 + c$ oe
10	125 n^3 oe final ans	**B2**	**B1** for 125 **B1** for n^3
	29 $6n-1$ oe final ans	**B3**	**B1** for 29 **B2** for $6n-1$ oe or **B1** for $6n+k$ or $an-1$ ($a \neq 0$)
	2^{n-3} oe final ans	**B2**	**B1** for $2^{n\,[+k]}$ oe
	25 $6n-1-2^{n-3}$ oe final ans OR 25.25 $-\frac{1}{24}n^3+\frac{1}{8}n^2+\frac{17}{3}n-1$ oe final ans	**B2**	**FT** *their* 29 – 4 and *their* $6n-1$ – *their* 2^{n-3} **B1FT** for each OR **B1** for each

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MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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

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[Turn over

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1 **(a)** **(i)** Yasmin and Zak share an amount of money in the ratio 21 : 19.
Yasmin receives $6 more than Zak.

Calculate the total amount of money shared by Yasmin and Zak.

$ ..... [2]

(ii) In a sale, all prices are reduced by 15%.

(a) Yasmin buys a blouse with an original price of $40.

Calculate the sale price of the blouse.

$ ..... [2]

(b) Zak buys a shirt with a sale price of $29.75 .

Calculate the original price of the shirt.

$ ..... [2]

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(b) Xavier's salary increases by 2% each year.
In 2010, his salary was $40 100.

(i) Calculate his salary in 2015.
Give your answer correct to the nearest dollar.

$ ..... [3]

(ii) In which year is Xavier's salary first greater than $47 500?

..... [3]

(c) In January 2020, the population of a town was 5% **more** than its population in January 2018.
In January 2021, the population of this town was 2% **less** than its population in January 2020.

Calculate the overall percentage increase in the population from January 2018 to January 2021.

..... % [2]

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2 **(a)** $y = px^2 + t$

(i) Find the value of y when $p = 3$, $x = 2$ and $t = -13$.

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

(ii) Rearrange the formula to write x in terms of p, t and y.

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

(b) **(i)** Factorise.

$15x^2 - 2x - 8$

..... [2]

(ii) Solve the equation.

$15x^2 - 2x - 8 = 0$

$x =$ ..... or $x =$ ..... [1]

(c) Factorise completely.

$x^3 - 16xy^2$

..... [3]

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(d) Simplify. $\dfrac{2x-1-4ax+2a}{2x^2-x}$

..... [4]

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3 **(a)** Zoe's test scores last term were 6 7 7 7 8 9 9 10 10.

Find

(i) the range,

..... [1]

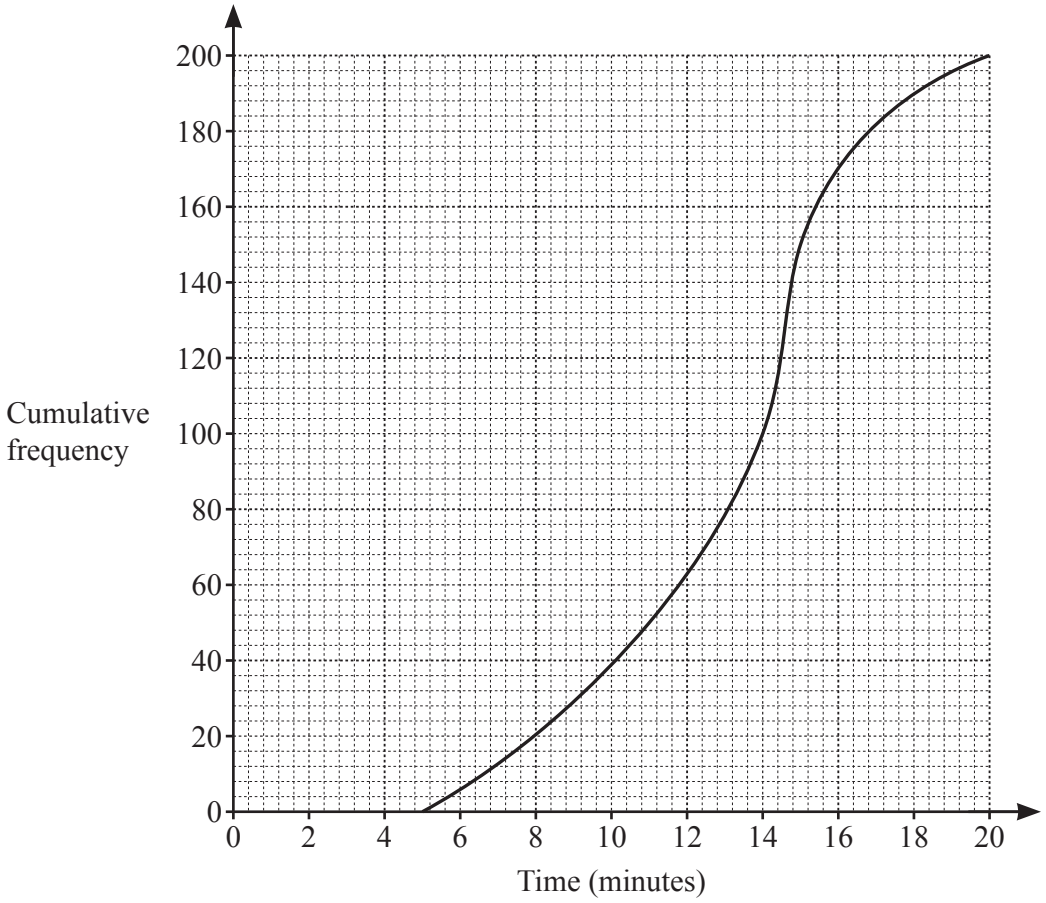
(ii) the mode,

..... [1]

(iii) the median.

..... [1]

(b) The cumulative frequency diagram shows information about the time taken by each of 200 students to solve a problem.



Use the diagram to find an estimate of

(i) the median,

..... min [1]

(ii) the interquartile range.

..... min [2]

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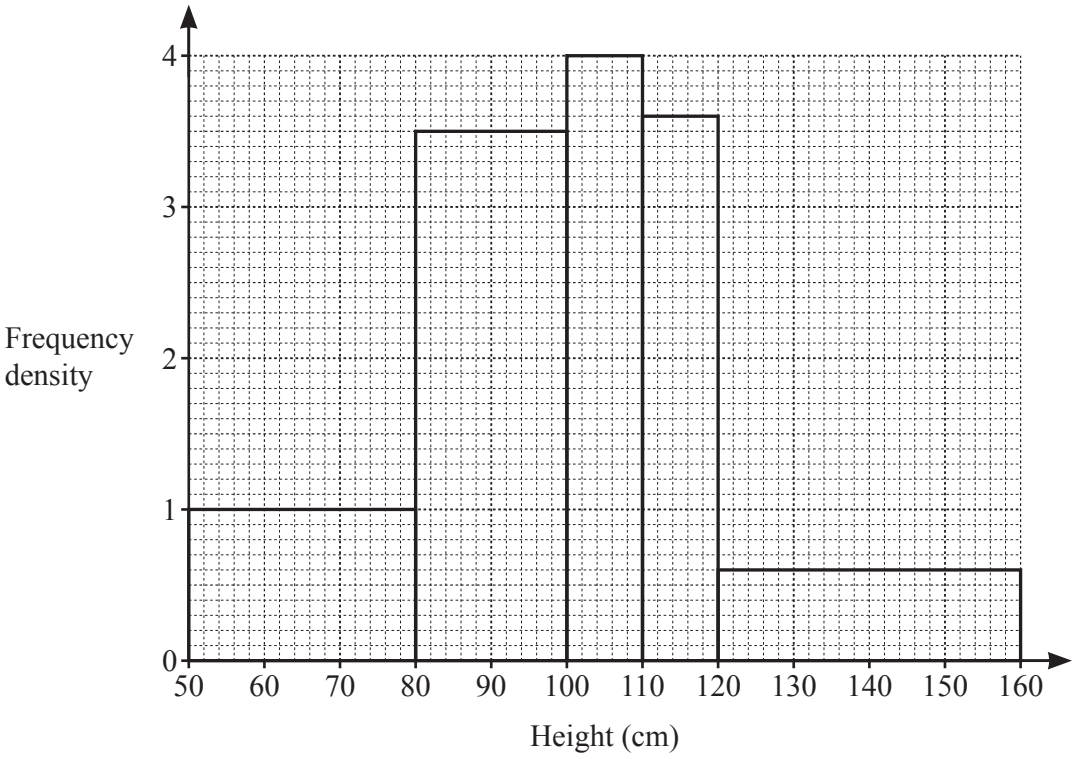
(c) The test scores of 200 students are shown in the table.

Score	5	6	7	8	9	10
Frequency	3	10	43	75	48	21

Calculate the mean.

..... [3]

(d) The height, in cm, of each of 200 plants is measured.
The histogram shows the results.



Calculate an estimate of the mean height.
You must show all your working.

..... cm [6]

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4 **(a)** A is the point (1, 5) and B is the point (3, 9).
M is the midpoint of AB.

(i) Find the coordinates of M.

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

(ii) Find the equation of the line that is perpendicular to AB and passes through M.
Give your answer in the form $y = mx + c$.

$y =$ ..... [4]

(b) The position vector of P is $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and the position vector of Q is $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$.

(i) Find the vector $\overrightarrow{PQ}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(ii) R is the point such that $\overrightarrow{PR} = 3\overrightarrow{PQ}$.

Find the position vector of R.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

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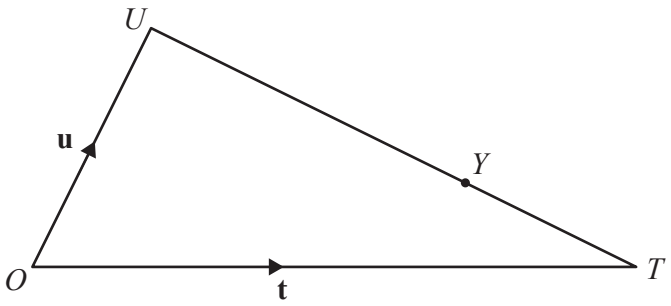
(c)



NOT TO SCALE

$\overrightarrow{OT} = \mathbf{t}$, $\overrightarrow{OU} = \mathbf{u}$ and $UY = 2YT$.

(i) Find $\overrightarrow{OY}$ in terms of **t** and **u**.
Give your answer in its simplest form.

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

(ii) Z is on OT and YZ is parallel to UO.

Find $\overrightarrow{OZ}$ in terms of **t** and/or **u**.
Give your answer in its simplest form.

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

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5 Solve the simultaneous equations.

(a) $x + 2y = 13$
$x + 5y = 22$

$x =$ .....

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

(b) $y = 2 - x$
$y = x^2 + 2x + 2$

$x =$ ..... $y =$ .....

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

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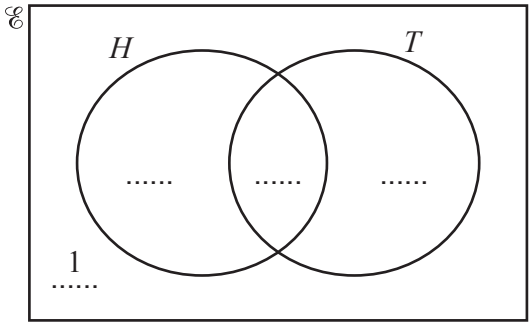
6 In a class of 24 students, 18 students like homework (H), 15 students like tests (T) and 1 student does not like homework and does not like tests.

(a) Complete the Venn diagram to show this information.



[2]

(b) Write down the number of students who like both homework and tests.

..... [1]

(c) Find $n(H' \cap T)$.

..... [1]

(d) A student is picked at random from the class.

Write down the probability that this student likes tests but does not like homework.

..... [1]

(e) Two students are picked at random from the class.

Find the probability that both students do not like homework and do not like tests.

..... [1]

(f) Two of the students who like homework are picked at random.

Find the probability that both students also like tests.

..... [3]

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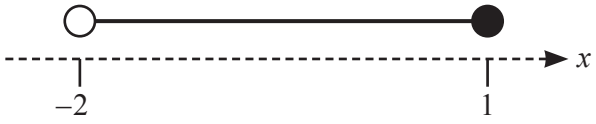
7 **(a)**



Write down the inequality in x shown by the number line.

..... [2]

(b) **(i)** Write x^2+4x+1 in the form $(x+p)^2+q$.

..... [2]

(ii) Use your answer to **part (b)(i)** to solve the equation $x^2+4x+1=0$.

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

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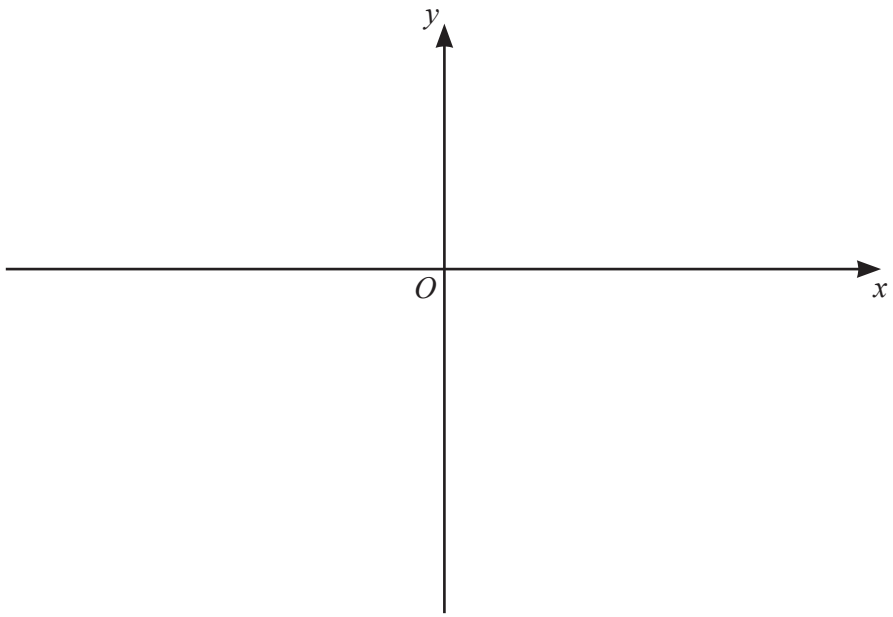
(iii) Use your answer to **part (b)(i)** to write down the coordinates of the minimum point on the graph of $y = x^2 + 4x + 1$.

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

(iv) On the diagram, sketch the graph of $y = x^2 + 4x + 1$.



[2]

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8 **(a)** A solid cuboid measures 20 cm by 12 cm by 5 cm.

(i) Calculate the volume of the cuboid.

..... cm^3 [1]

(ii) **(a)** Calculate the total surface area of the cuboid.

..... cm^2 [3]

(b) The surface of the cuboid is painted.
The cost of the paint used is \$1.52 .

Find the cost to paint $1 cm^2$ of the cuboid.
Give your answer in cents.

..... cents [1]

(b) A solid metal cylinder with radius x and height $\frac{9x}{2}$ is melted.
All the metal is used to make a sphere with radius r.

Find r in terms of x.

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

$r =$ ..... [3]

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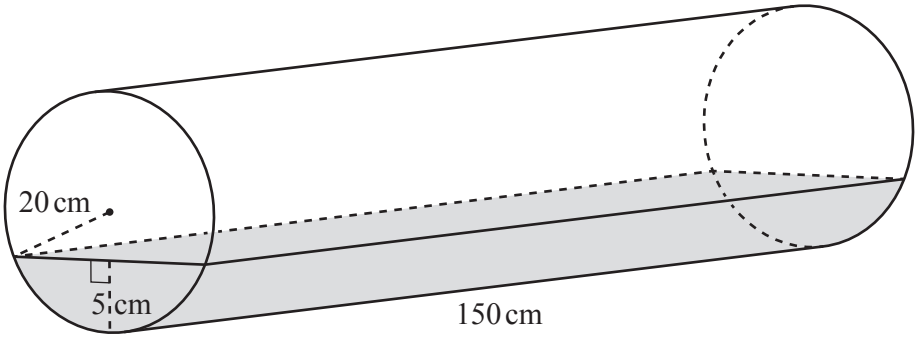
(c)



NOT TO SCALE

The diagram shows a cylinder of length 150 cm on horizontal ground.
The cylinder has radius 20 cm.
The cylinder contains water to a depth of 5 cm, as shown in the diagram.

Calculate the volume of water in the cylinder.
Give your answer in litres.

..... litres [7]

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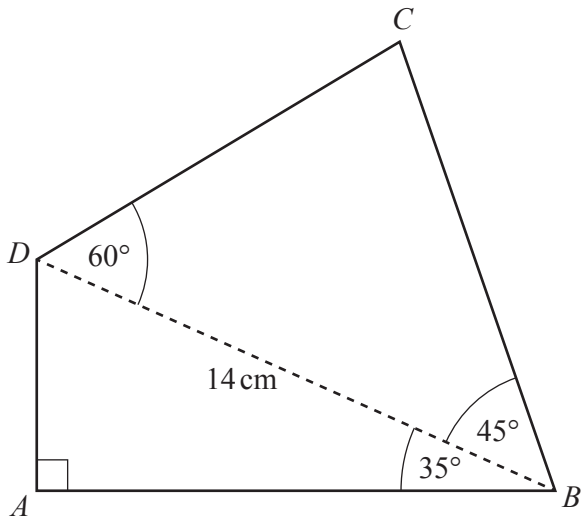
9 (a)



NOT TO SCALE

Calculate the perimeter of the quadrilateral $ABCD$.

..... cm [7]

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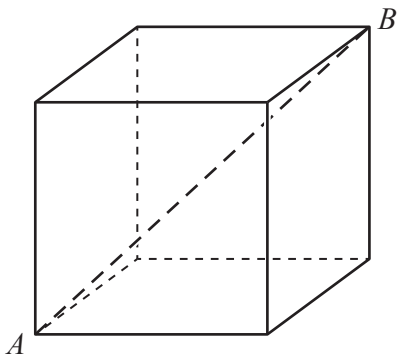
(b)



NOT TO SCALE

The diagram shows a cube.
The length of the diagonal AB is 8.5 cm.

(i) Calculate the length of an edge of the cube.

..... cm [3]

(ii) Calculate the angle between AB and the base of the cube.

..... [3]

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10 $\mathrm{f}(x) = 3x - 2$ $\mathrm{g}(x) = 5x - 7$ $\mathrm{h}(x) = x^2 + x$ $\mathrm{j}(x) = 3^x$

(a) Find

(i) f(2),

..... [1]

(ii) g(2),

..... [1]

(iii) gf(2).

..... [1]

(b) Find $\mathrm{f}^{-1}(x)$.

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

(c) Find hf(x), giving your answer in the form $ax^2 + bx + c$.

..... [3]

(d) Find the derivative of h(x).

..... [1]

(e) **(i)** Find x when $\mathrm{j}^{-1}(x) = 4$.

$x =$ ..... [1]

(ii) Simplify $\mathrm{j}^{-1}\mathrm{j}(x)$.

..... [1]

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11 **(a)** These are the first four terms of a sequence.

11 7 3 −1

(i) Write down the next term.

..... [1]

(ii) Write down the term to term rule for this sequence.

..... [1]

(iii) Find the nth term of this sequence.

..... [2]

(b) The nth term of a different sequence is $\frac{2n}{n+1}$.

(i) Find the difference between the 5th term and the 6th term of this sequence.
Give your answer as a fraction.

..... [2]

(ii) Is $\frac{3}{4}$ a term in this sequence?
Show how you decide.

[3]

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MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2021**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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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.

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

Abbreviations

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

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Question	Answer	Marks	Partial Marks
1(a)(i)	120	**2**	**M1** for $6 \div (21 - 19)$ oe soi or for $\frac{2x}{40} = 6$
1(a)(ii)(a)	34	**2**	**M1** for $40 - \frac{15}{100} \times 40$ oe or better or **B1** for 6
1(a)(ii)(b)	35	**2**	**M1** for $\left(1 - \frac{15}{100}\right) \times p = 29.75$ or better
1(b)(i)	44 274 cao	**3**	**B2** for 44273 to 44274 or 44270 or **M1** for $40100 \times \left(1 + \frac{2}{100}\right)^5$ oe
1(b)(ii)	2019 nfww	**3**	**M2** for one correct trial of $n = 8$ or $n = 9$ either to find a salary or, if working with 1.02^n and 47 500÷ 40 100 [= 1.1845], to find a value of 1.02^n or **B2** for final answer 9 or 4 nfww or **M1** for *their* $44\,274 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or $40\,100 \times \left(1 + \frac{2}{100}\right)^n = 47\,500$ oe or for at least one trial giving a value greater than *their* 44 274
1(c)	2.9 [increase]	**2**	**M1** for $\left(1 + \frac{5}{100}\right) \times \left(1 - \frac{2}{100}\right)$ oe implied by 1.029 or 102.9[%]
2(a)(i)	–1	**2**	**M1** for $3 \times 2^2 - 13$ oe
2(a)(ii)	$[\pm]\sqrt{\frac{y-t}{p}}$ oe final answer	**3**	**M1** for correct rearrangement to isolate x^2 term **M1** for correct division by p **M1** for correct square root Incorrect answer scores a maximum of M2 If 0 scored, SC1 for a correctly rearranged formula with $p = 3$ and $t = -13$ substituted

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Question	Answer	Marks	Partial Marks
2(b)(i)	$(5x-4)(3x+2)$ oe final answer	**2**	**B1** for $(ax+b)(cx+d)$ where either $ac = 15$ and $bd = -8$ or $ad + bc = -2$ or $5x(3x + 2) – 4(3x + 2)$ or $3x(5x – 4) + 2(5x – 4)$ or correct factors seen and spoiled
2(b)(ii)	$\frac{4}{5}$ oe and $-\frac{2}{3}$ oe	**1**	**FT** a factorised quadratic
2(c)	$x(x+4y)(x-4y)$ final answer	**3**	**B2** for $(x^2+4xy)(x-4y)$ or $(x+4y)(x^2-4xy)$ or answer in the form $x(a + b)(a – b)$ or correct answer seen and spoiled or **B1** for $x(x^2-16y^2)$ oe or $(x+4y)(x-4y)$
2(d)	$\frac{1-2a}{x}$ oe final answer	**4**	**B2** for $(2x – 1)(1 – 2a)$ oe or **B1** for $2x – 1 – 2a(2x – 1)$ or $2x(1 – 2a) – (1 – 2a)$ **B1** for $x(2x – 1)$
3(a)(i)	4	**1**	
3(a)(ii)	7	**1**	
3(a)(iii)	8	**1**	
3(b)(i)	14	**1**	
3(b)(ii)	4	**2**	**B1** for [l.q. =] 11 or [u.q =] 15
3(c)	8.09	**3**	**M1** for $5 \times 3 + 10 \times 6 + 43 \times 7 + 75 \times 8 + 48 \times 9 + 21 \times 10$ **M1 dep** ÷ 200
3(d)	30, 70, 40, 36, 24 seen	**B2**	**B1** for 3 or 4 correct or **M1** for $1 \times (80 – 50)$, $3.5 \times (100 – 80)$, $4 \times (110 – 100)$, $3.6 \times (120 – 110)$ and $0.6 \times (160 – 120)$ oe
	(their 30×65 + *their* 70×90 + *their* 40×105 + *their* 36×115 + *their* $24 \times 140) \div 200$	**M3**	**M1** for midpoints soi **M1** for Σfx, x in interval or boundary of interval **M1 dep on second M1** for ÷ 200
	99.75	**A1**	
4(a)(i)	(2, 7)	**2**	**B1** for each coordinate

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Question	Answer	Marks	Partial Marks
4(a)(ii)	$-\frac{1}{2}x+8$ oe	4	Correct equivalent in different form scores 3 marks. **M1** for gradient of $AB = \frac{9-5}{3-1}$ or $\frac{4}{2}$ or 2 **M1 dep** for gradient $p = -\frac{1}{their\ grad\ of\ AB}$ **M1 (dep** on previous M1) for substitution of *their* midpoint into $y = (their\ p)x + c$ oe where *their* $p \neq 0$
4(b)(i)	$\begin{pmatrix}0\\2\end{pmatrix}$	2	**B1** for $\begin{pmatrix}0\\k\end{pmatrix}$ or $\begin{pmatrix}k\\2\end{pmatrix}$
4(b)(ii)	$\begin{pmatrix}-2\\9\end{pmatrix}$	2	**FT** *their* $\overrightarrow{PQ}$ **B1FT** for $\begin{pmatrix}0\\6\end{pmatrix}$
4(c)(i)	$\frac{2}{3}\mathbf{t}+\frac{1}{3}\mathbf{u}$ or $\frac{1}{3}(2\mathbf{t}+\mathbf{u})$ final answer	2	**M1** for $\overrightarrow{UY} = \frac{2}{3}(\mathbf{t}-\mathbf{u})$ oe or $\overrightarrow{TY} = \frac{1}{3}(\mathbf{u}-\mathbf{t})$ oe or correct route soi
4(c)(ii)	$\frac{2}{3}\mathbf{t}$ cao	1	
5(a)	$[x =]$ 7 $[y =]$ 3	2	**B1** for each
5(b)	$[x =]$ 0, $[y =]$ 2 $[x =]$ –3, $[y =]$ 5	4	**B3** for $x = 0$ and $x = -3$ or **B2** for $x^2 + 3x = 0$ or **M1** for $2 - x = x^2 + 2x + 2$ If 0 scored award **B1** for $x = 0$, $y = 2$ or $x = -3$, $y = 5$ from no/incorrect working ALTERNATIVE **B3** for $y = 2$ and $y = 5$ or **B2** for $y^2 - 7y + 10 = 0$ or **M1** for $y = (2 - y)^2 + 2(2 - y) + 2$ If 0 scored award **B1** for $x = 0$, $y = 2$ or $x = -3$, $y = 5$ from no/incorrect working

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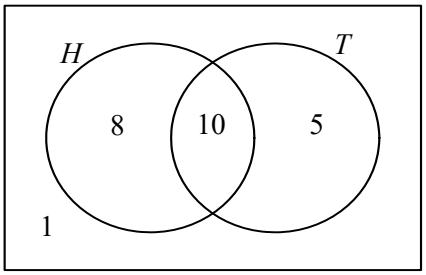
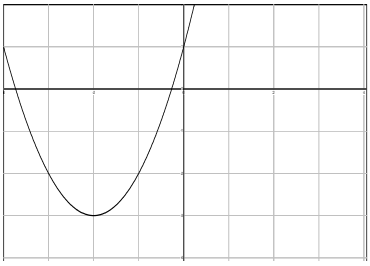
Question	Answer	Marks	Partial Marks
6(a)		2	i.e. 8, 10 and 5 correctly placed **B1** for 10 correctly placed or **M1** for $18-x$, x and $15-x$ correctly placed on diagram and $x = 10$ seen
6(b)	10	1	**FT** *their* Venn diagram
6(c)	5	1	**FT** *their* Venn diagram
6(d)	$\frac{5}{24}$ oe	1	**FT** *their* 5 on the Venn diagram
6(e)	0	1	
6(f)	$\frac{5}{17}$ oe	3	**M2** for $\frac{their10}{18}\times\frac{their9}{17}$ or **B1FT** for $\frac{their10}{18}$ or $\frac{their9}{17}$ seen After 0 scored, **SC1** for answer $\frac{25}{81}$ oe
7(a)	$-2 < x \leqslant 1$	2	**B1** for $-2 < x$ or $x \leqslant 1$
7(b)(i)	$(x+2)^2-3$	2	**M1** for $(x+2)^2+k$
7(b)(ii)	$(x+2)^2=3$	M1	**FTdep** *their* **(b)(i)** for $k < 0$
	–3.73 or –3.732... and –0.268 or –0.2679...	B1	
7(b)(iii)	(–2, –3)	2	**FT** *their* $(x+2)^2-3$ **B1** for each coordinate
7(b)(iv)	Correct sketch 	2	Parabola with minimum point in correct quadrant and both x-intercepts negative and positive y-intercept **B1** for parabola with minimum point.

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Question	Answer	Marks	Partial Marks
8(a)(i)	1200	**1**	
8(a)(ii)(a)	800	**3**	**M2** for [2 ×] (20 × 12 + 20 × 5 + 12 × 5) or **M1** for 20 × 12 or 20 × 5 or 12 × 5
8(a)(ii)(b)	0.19	**1**	**FT** 152 ÷ *their* 800
8(b)	$\frac{3x}{2}$ or $1.5x$	**3**	**B2** for $r^3 = \frac{27x^3[\pi]}{8[\pi]}$ or better or **M1** for $\frac{4}{3}\pi r^3 = \pi x^2 \times \frac{9x}{2}$
8(c)	13.6 or 13.59 to 13.61	**7**	If chord is *AB* and *O* is centre of the cross section **M2** for $2 \times \quad \cos^{-1}\left(\frac{20-5}{20}\right)$ oe or **M1** for $\cos = \frac{20-5}{20}$ oe **M1** for $\frac{theirAOB}{360} \times \pi \times 20^2$ or $\frac{1}{2}(20)^2\left(\frac{82.8\pi}{180}\right)$ **M1** for $\frac{1}{2} \times 20^2 \times \sin(their\ AOB)$ oe **M1** for *their* area × 150 **M1** for *their* volume ÷ 1000
9(a)	42.3 or 42.28 to 42.30...	**7**	**M1** for $\frac{AB}{14} = \cos 35$ oe **M1** for $\frac{AD}{14} = \sin 35$ oe **B1** for [*C* =] 75 **M3** for [BC =] $\frac{14\sin 60}{\sin their 75}$ oe **and** [DC] $\frac{14\sin 45}{\sin their 75}$ oe or **M2** for $\frac{14\sin 60}{\sin their 75}$ **or** $\frac{14\sin 45}{\sin their 75}$ oe or **M1** for $\frac{\sin their 75}{14} = \frac{\sin 60}{BC}$ oe or $\frac{\sin their 75}{14} = \frac{\sin 45}{CD}$ oe

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Question	Answer	Marks	Partial Marks
9(b)(i)	4.91 or 4.907...	**3**	**B2** for $[l^2 =]$ 24.1 or 24.08... or M2 for $\sqrt{3}\, l = 8.5$ or $[l =] \sqrt{\frac{8.5^2}{3}}$ oe or **M1** for $l^2 + l^2 + l^2 = 8.5^2$ oe
9(b)(ii)	35.3 or 35.26 to 35.3 nfww	**3**	**M2dep** for sin (angle) = $\frac{\textit{their}\ \textbf{(b)(i)}}{8.5}$ oe or **M1** for clear recognition of correct angle
10(a)(i)	4	**1**	
10(a)(ii)	3	**1**	
10(a)(iii)	13	**1**	**FT** $5 \times$ *their* **(a)(i)** $- 7$
10(b)	$\frac{x+2}{3}$ final answer	**2**	**M1** for $y + 2 = 3x$ or for $\frac{y}{3} = x - \frac{2}{3}$ or for $x = 3y - 2$
10(c)	$9x^2 - 9x + 2$ final answer	**3**	**M1** for $(3x-2)^2 + 3x - 2$ **B1** for $(3x-2)^2 = 9x^2 - 6x - 6x + 4$
10(d)	$2x + 1$	**1**	
10(e)(i)	81	**1**	
10(e)(ii)	x	**1**	Not $y = x$
11(a)(i)	-5	**1**	
11(a)(ii)	Subtract 4 oe	**1**	
11(a)(iii)	$15 - 4n$ oe final answer	**2**	**B1** for $k - 4n$ or $15 - jn$ $j \neq 0$
11(b)(i)	$\frac{1}{21}$ or equivalent fraction	**2**	**B1** for $\frac{12}{7}$ and $\frac{10}{6}$
11(b)(ii)	$n = \frac{3}{5}$ oe or $2n \geqslant n + 1$ but $3 < 4$.	**M2**	**M1** for $\frac{3}{4} = \frac{2n}{n+1}$ oe or **M1** for $2n > n + 1$ but $3 < 4$
	No, n is not an integer oe or No, $\frac{3}{4}$ is less than 1, oe	**A1**	