Muhammad Shafiq ur Rehman (03247304567) Aitchison College

Cambridge Assessment International Education

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CENTRE NUMBER						CANDIDATE NUMBER				

9971247929

MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2023**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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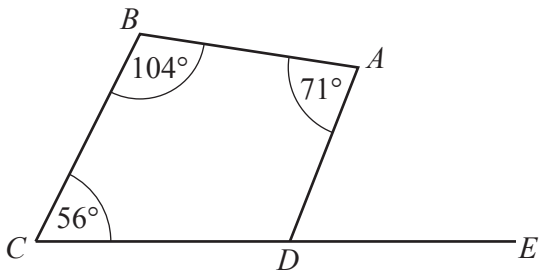
1



NOT TO SCALE

CDE is a straight line.

Find angle *ADE*.

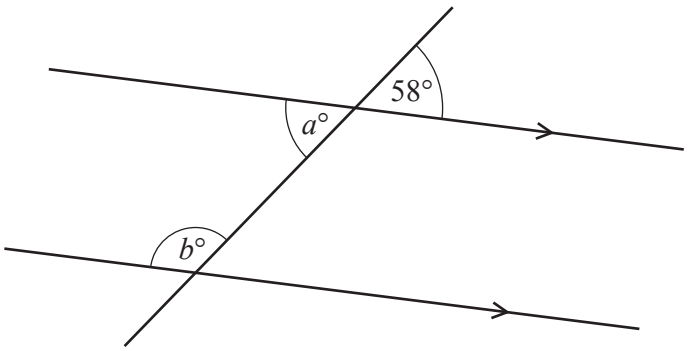
..... [2]

2 A train journey starts at 21 43.
It takes 8 hours and 32 minutes.

Find the time the journey finishes.

..... [1]

3



NOT TO SCALE

The diagram shows a straight line intersecting two parallel lines.

Find the value of *a* and the value of *b*, giving a geometrical reason for each answer.

a = ... because .....

b = ... because ..... [4]

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4 By writing each number in the calculation correct to 1 significant figure, work out an estimate for the value of

$$\frac{6.7 \times 2.1}{18 - 5.9}.$$

You must show all your working.

..... [2]

5 Eric has four colours of paint.
The table shows the probability that he uses each colour.

Colour	Red	Blue	Green	Yellow
Probability	0.3	0.35	0.13	x

Find the value of x.

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

6 Calculate the volume of a sphere with diameter 4.8 cm.

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

..... cm^3 [2]

7 The scale of a map is 1 : 125 000.
On a map, the length of an island is 9.4 cm.

Calculate the actual length of the island, giving your answer in kilometres.

..... km [2]

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8 **(a)** The nth term of a sequence is $10 - n^2$.

Write down the first three terms of this sequence.

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

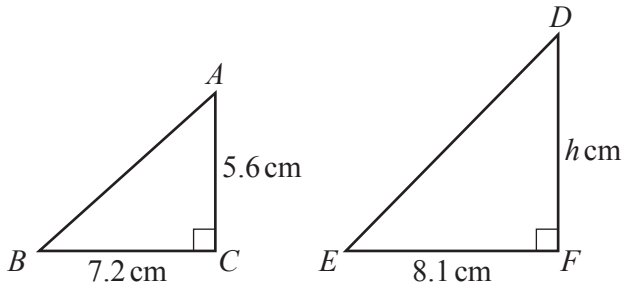
(b) These are the first four terms of another sequence.

7 10 13 16

Find an expression for the nth term of this sequence.

..... [2]

9



NOT TO SCALE

Triangle ABC is similar to triangle DEF.

Calculate the value of h.

$h =$ ..... [2]

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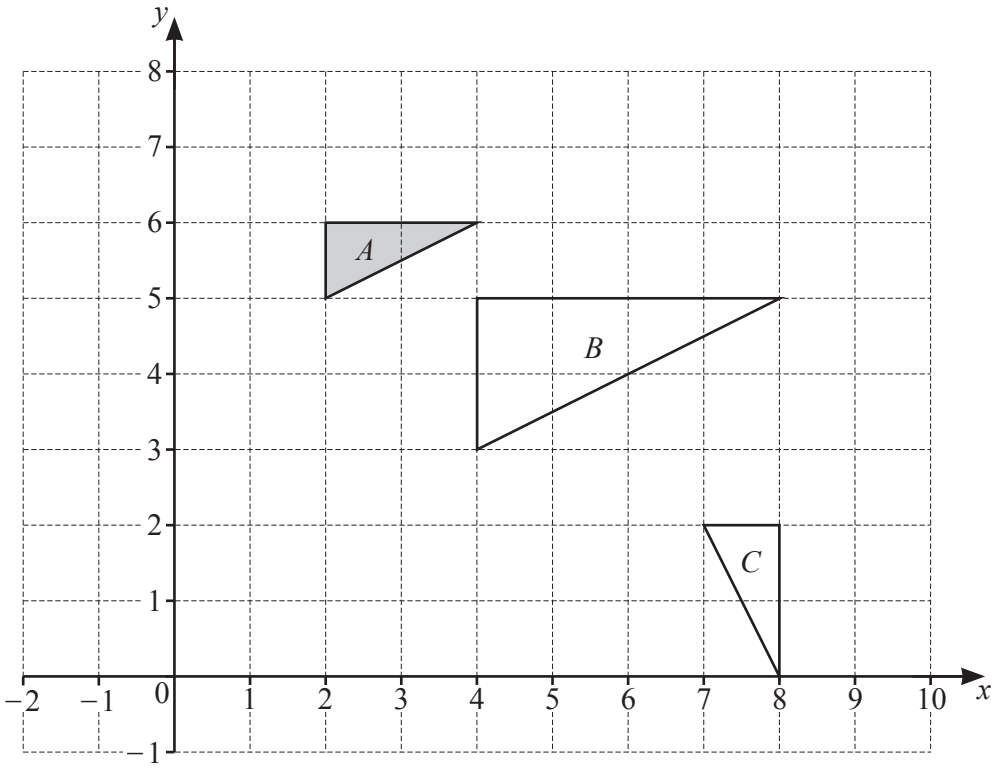
10 **Without using a calculator**, work out $2\frac{1}{7} \div \frac{5}{9}$.

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

..... [3]

11



Describe the **single** transformation that maps

(a) triangle A onto triangle B

.....

..... [3]

(b) triangle A onto triangle C.

.....

..... [3]

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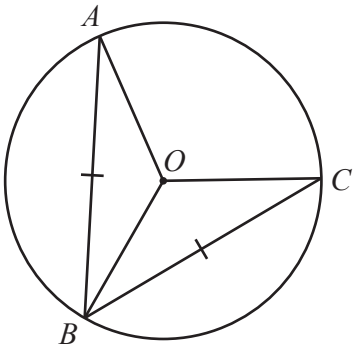
12 (a)



NOT TO SCALE

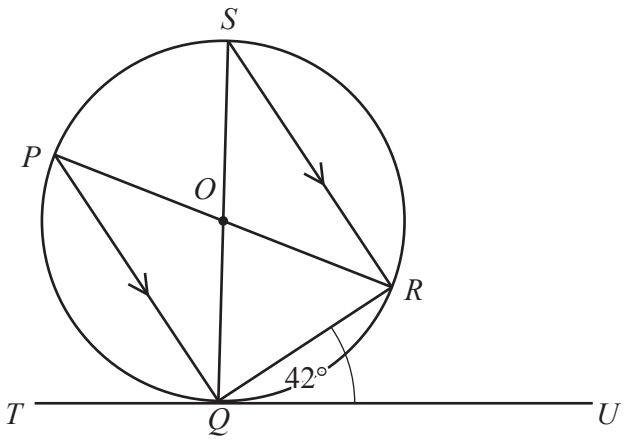
AO, OB and OC are all radii of the circle.
$AB = BC$.
Therefore triangle AOB is congruent to triangle COB.

Draw a ring around the correct criterion for this statement.

SAS *RHS* *SSS* *ASA*

[1]

(b)



NOT TO SCALE

P, Q, R and S are points on the circle and TQU is a tangent to the circle at Q.
PR and SQ intersect at the centre of the circle, O, and PQ is parallel to SR.
Angle $RQU = 42°$.

Calculate

(i) angle QSR

Angle QSR = ... [1]

(ii) angle PQS

Angle PQS = ... [1]

(iii) angle POS.

Angle POS = ... [1]

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13 Anya invests \$6000 in an account that pays compound interest at a rate of r% per year.
At the end of 8 years, the account has earned \$621.70 in interest.

Calculate the value of r.

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

14 y is directly proportional to the square of $(x + 3)$.
When $x = 2$, $y = 5$.

Find y when $x = 1$.

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

15 A bag contains 5 green buttons, 2 blue buttons and 6 white buttons.
Maya takes two buttons at random from the bag, without replacement.

Calculate the probability that one button is green and the other button is not green.

..... [3]

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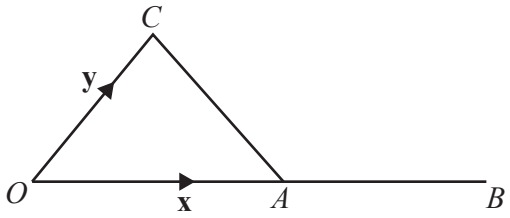
16 **(a)** Find the magnitude of the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$.

..... [2]

(b)



NOT TO SCALE

The diagram shows a triangle OAC.
A is the midpoint of the straight line OB.
$\overrightarrow{OA} = \mathbf{x}$ and $\overrightarrow{OC} = \mathbf{y}$.

Find $\overrightarrow{CB}$ in terms of $\mathbf{x}$ and $\mathbf{y}$.

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

17 Simplify $\left(81x^{12}\right)^{\frac{3}{4}}$.

..... [2]

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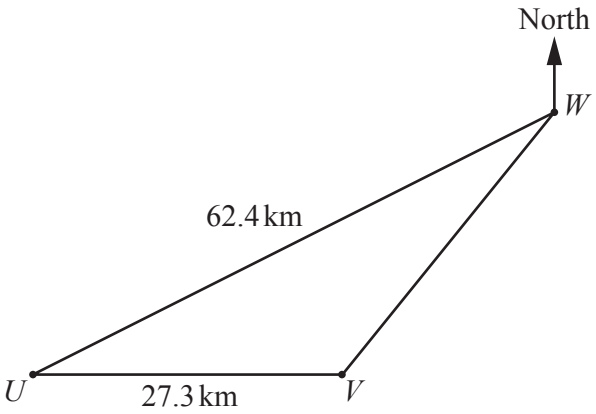
18



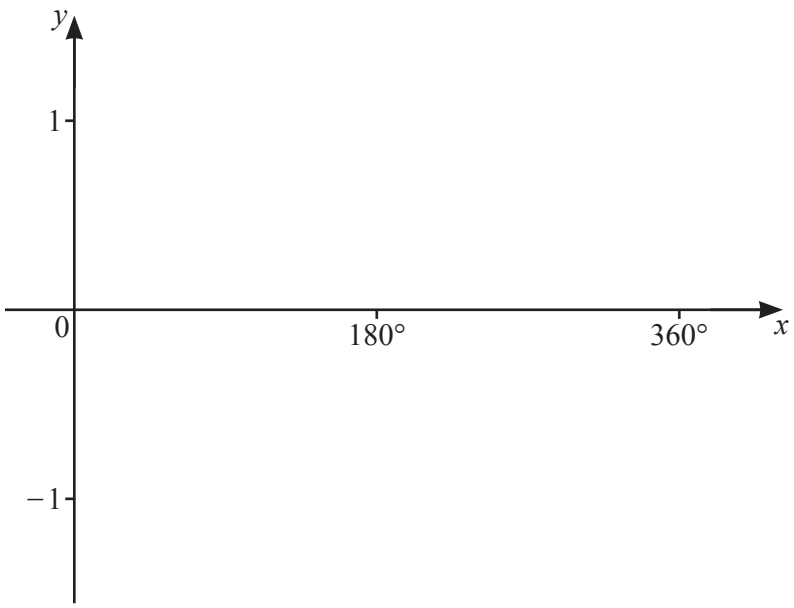
NOT TO SCALE

The diagram shows the position of three towns, U, V and W.
U is due west of V and angle $UVW = 125°$.

Calculate the bearing of U from W.

..... [4]

19 **(a)** On the diagram, sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Solve the equation $5\cos x + 3 = 0$ for $0° \leqslant x \leqslant 360°$.

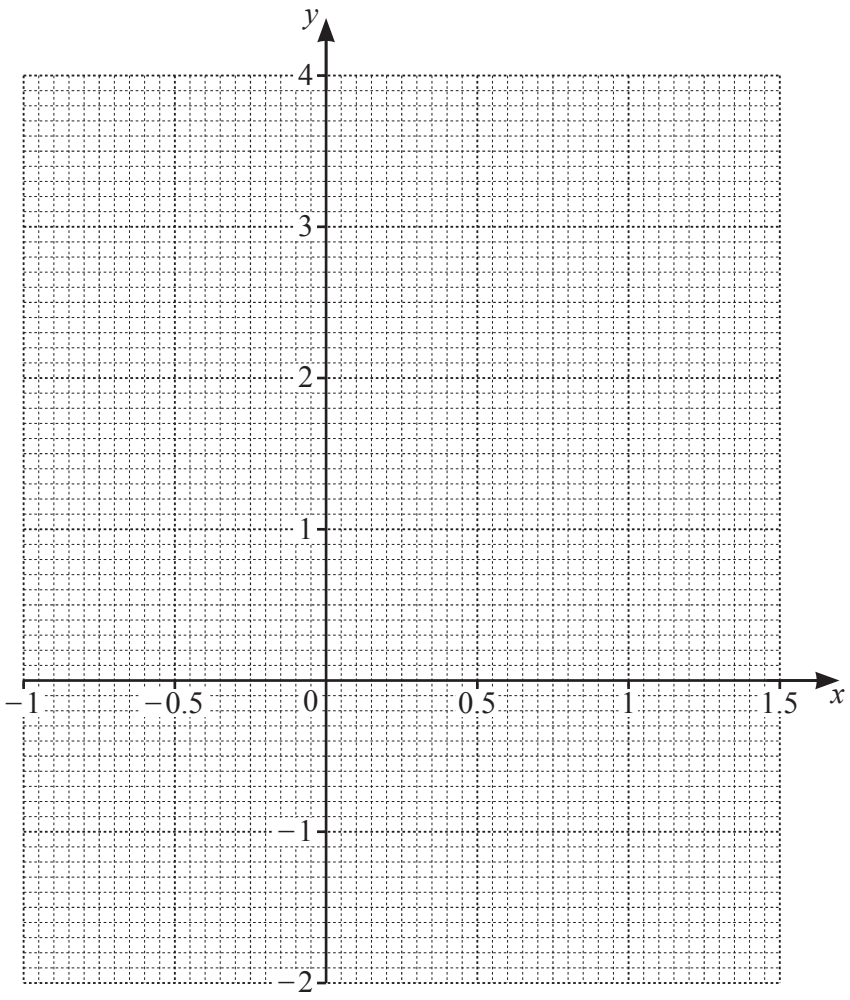
$x =$ ..... or $x =$ ..... [3]

20 The table shows some values for $y = 3x^2 - 2x - 1$.

x	-1	-0.5	0	0.5	1	1.5
y	4		-1		0	2.75

(a) Complete the table. [1]

(b) On the grid, draw the graph of $y = 3x^2 - 2x - 1$ for $-1 \leqslant x \leqslant 1.5$.



[3]

(c) By drawing a suitable straight line, solve the equation $3x^2 - 4x - 2 = 0$ for $-1 \leqslant x \leqslant 1.5$.

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

Question 21 is printed on the next page.

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21 A curve has equation $y = x^3 - 12x$.

(a) Find the gradient of the curve at the point $(1,-11)$.

..... [3]

(b) Find the coordinates of the turning points of the curve.

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

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MATHEMATICS **0580/21**

Paper 2 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 70

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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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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Abbreviations

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

Question	Answer	Marks	Partial Marks
1	51	**2**	**M1** for 360 – (56 + 104 + 71)
2	06 15 or 6:15 am	**1**	
3	58, vertically opposite	**2**	**B1** for each
	122, interior	**2**	**B1** for each
4	$\frac{7\times2}{20-6}$	**M1**	
	1 nfww	**A1**	If 0 scored **SC1** for 3 correct roundings or for all correct but with any trailing zeros
5	0.22 oe	**2**	**M1** for 1 – (0.3 + 0.35 + 0.13) oe or B1 for 0.78 oe
6	57.9 or 57.90 to 57.91...	**2**	**M1** for $\frac{4}{3}\times\pi\times\left(\frac{4.8}{2}\right)^3$
7	11.75	**2**	**M1** for $\frac{9.4\times125000}{100\times1000}$ oe or **B1** for figs 1175 or 1 cm : 1.25 km
8(a)	9 6 1	**2**	**B1** for 2 correct
8(b)	$3n + 4$ oe final answer	**2**	**B1** for $3n + j$ or $kn + 4$ $k \neq 0$, or $3n + 4$ seen then spoilt
9	6.3	**2**	**M1** for $\frac{5.6}{h}=\frac{7.2}{8.1}$ oe or better
10	$\frac{15}{7}\times\frac{9}{5}$ oe or $\frac{135}{63}\div\frac{35}{63}$ oe with common denominator	**M2**	**B1** for $\frac{15}{7}$ oe or **M1** for $\frac{their\,15}{7}\times\frac{9}{5}$ oe

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Question	Answer	Marks	Partial Marks
	$3\frac{6}{7}$ cao	**A1**	
11(a)	Enlargement [sf] 2 (0, 7)	**3**	**B1** for each
11(b)	Rotation (3, 1) 90° clockwise oe	**3**	**B1** for each
12(a)	SSS	**1**	
12(b)(i)	42	**1**	
12(b)(ii)	42	**1**	**FT** their part **(i)**
12(b)(iii)	84	**1**	**FT** 2 × their part **(ii)**
13	1.24[0…]	**3**	**M2** $\sqrt[8]{\frac{6000+621.70}{6000}}$ oe or **M1** for $6000+621.70=6000(k)^8$ oe
14	3.2 oe	**3**	**M1** for $y=k(x+3)^2$ oe or better **M1** for substituting *their k* into $y=k(1+3)^2$
15	$\frac{20}{39}$ oe	**3**	**M2** for $\frac{5}{13}\times\frac{8}{12}[\times 2]$ oe or **M1** for $\frac{5}{13}$ or $\frac{8}{12}$ or $\frac{5}{12}$ or $\frac{8}{13}$ If 0 scored **SC1** for answer $\frac{80}{169}$ oe
16(a)	6.4[0] or 6.403...	**2**	**M1** for $(-4)^2+5^2$ oe
16(b)	$2\mathbf{x}-\mathbf{y}$	**1**	
17	$27x^9$ final answer	**2**	**B1** for answer $27x^n$ or nx^9, or for correct answer seen and spoilt

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Question	Answer	Marks	Partial Marks
18	236[.0…]	**4**	**M2** for $\frac{27.3\times \sin 125}{62.4}$ or **M1** for $\frac{27.3}{\sin UWV}=\frac{62.4}{\sin 125}$ **M1** for $180+(125-90)+$ *their* 21 oe or $180+(90-$ *their* $34)$ oe If 0 scored **SC1** for the correct bearing marked at W

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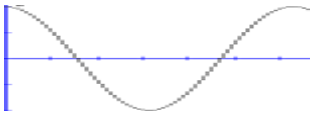
Question	Answer	Marks	Partial Marks
19(a)	correct sketch  Correct sketch to go through (0, 1), (360, 1) and (180, –1)	**2**	**B1** for correct cosine curve shape through (0, 1)
19(b)	126.9 or 126.86 to 126.87 233.1 or 233.13 to 233.14	**3**	**B2** for 1 correct angle or **M1** for $\cos x = -\frac{3}{5}$ oe If M1 or 0 scored SC1 for two angles with a sum of 360
20(a)	0.75 and –1.25	**1**	
20(b)	Correct curve	**3**	**B2 FT** for 6 or 5 correct plots or **B1 FT** for 4 or 3 correct plots
20(c)	ruled line $y = 2x + 1$	**B2**	**B1** for correct equation $[y =]2x + 1$ soi or $y = 2x + k$ or $y = kx + 1$ drawn
	−0.35 to −0.45	**B1**	
21(a)	-9	**3**	**B2** for $3x^2 - 12$ isw or **B1** for $3x^2 - k$ or $kx^2 - 12$
21(b)	$(-2, 16)$ $(2, -16)$	**3**	**M1** for *their* $(3x^2 - 12) = 0$ or stating $\frac{dy}{dx} = 0$ **A1** for $x = \pm 2$ or $(-2, 16)$ or $(2, -16)$

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1 Find the temperature that is 8 °C colder than −5 °C.

..... °C [1]

2 There are two prime numbers in this list.

27 47 57 61 75 93

Work out the sum of these two prime numbers.

..... [2]

3 On ten days, Stefan records the number of minutes he has to wait for a train.

1 3 12 5 4 23 5 24 11 8

(a) Complete the stem-and-leaf diagram to show this information.

0	1 3
1	
2	

Key: 0 | 1 represents 1 minute

[2]

(b) Find the median.

..... min [1]

4 The distance from town *A* to town *B* on a map is 3.5 cm.
The scale on the map is 1 : 250 000.

Find the actual distance, in kilometres, from town *A* to town *B*.

..... km [2]

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5 A spinner is spun.
The possible outcomes are A, B, C or D.
The probability of spinning A, C or D is shown in the table.

Letter on spinner	A	B	C	D
Probability	0.2		0.05	0.35

Complete the table.

[2]

6 $\mathscr{E} = \{x: 1 \leqslant x \leqslant 20\}$
$E = \{\text{even numbers}\}$
$M = \{\text{multiples of 5}\}$

(a) Find $\text{n}(M)$.

..... [1]

(b) Find the elements in the set $E \cap M$.

..... [1]

(c) $y \notin E$.

Write down a possible value of y.

..... [1]

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7 **Without using a calculator**, work out $\frac{4}{7} \div 1\frac{5}{21}$.
You must show all your working and give your answer as a fraction in its simplest form.

..... [3]

8 Solve.

(a) $\frac{30}{x} = 6$

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

(b) $11x - 3 \geqslant 2(2x + 9)$

..... [3]

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9 F is the point $(1, -4)$, $\overrightarrow{FG} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$ and $\overrightarrow{GH} = \begin{pmatrix} -12 \\ 35 \end{pmatrix}$.

Find

(a) $3\overrightarrow{FG}$

( ) [1]

(b) $\overrightarrow{FG} + \overrightarrow{GH}$

( ) [1]

(c) the coordinates of the point G

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

(d) the magnitude of vector $\overrightarrow{GH}$.

..... [2]

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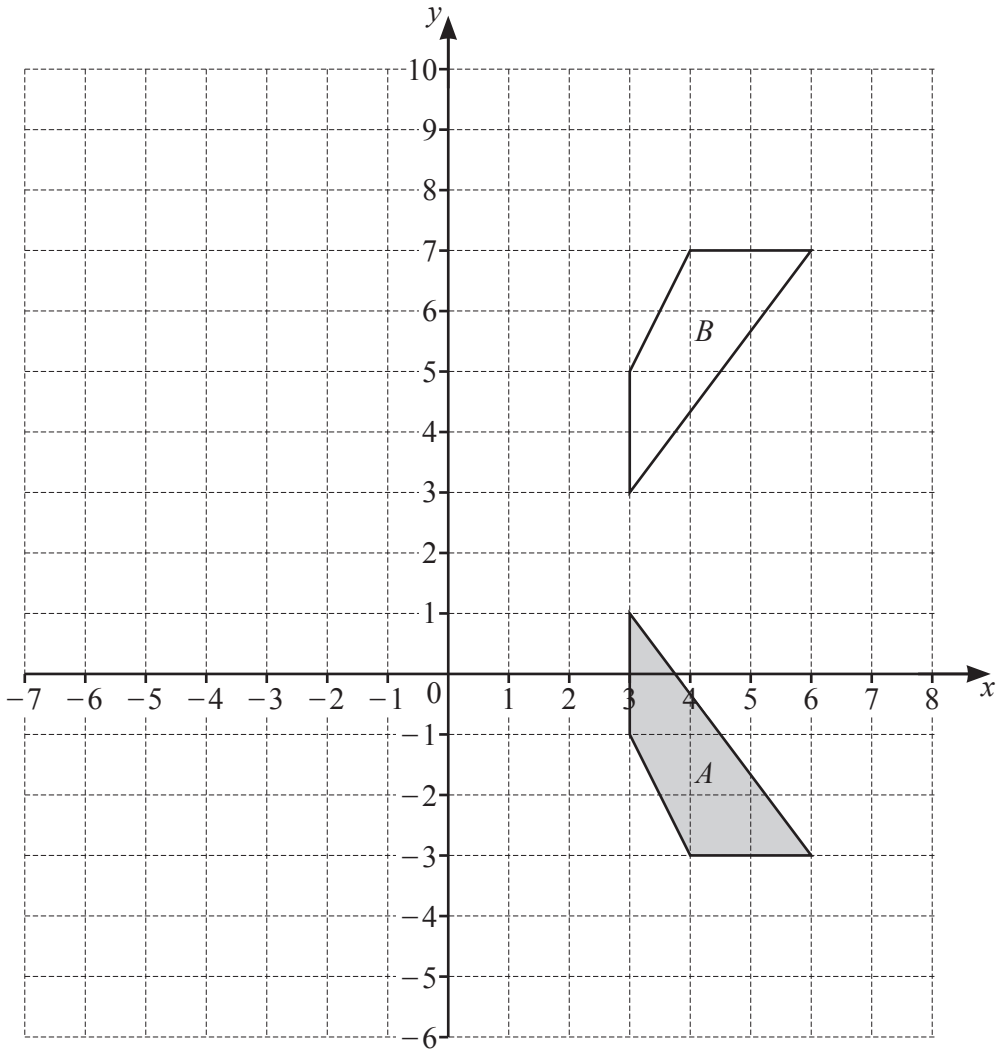
10



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

.....

..... [2]

(b) Rotate shape A 90° clockwise about the point $(-1, 2)$. [2]

(c) Enlarge shape A by scale factor -2, centre $(2, 0)$. [2]

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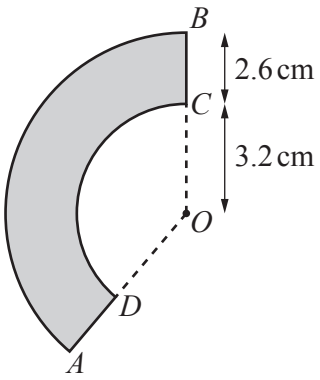
11



NOT TO SCALE

The diagram shows a shape, $ABCD$, formed by the sectors of two circles with the same centre O.
Both sector angles are 140°, $OC = 3.2$ cm and $CB = 2.6$ cm.
The area of the shape is $k\pi$ cm^2.

Find the value of k.

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

12 One solution of the equation $ax^2 + b = 181$ is $x = 8$.
a and b are both positive integers **greater than 1**.

(a) Find the value of b.

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

(b) Write down the other solution of the equation $ax^2 + b = 181$.

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

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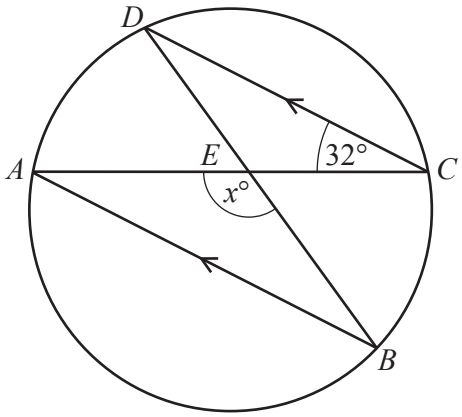
13



NOT TO SCALE

A, B, C and D are points on a circle.
AB is parallel to DC and angle $ACD = 32°$.
Chords AC and DB intersect at E.

Find the value of x.

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

14 $\mathrm{f}(x) = 5x + 2$

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

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

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15 C is the point $(5, -1)$ and D is the point $(13, 15)$.

(a) Find the midpoint of CD.

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

(b) Find the gradient of CD.

..... [2]

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

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

16 Write $0.62\dot{1}$ as a fraction in its simplest form.
You must show all your working.

..... [3]

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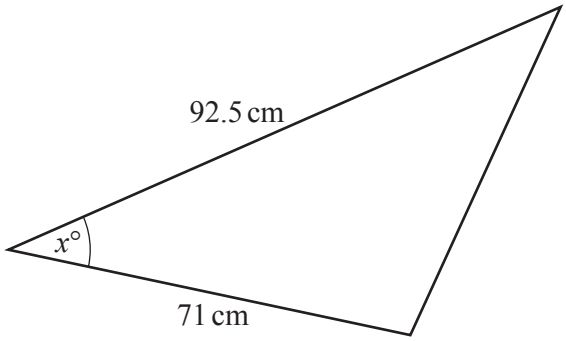
17



NOT TO SCALE

The diagram shows a triangle with an acute angle marked $x°$.
The area of the triangle is $2143\,\text{cm}^2$.

Work out the value of x.

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

18 Make x the subject of the formula.

$$c = \frac{3x}{2x-5}$$

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

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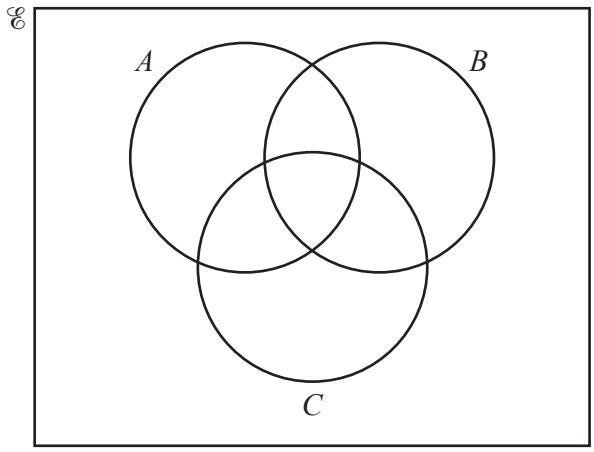
19 m is inversely proportional to the square of $(t+2)$.
$m = 0.64$ when $t = 3$.

Find m when $t = 8$.

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

20 In the Venn diagram, shade the region $A \cap B' \cap C$.



[1]

21 Solve the equation $5\sin x = -3$ for $0° \leqslant x \leqslant 360°$.

..... [3]

Questions 22 and 23 are printed on the next page.

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22 Write as a single fraction in its simplest form.

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

..... [3]

23 Bag A and bag B each contain red sweets and yellow sweets.
Anna picks a sweet at random from bag A.
Ben picks a sweet at random from bag B.
The probability that Anna picks a red sweet is $\frac{2}{5}$.
The probability Anna and Ben both pick a yellow sweet is $\frac{1}{10}$.

Find the probability that Anna and Ben both pick a red sweet.

..... [3]

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MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 70

Published

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

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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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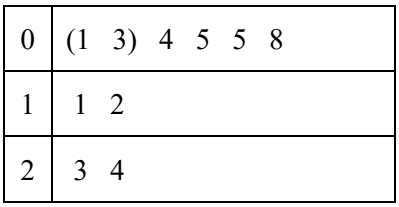
Abbreviations

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

Question	Answer	Marks	Partial Marks
1	–13	**1**	
2	108	**2**	**B1** for 47 or 61 identified
3(a)		**2**	**B1** for a correct diagram with one error or omission or for a fully correct unordered stem-and-leaf diagram
3(b)	6.5	**1**	
4	8.75	**2**	**M1** for $\frac{3.5\times250000}{100\times1000}$ oe or **B1** for figs 875 or 1 cm : 2.5 km
5	0.4 oe	**2**	**M1** for 1 – (0.2 + 0.05 + 0.35) oe or **B1** for 0.6 oe
6(a)	4 cao	**1**	
6(b)	10, 20	**1**	
6(c)	An odd number or decimal in the range $1 \leqslant x \leqslant 20$	**1**	
7	$\frac{4}{7} \times \frac{21}{26}$ oe or $\frac{12}{21} \div \frac{26}{21}$ oe with common denominator	**M2**	**B1** for $\frac{26}{21}$ or $\frac{21}{26}$ oe or **M1** for $\frac{4}{7} \times \frac{21}{\textit{their}\,26}$ oe
	$\frac{6}{13}$ cao	**A1**	
8(a)	5	**1**	

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Question	Answer	Marks	Partial Marks
8(b)	$x \geqslant 3$ final answer	**3**	**M1** for correct first step $11x - 3 \geq 4x + 18$ or $5.5x - 1.5 \geqslant 2x + 9$ or better **M1** for correctly collecting *their* x terms on one side and *their* number terms on the other side e.g. $11x - 4x \geqslant 18 + 3$ or better
9(a)	$\begin{pmatrix} 24 \\ -9 \end{pmatrix}$	**1**	
9(b)	$\begin{pmatrix} -4 \\ 32 \end{pmatrix}$	**1**	
9(c)	(9, –7)	**1**	
9(d)	37	**2**	**M1** for $(-12)^2 + 35^2$ oe
10(a)	Reflection $y = 2$	**2**	**B1** for each
10(b)	Shape at (–2, –2), (–6, –5), (–6, –3), (–4, –2)	**2**	**B1** for correct size and orientation but wrong position or for rotation of 90° anticlockwise about (–1, 2) or for three correct vertices
10(c)	Shape at (0, –2), (0, 2), (–2, 6), (–6, 6)	**2**	**B1** for correct size and orientation but wrong position or for three correct vertices
11	9.1	**3**	**M2** for $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2 - \frac{140}{360} \times [\pi] \times 3.2^2$ oe or **M1** for $\frac{140}{360} \times [\pi] \times 3.2^2$ oe or $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2$ oe or $[\pi] \times (3.2 + 2.6)^2 - [\pi] \times 3.2^2$
12(a)	53	**2**	**M1** for $a \times 8^2 + b = 181$ oe seen
12(b)	–8	**1**	

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Question	Answer	Marks	Partial Marks
13	116	**2**	**B1** for $ABD = 32$, $CAB = 32$, $BDC = 32$ or $CED = 116$ or **M1** for $180 - 32 - 32$
14	$\frac{x-2}{5}$ oe final answer	**2**	**M1** for a correct first step $x = 5y + 2$ or $y - 2 = 5x$ or $\frac{y}{5} = x + \frac{2}{5}$
15(a)	(9, 7)	**2**	**B1** for each
15(b)	2	**2**	**M1** for $\frac{15 - -1}{13 - 5}$ oe
15(c)	$[y =] -\frac{1}{2}x + \frac{23}{2}$ oe final answer	**3**	**M1** for gradient = $-\frac{1}{\textit{their}\ \textbf{(b)}}$ oe **M1** for correct substitution of *their* **(a)** into $y = (\textit{their}\ m)x + c$ oe
16	621.21… – 6.21… oe	**M1**	
	$\frac{41}{66}$ cao	**A2**	**A1** for $\frac{615}{990}$ oe If M0 scored **SC1** for $\frac{k}{990}$ or for answer $\frac{41}{66}$ with insufficient working
17	40.7 or 40.73 to 40.74	**2**	**M1** for $\frac{1}{2} \times 92.5 \times 71 \sin x = 2143$ oe
18	$\frac{5c}{2c-3}$ oe final answer	**4**	**M1** for correctly clearing the denominator **and** expanding bracket or correctly clearing the denominator **and** dividing by c **M1** for correctly collecting terms in x on one side and terms not in x on the other **M1** for correct factorising **M1** for correct division dependent on x appearing only once in a factorised expression Maximum 3 marks for an incorrect answer

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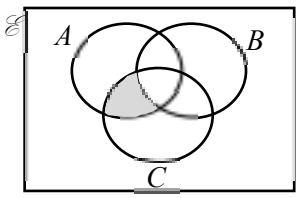
Question	Answer	Marks	Partial Marks
19	0.16 oe	**3**	**M1** for $m = \frac{k}{(t+2)^2}$ oe **M1** for substituting *their k* into $m = \frac{their\ k}{(8+2)^2}$ OR **M2** for $0.64 \times (3+2)^2 = m(8+2)^2$ oe
20		**1**	
21	216.9 or 216.86 to 216.87 323.1 or 323.13…	**3**	**B2** for one correct angle or **M1** for $\sin x = -\frac{3}{5}$ or better If M1 or 0 scored **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180
22	$\frac{22x+3}{(3x+2)(2x-1)}$ final answer	**3**	**B1** for a common denominator $(3x + 2)(2x – 1)$ oe isw **B1** for $5(2x – 1) + 4(3x + 2)$ oe isw
23	$\frac{1}{3}$ oe	**3**	**M1** for $\left(1-\frac{2}{5}\right) \times p = \frac{1}{10}$ oe **M1** for $\frac{2}{5} \times (1 - their\ p)$ where $0 < their\ p < 1$

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MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2023**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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

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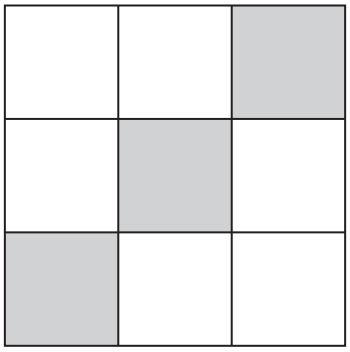
1



(a) Complete the statement.

The diagram has rotational symmetry of order ..... . [1]

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

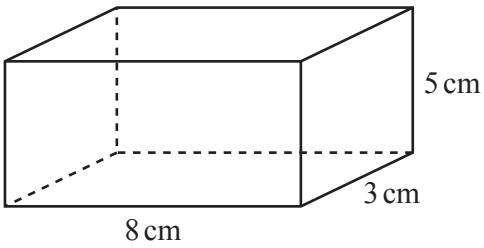
[2]

2 A film lasts for 2 hours 50 minutes.
The film ends at 23 05.

Find the time the film starts.

..... [1]

3



NOT TO SCALE

Find the total surface area of the cuboid.

..... cm^2 [3]

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4 $v = u - 9.8t$

Find the value of v when $u = 4$ and $t = -7$.

$v =$ ..... [2]

5 Simplify $d^8 \div d^2$.

..... [1]

6 At the end of the day, a shopkeeper has 12 tins of cat food left.
This is $\frac{3}{13}$ of the number he had at the beginning of the day.

Calculate the number of tins he had at the beginning of the day.

..... [2]

7 A spinner has five sides.
Each side is painted red, blue, green, yellow or orange.
The table shows some of the probabilities of the spinner landing on each colour.

Colour	Red	Blue	Green	Yellow	Orange
Probability	0.3	0.16	0.18	0.25	

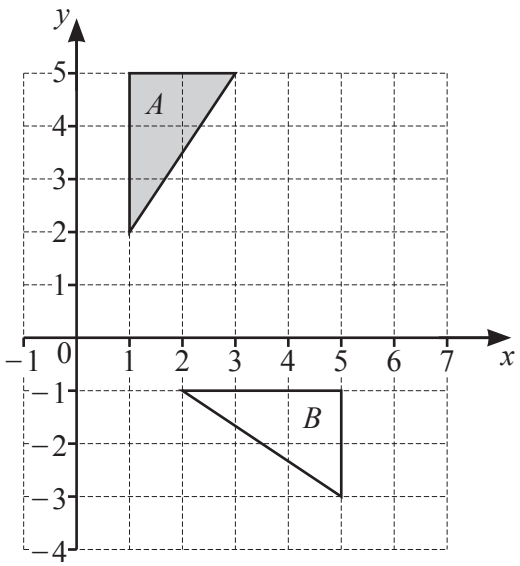
(a) Complete the table. [2]

(b) Dan spins the spinner once.

Find the probability that the spinner lands on red or blue.

..... [2]

8

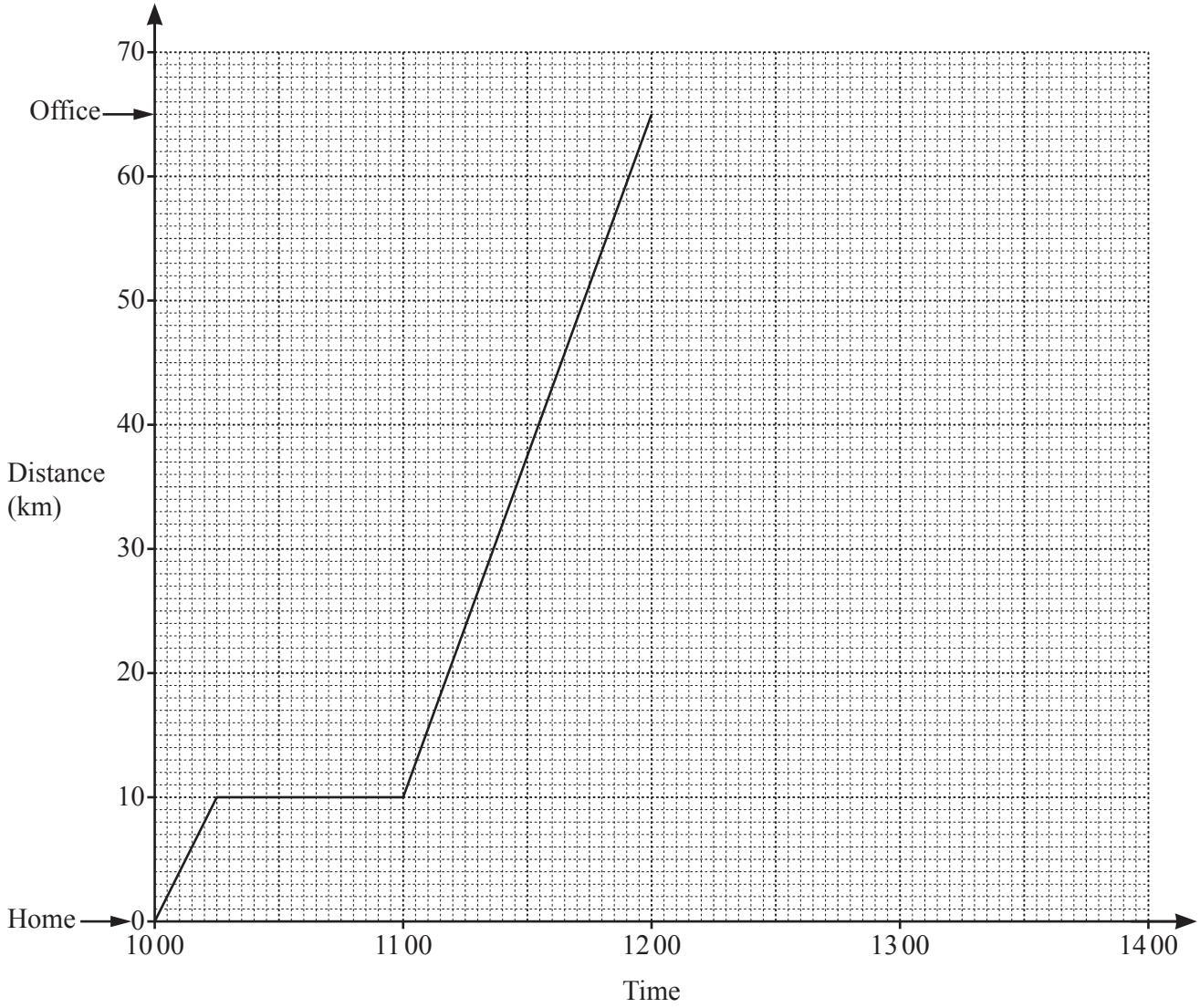


Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

.....

..... [3]

9 The distance–time graph shows information about Kai's journey from home to the office.



(a) Calculate the average speed, in km/h, for Kai's journey from home to the office.

..... km/h [2]

(b) When Kai arrives at the office, he finds his meeting is cancelled. He immediately returns home at a constant speed of 50 km/h.

Complete the distance–time graph to show his journey home. [1]

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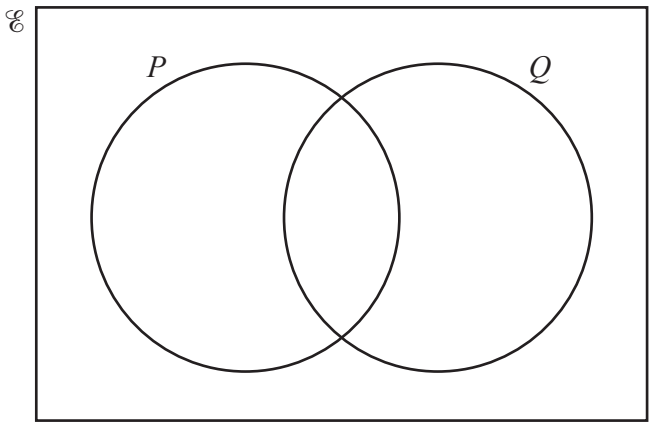
10 **Without using a calculator**, work out $5\frac{11}{12}+2\frac{1}{4}$.

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

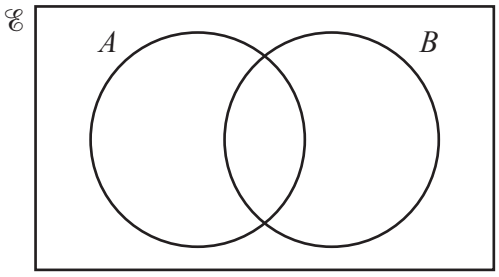
..... [3]

11 **(a)** $\mathscr{E} = \{ a, b, e, g, l, m, o, r, t, y \}$
$P = \{ a, b, e, g, l, r \}$
$Q = \{ e, g, m, o, r, t, y \}$



Complete the Venn diagram. [2]

(b)



Shade the region $A' \cap B$. [1]

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12 The position vector of A is $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and $\overrightarrow{BA} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$.

Show that $\left|\overrightarrow{OB}\right| = 5.1$, correct to 1 decimal place.

[3]

13 Calculate $\sqrt{42} + 3^{0.4}$.

..... [1]

14 Write $0.5\dot{8}\dot{1}$ as a fraction.
You must show all your working and give your answer in its simplest form.

..... [3]

15 The number of trees in a forest is decreasing exponentially at a rate of 1.75% per year.
Eleven years ago there were 980 trees.

Calculate the number of trees in the forest now.
Give your answer correct to the nearest integer.

..... [2]

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16 The volume of a cylinder is $1970\,\text{cm}^3$.
The height of the cylinder is $12.8\,\text{cm}$.

Calculate the radius of the cylinder.

..... cm [3]

17 Rearrange the formula to make m the subject.

$$R = \frac{2(m-k)}{m}$$

$m =$ ..... [4]

18 y is inversely proportional to the cube root of $(x + 5)$.
When $x = 3$, $y = 12$.

Find y when $x = 22$.

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

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19 Solve the equation $x^2 + 5x - 7 = 0$.
You must show all your working and give your answers correct to 2 decimal places.

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

20 $f(x) = 6x - 7$ $g(x) = x^{-3}$

(a) Find $f(x+2)$.
Give your answer in its simplest form.

..... [2]

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

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

(c) Find x when $g(x) = f(22)$.

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

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21 Simplify.

$$\frac{2x^2+5x-12}{4x^2-9}$$

..... [4]

22 These are the first four terms of a sequence.

2.75 6 11.25 20

The nth term of this sequence is $\frac{1}{4}n^3+an^2+bn$.

Calculate the value of a and the value of b.

$a =$ .....

$b =$ ..... [5]

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23 A train travels between two stations.
The distance between the stations is 220 km, correct to the nearest kilometre.
The speed of the train is 125 km/h, correct to the nearest 5 km/h.

Calculate the upper bound for the time the journey takes.
Give your answer in hours and minutes.

..... h ..... min [4]

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MATHEMATICS **0580/23**

Paper 2 (Extended) **May/June 2023**

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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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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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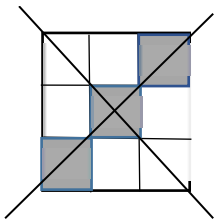
Question	Answer	Marks	Partial Marks
1(a)	2	**1**	
1(b)		**2**	**B1** for one correct line and no extras or two correct lines and one extra
2	20 15 or [0]8.15pm	**1**	
3	158	**3**	**M2** for $[2](8\times5+8\times3+5\times3)$ or **M1** for 8×5 or 8×3 or 5×3
4	72.6	**2**	**M1** for $4-9.8\times-7$ or better
5	d^6	**1**	
6	52	**2**	**M1** for $12=x\times\frac{3}{13}$ oe or better e.g. $12\div\frac{3}{13}$ oe
7(a)	0.11 oe	**2**	**M1** for 1 – (0.3 + 0.16 + 0.18 + 0.25) oe or **B1** for 0.89 oe
7(b)	0.46 oe	**2**	**M1** for 0.3 + 0.16
8	Rotation (0,0) oe 90° clockwise oe	**3**	**B1** for each
9(a)	32.5	**2**	**M1** for $\frac{65}{\textit{their time}}$ or $\frac{\textit{their distance}}{2}$
9(b)	correct ruled line from (12 00, 65) to (13 18, 0)	**1**	
10	$\frac{k}{12}+\frac{27}{12}$ or $\frac{71}{12}+\frac{c}{12}$ oe	**M1**	[5] $\frac{11}{12}$ and [2] $\frac{3}{12}$ oe Accept with other correct common denominators e.g. 24, 36, 48 such as $\frac{71f}{12f}$ and $\frac{27f}{12f}$
	$8\frac{1}{6}$ cao	**A2**	**A1** for fraction equivalent to $8\frac{1}{6}$ e.g. $\frac{49k}{6k}$ or $8\frac{1k}{6k}$ or $7\frac{7}{6}$

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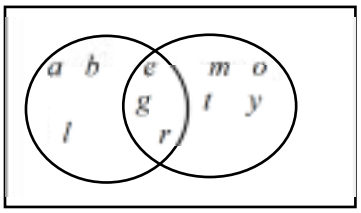
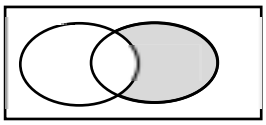
Question	Answer	Marks	Partial Marks
11(a)		2	**B1** for 1 region correct
11(b)		1	
12	$\sqrt{1^2 + (-5)^2}$	M2	**M1** for $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$ or $(5-4)^2 + (3-8)^2$ or $\sqrt{e^2+f^2}$ from *their* $\overrightarrow{OB} = \begin{pmatrix} e \\ f \end{pmatrix}$ or *their* $B = (e, f)$ or only $\sqrt{1+25}$
	Correct working leading to 5.09[9..]	A1	**Dep.** on **M2** or **M1** for only $\sqrt{1+25}$
13	8.03 or 8.032 to 8.033	1	
14	581.81...− 5.81...oe	M1	
	$\frac{32}{55}$ cao	A2	**A1** for $\frac{576}{990}$ oe If **M0** scored **SC1** for $\frac{k}{990}$ or for answer $\frac{32}{55}$ with insufficient working.
15	807	2	**M1** for $980 \times \left(1 - \frac{1.75}{100}\right)^{11}$ oe or better
16	7.00 or 6.998 to 7.002	3	**M2** for $[r^2] = \frac{1970}{12.8 \times \pi}$ oe or better or **M1** for $1970 = \pi \times r^2 \times 12.8$ or better

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Question	Answer	Marks	Partial Marks
17	$m=\frac{2k}{(2-R)}$ or $m=\frac{-2k}{(R-2)}$ final answer	**4**	**M1** for clearing fractions **M1** for expanding brackets (or ÷ 2) **M1** for collecting terms in *m* on one side and terms not in *m* on the other **M1** for dividing by a bracket maximum of **3** if final answer incorrect
18	8	**3**	**M1** for $y=\frac{k}{\sqrt[3]{x+5}}$ oe **M1** for substituting *their k* into $y=\frac{k}{\sqrt[3]{22+5}}$ oe OR **M2** for $12\sqrt[3]{3+5}=y\sqrt[3]{22+5}$ oe
19	$\frac{-5\pm\sqrt{5^2-4\times1\times-7}}{2\times1}$	**B2**	**B1** for $\sqrt{5^2-4\times1\times-7}$ and if in form $\frac{p+\sqrt{q}}{r}$ or $\frac{p-\sqrt{q}}{r}$ **B1** for $p=-5$ and $r=2\times1$
	−6.14 and 1.14 cao	**B2**	**B1** for 1 correct answer for −6.1 and 1.1 or −6.140... and 1.140... or 6.14 and −1.14 or correct answers seen in working
20(a)	$6x+5$ cao final answer	**2**	**M1** for $6(x+2)-7$ oe
20(b)	$\frac{x+7}{6}$ or $\frac{x}{6}+\frac{7}{6}$ final answer	**2**	**M1** for $x=6y-7$ or $y+7=6x$ or $\frac{y}{6}=x-\frac{7}{6}$
20(c)	$\frac{1}{5}$ or 0.2	**2**	**M1** for $x^{-3}=6\times22-7$ or better
21	$\frac{x+4}{2x+3}$ final answer	**4**	**B1** for $(2x-3)(2x+3)$ **B2** for $(2x-3)(x+4)$ or **B1** for $(2x+a)(x+b)$ where $ab=-12$ or $a+2b=5$ or $x(2x-3)+4(2x-3)$ or $2x(x+4)-3(x+4)$

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Question	Answer	Marks	Partial Marks
22	[a =] $\frac{-1}{2}$ oe [b =] 3	**5**	**B4** for $\frac{1}{4}n^3 - \frac{1}{2}n^2 + 3n$ seen OR **M2** for any two of $\frac{1}{4} + a + b = 2.75$ $8 \times \frac{1}{4} + 4a + 2b = 6$ $27 \times \frac{1}{4} + 9a + 3b = 11.25$ $64 \times \frac{1}{4} + 16a + 4b = 20$ or **M1** for one correct equation **M1** for correct method to eliminate 1 variable **B1** for 1 correct answer
23	1h 48 min nfww	**4**	**B3** for 1.8 [hrs], $1\frac{4}{5}$ [hrs], $\frac{9}{5}$ [hrs] or 108 [mins] nfww or **M2** for $\frac{220 \text{ to } 221}{125 - 2.5}$ or $\frac{220 + 0.5}{120 \text{ to } 125}$ or **M1** for 220 + 0.5 or 220 – 0.5 or 125 + 2.5 or 125 – 2.5

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2023**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

This document has **20** pages.

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1 **(a)** An orchard has 1250 trees.
The trees are in the ratio apple : pear : cherry = 12 : 9 : 4.

(i) Calculate the number of apple trees.

..... [2]

(ii) Last year in the orchard, the mean mass of fruit produced was 64 kg per tree.

Calculate the total mass of fruit produced last year.
Give your answer in tonnes.
[1 tonne = 1000 kg]

..... tonnes [2]

(iii) Last year, the mean mass of pears produced was 54 kg per tree.
This was a decrease of 10% on the mean mass of pears produced per tree from the year before.

Calculate the mean mass of pears produced by each pear tree the year before.

..... kg [2]

(iv) The orchard loses $\frac{1}{5}$ of its total number of trees in a storm.

Calculate the number of trees that remain.

..... [2]

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(b) Paulo buys some pears from a market.
Pears cost \$0.54 each or 0.51 euros each.

(i) Paulo pays **in dollars** for 12 pears.

Calculate the change he receives from \$10.

\$ ..... [2]

(ii) The exchange rate is \$1 = 0.826 euros.

Calculate how much more Paulo pays for **each** pear when he pays in euros.
Give your answer in dollars, correct to the nearest cent.

\$ ..... [3]

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[Turn over

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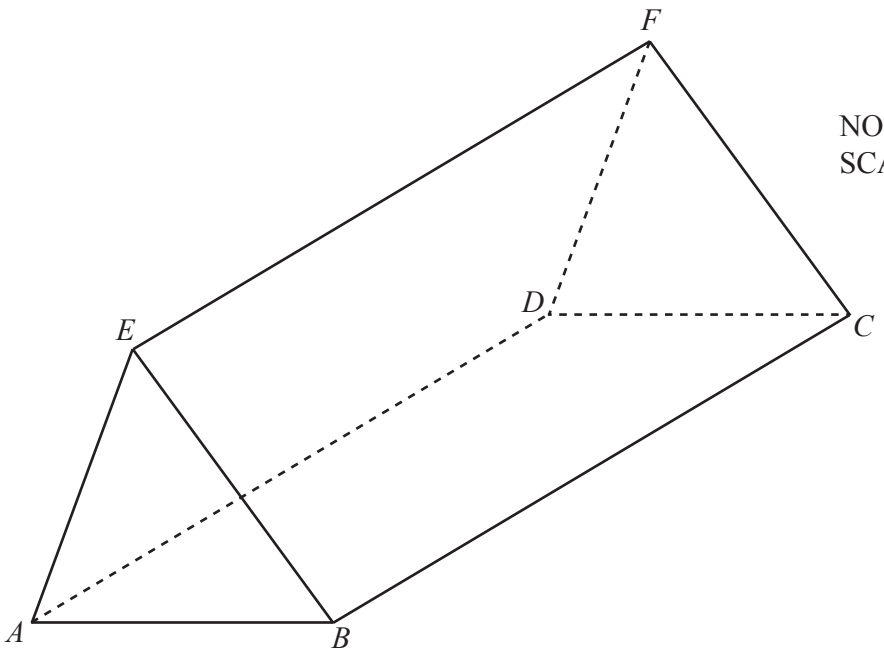
2



The diagram shows a solid triangular prism $ABCDEF$ of length 15 cm.
$AB = 6.4$ cm, $EB = 5.7$ cm and the volume of the prism is 145 cm^3.

(a) Show that angle $EBA = 32°$, correct to the nearest degree.

[3]

(b) Find the length of EA.

..... cm [3]

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(c) Calculate the shortest distance from E to AB.

..... cm [3]

(d) Calculate the angle BF makes with the base, $ABCD$, of the prism.

..... [4]

(e) The prism is made of plastic with density $938\,kg/m^3$.

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

..... g [3]

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3 **(a)** The table shows information about the mass of each of 1000 eggs.

Mass (m grams)	$40 < m \leqslant 50$	$50 < m \leqslant 56$	$56 < m \leqslant 64$	$64 < m \leqslant 70$
Frequency	126	520	154	200

(i) Calculate an estimate of the mean.

..... g [4]

(ii) An egg is picked at random from the 1000 eggs.

Find the probability that this egg has a mass greater than 56 g.
Give your answer as a fraction in its simplest form.

..... [2]

(b) One year, a farmer makes a profit of $24 730 selling eggs.

Write this profit

(i) correct to 2 significant figures

$ ..... [1]

(ii) in standard form.

$ ..... [1]

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(c) On a farm, there are 500 hens, correct to the nearest 10.

(i) In one year, the mean number of eggs laid per hen was 320 eggs, correct to the nearest 20.

Calculate the upper bound for the total number of eggs all the hens lay in that year.

..... [3]

(ii) Another farm has 800 hens, correct to the nearest 20.

Calculate the lower bound for the difference between the number of hens on the two farms.

..... [2]

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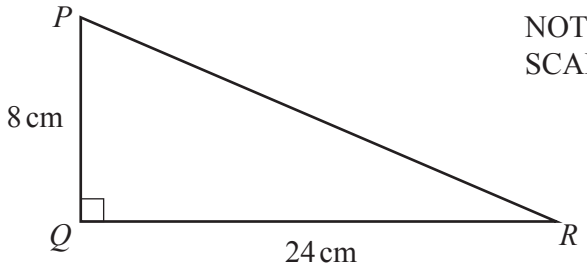
4 **(a)**



NOT TO SCALE

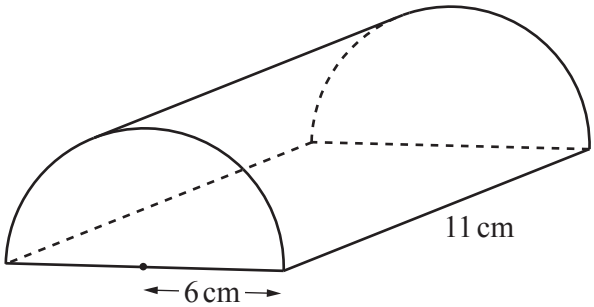
(i) Calculate the area of triangle PQR.

..... cm^2 [2]

(ii) Calculate angle PRQ.

Angle PRQ = ... [2]

(b)



NOT TO SCALE

The diagram shows a half-cylinder of radius 6 cm and length 11 cm.

Calculate the volume of the half-cylinder.

..... cm^3 [2]

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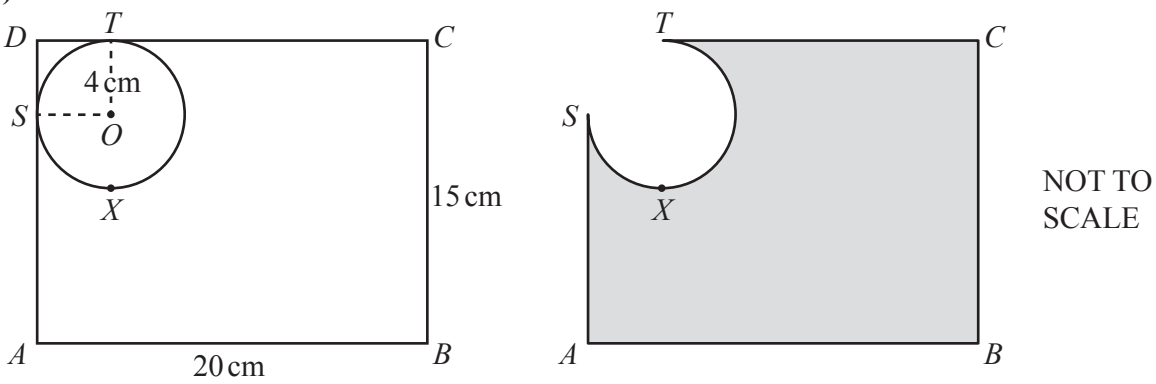
(c)



(i) $ABCD$ is a rectangle with $AB = 20$ cm and $BC = 15$ cm.
S, X and T are points on a circle centre O, such that DSA and DTC are tangents to the circle.
The radius of the circle is 4 cm and TX is a diameter of the circle.
The shape $DSXT$ is removed from the corner of the rectangle, leaving the shaded shape shown in the second diagram.

Calculate the area of the shaded shape.

..... cm^2 [5]

(ii) Calculate the perimeter of the shaded shape.

..... cm [3]

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[Turn over

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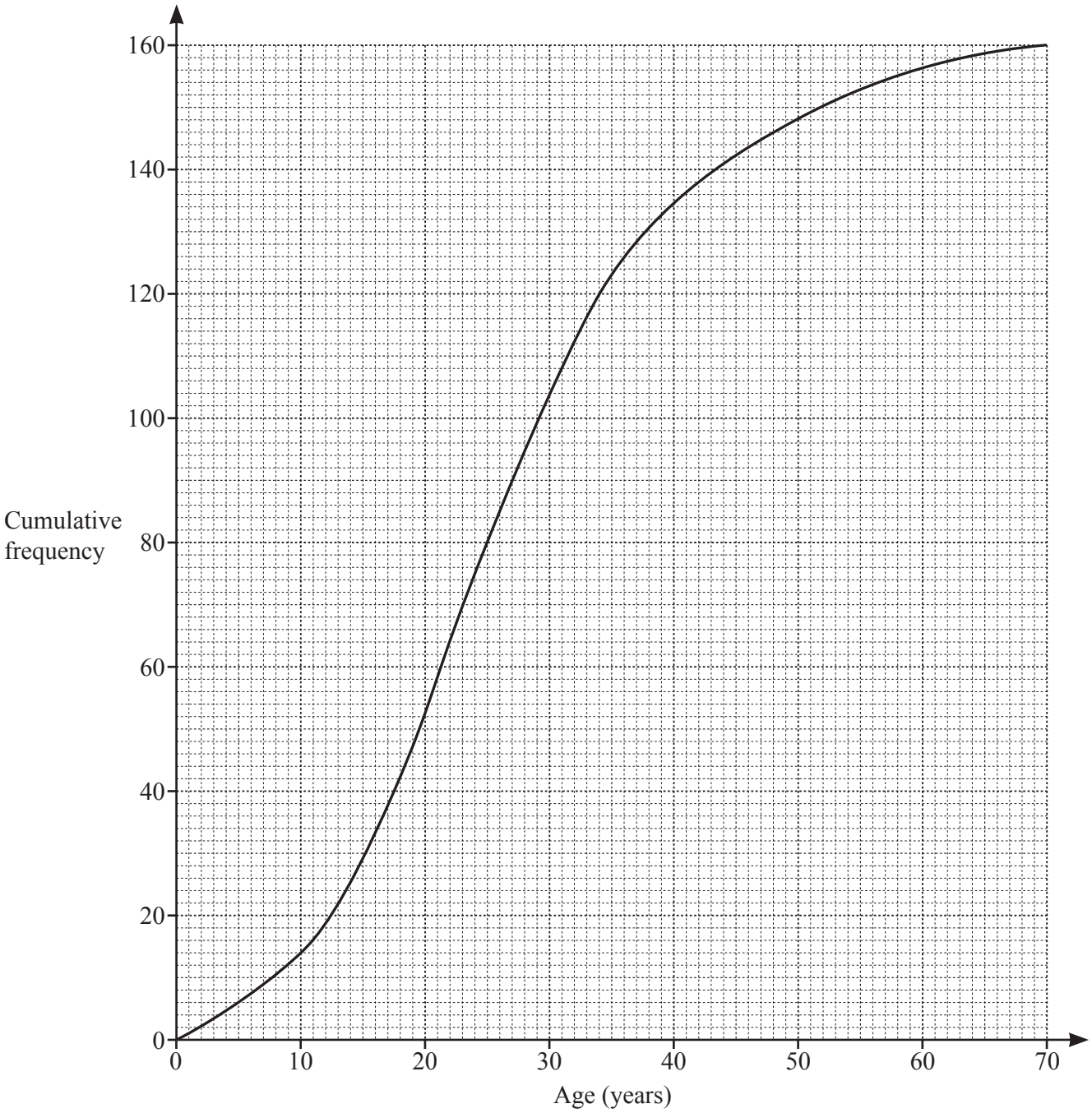
5 **(a)** There are 160 people in a village.
The cumulative frequency diagram shows information about their ages.



(i) Find an estimate for

(a) the median age

..... [1]

(b) the lower quartile

..... [1]

(c) the number of people who are 50 or more years of age

..... [2]

(d) the 65th percentile.

..... [2]

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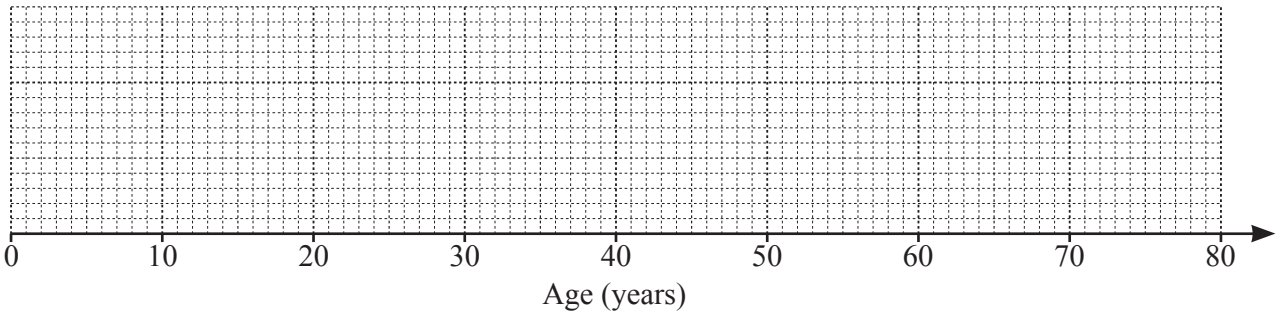
(ii) The youngest person in the village is 1 year old and the oldest is 70 years old.

(a) Draw a box-and-whisker plot to show the distribution of ages in the village.



[3]

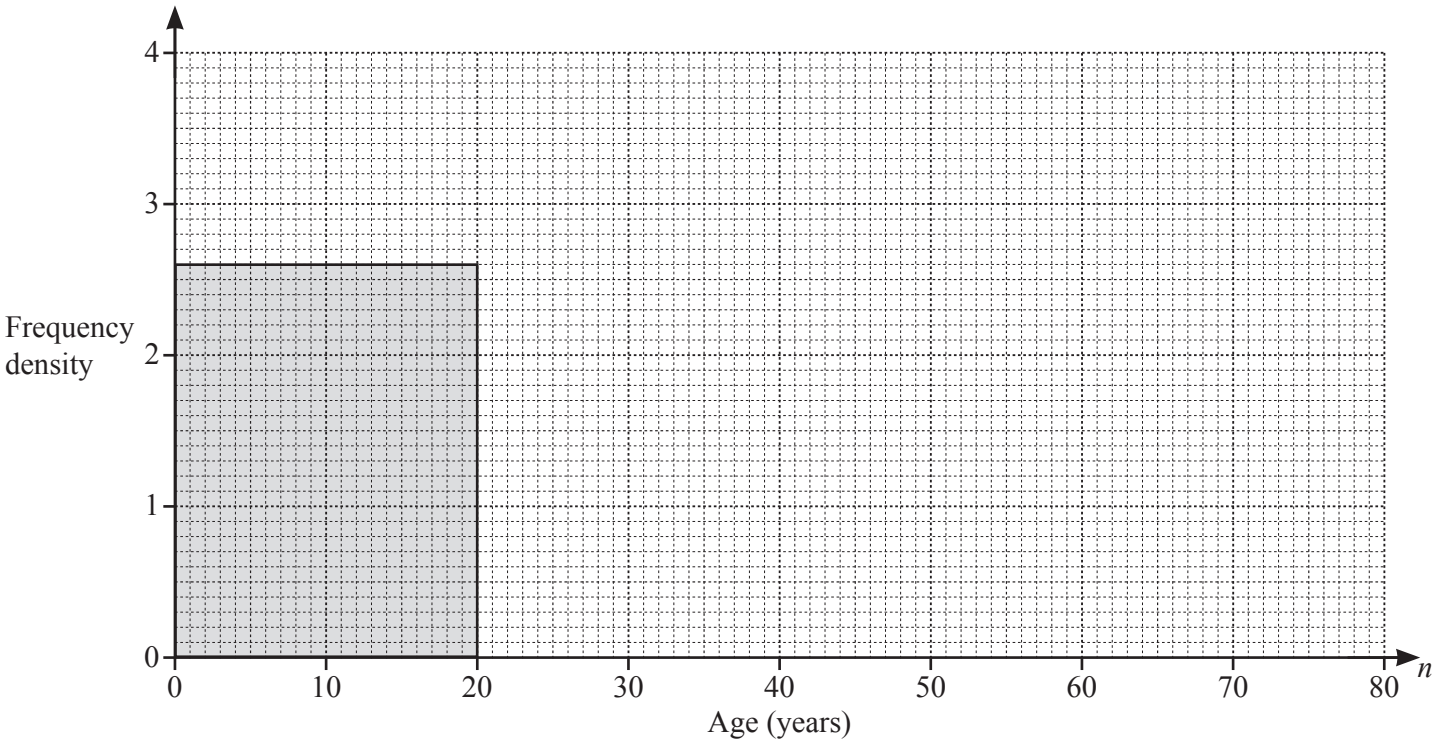
(b) Write down an estimate of the percentage of people in the village that are younger than the median age.

..... % [1]

(b) The frequency table shows information about the age of each person in another village.

Age (n years)	$0 < n \leqslant 20$	$20 < n \leqslant 30$	$30 < n \leqslant 50$	$50 < n \leqslant 80$
Frequency	52	37	24	60

On the grid, complete the histogram to show this information.
The first block has been drawn for you.



[3]

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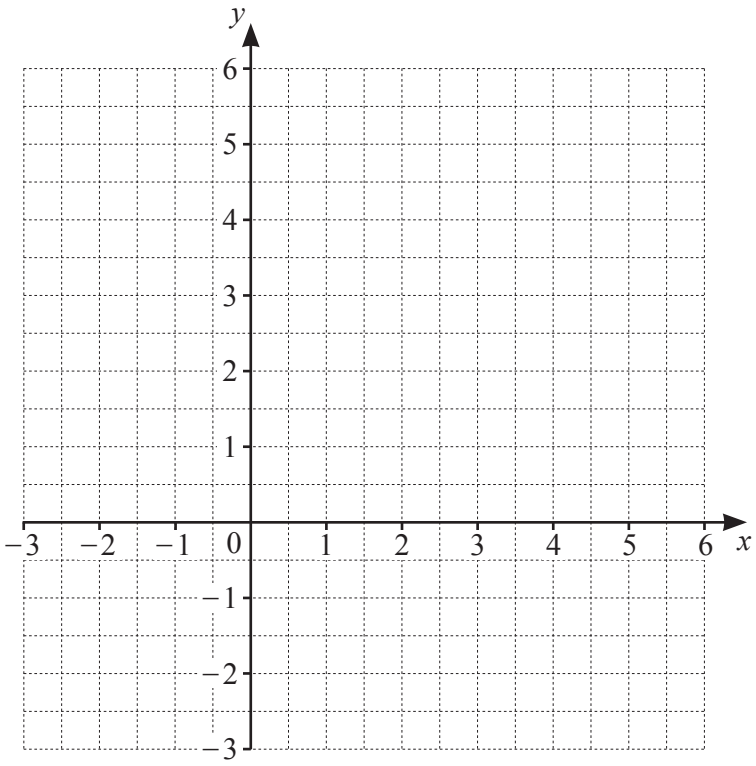
6 **(a)** In the square $ABCD$, A has coordinates $(-2, 1)$ and B has coordinates $(1, 5)$.
C has coordinates (a, b), where a and b are both positive integers.

Find the coordinates of C and the coordinates of D.
You may use the grid to help you.



C (..... , ...)

D (..... , ...) [4]

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(b) P has coordinates $(-1, 3)$ and Q has coordinates $(6, 4)$.

(i) Find the coordinates of the midpoint of PQ.

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

(ii) Find the length PQ.

..... [3]

(iii) Find the gradient of PQ.

..... [2]

(iv) Find the equation of the line parallel to PQ that crosses the x-axis at $x = 2$.

..... [3]

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7 **(a)** Factorise fully.

(i) $27y^2 - 3$

..... [3]

(ii) $2m - pk + 2k - pm$

..... [2]

(b) Solve $\frac{x-1}{x+1} - \frac{6}{x-1} = 1$.

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

(c) Solve $4x^2 - 3x - 2 = 0$.
You must show all your working and give your answers correct to 2 decimal places.

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

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(d) Make k the subject of the formula.

$$\frac{k}{m} = 4 + kp$$

$k =$ ..... [4]

8 A tailor makes x dresses and y shirts in one week.
In one week

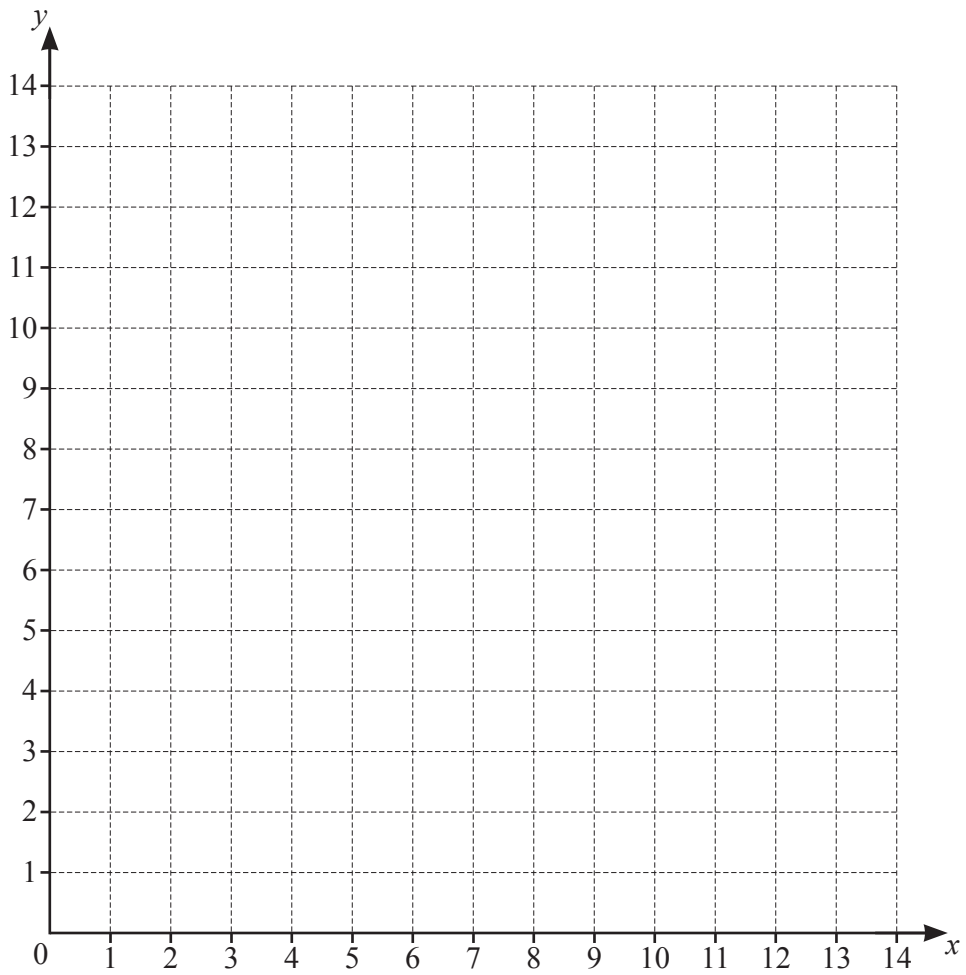
- he makes at least 4 dresses
- he makes no more than 7 shirts
- he makes less than 14 dresses and shirts altogether
- the number of shirts he makes is more than $\frac{2}{3}$ of the number of dresses.

One of the inequalities that shows this information is $x \geqslant 4$.

(a) Write down the other three inequalities in x and/or y.

.... [3]

(b)



On the grid, draw 4 straight lines and shade the unwanted regions to show these inequalities.
Label the region R that satisfies the 4 inequalities. [6]

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(c) Use your diagram to find the smallest number of dresses and the smallest number of shirts the tailor makes in one week.

..... dresses and ..... shirts [1]

(d) The profit the tailor makes on one dress is $10 and the profit on one shirt is $6.

Use your diagram to find the largest profit the tailor can make in one week.

$ ..... [2]

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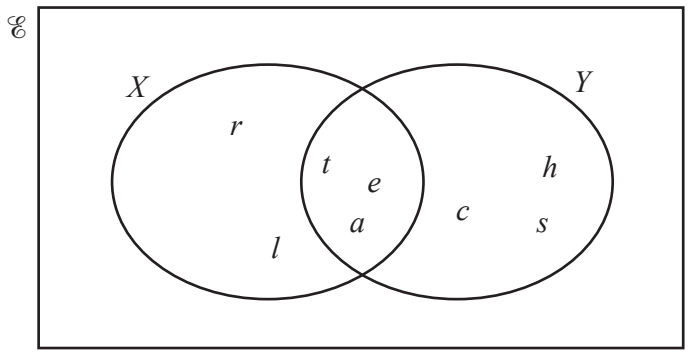
9 **(a)** The Venn diagram shows set X and set Y.



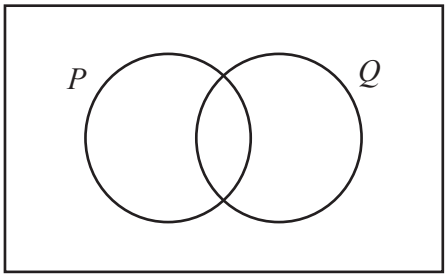
(i) List the elements of X.

..... [1]

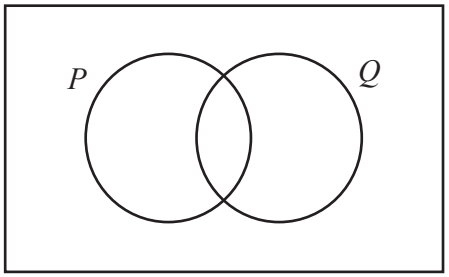
(ii) Find $n(Y')$.

..... [1]

(b) In each Venn diagram, shade the required region.



$P \cup Q$



$P' \cap Q$

[2]

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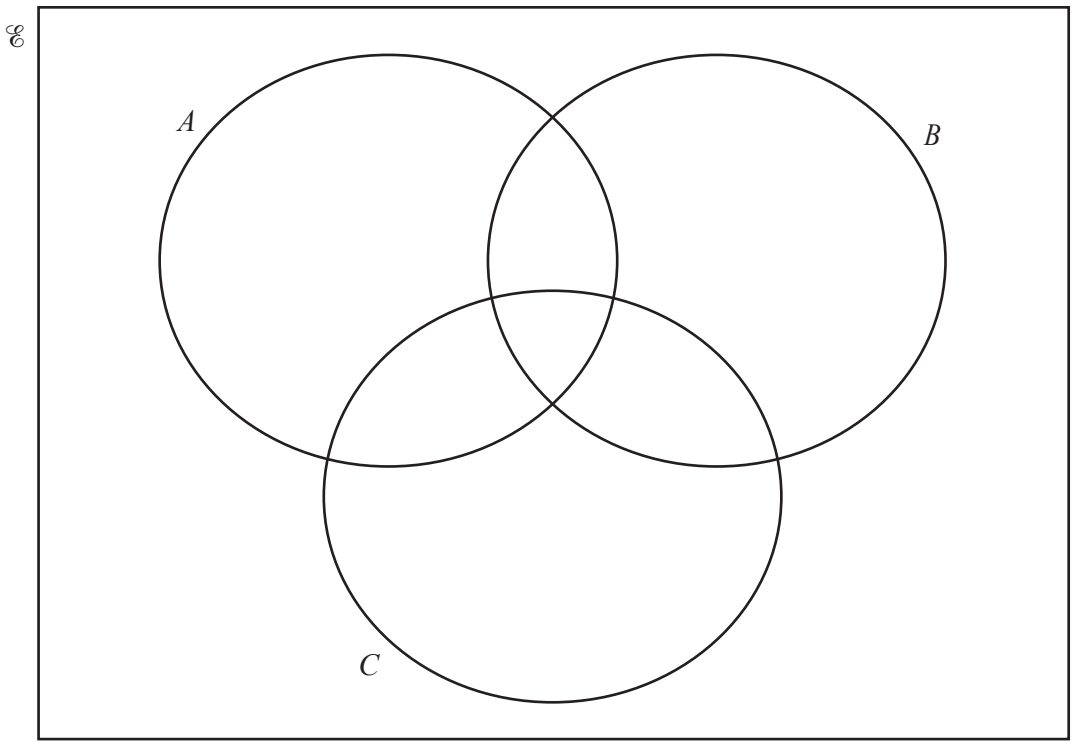
(c) $\mathscr{E} = \{\text{positive integers} < 13\}$

$A = \{x : x < 9\}$

$B = \{x : x \text{ is even}\}$

$C = \{x : x \text{ is a multiple of } 3\}$



(i) Complete the Venn diagram. [3]

(ii) Find $\text{n}(A' \cup (B \cap C))$.

..... [1]

Question 10 is printed on the next page.

10 $f(x) = x - 4$ $g(x) = 2x + 5$ $h(x) = 3^x$

(a) Find

(i) $f(-3)$

..... [1]

(ii) $g^{-1}(x)$

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

(iii) $f(x) \times g(x) \times f(x)$.

..... [4]

(b) Find x when $h(x) = g(f(2))$.

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

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MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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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)	600	**2**	**M1** for $\frac{1250}{12+9+4}\times k$ where $k = 1, 4, 9, 12$ oe
1(a)(ii)	80	**2**	**M1** for 1250×64 [÷ 1000]
1(a)(iii)	60	**2**	**M1** for $x\times\left(1-\frac{10}{100}\right)=54$ oe
1(a)(iv)	1000	**2**	**M1** for 1250 – (1250 ÷ 5) oe or **B1** for 250
1(b)(i)	3.52	**2**	**M1** for [10 –] 12 × 0.54 or **B1** for 6.48
1(b)(ii)	0.08	**3**	**B2** for 0.077[4...] or **M1** for 0.51 ÷ 0.826 If 0 or 1 scored award instead **SC2** for 0.93 final answer OR If 0 scored **SC1** for 0.06 as answer
2(a)	[sin =] $\frac{145}{\frac{1}{2}\times 6.4\times 5.7\times 15}$	**M2**	**M1** for $145 = \frac{1}{2}\times 6.4\times 5.7\times \sin x\times 15$ oe or for $\frac{1}{2}\times 6.4\times h\times 15 = 145$ and $\sin x = \frac{h}{5.7}$
	32.0[0]	**A1**	If M0, **SC1** for $145 = 0.5\times 6.4\times 5.7\times sin32\times 15$ oe
2(b)	3.4[0] or 3.402 to 3.403 nfww	**3**	**M2** for $\sqrt{6.4^2+5.7^2-2\times 6.4\times 5.7\times\cos(32)}$ OR **M1** for $6.4^2+5.7^2-2\times 6.4\times 5.7\times\cos(32)$ **A1** for 11.6 or 11.57 to 11.58
2(c)	3.02 or 3.020 to 3.021	**3**	**M2** for $\sin(32)=\frac{x}{5.7}$ $\sqrt{80^2+50^2-2\times 80\times 50\times\cos 75}$ or **M1** for recognition that the line from E is perpendicular to AB e.g. right angle seen or $\frac{1}{2}\times 6.4\times h$

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Question	Answer	Marks	Partial Marks
2(d)	10.8 or 10.9 or 10.84 to 10.85...	4	**M3** for [sin =] $\frac{their\,(c)}{\sqrt{15^2+5.7^2}}$ or $\left[\tan =\right]\frac{their\,(c)}{\sqrt{\left(5.7\times cos32\right)^2+15^2}}$ or **M2** for $15^2+5.7^2$ or $\left(5.7\times\cos 32\right)^2+15^2$ oe or **M1** for recognition of correct angle
2(e)	136 or 136.0...	3	**M2** for $938\times145\times\frac{1000}{1000000}$ oe or **M1** for figs 136 or 13601
3(a)(i)	55.87	4	**M1** for midpoints soi **M1** for use of $\sum fm$ where m is in the correct interval including boundaries **M1** (dep on 2nd M1) for $\sum fm \div 1000$
3(a)(ii)	$\frac{177}{500}$ cao	2	**M1** for $\frac{154+200}{1000}$ oe
3(b)(i)	25000	1	
3(b)(ii)	2.473×10^4	1	
3(c)(i)	166 650 or 165816 nfww	3	**M2** for (500 + 5) × '320 to 340' or '500 to 510' × (320 + 10) or **M1** for 500 − 5 or 500 + 5 or 320 −10 or 320 +10 Alternative method **M2** for 504 × '320 to 340' or '500 to 510' × 329 or **M1** for 504 or 329
3(c)(ii)	285 or 286 nfww	2	**M1** for 800 −10
4(a)(i)	96	2	**M1** for $\frac{1}{2}\times24\times8$
4(a)(ii)	18.4 or 18.43...	2	**M1** for $\tan\left[x\right]=\frac{8}{24}$ oe

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Question	Answer	Marks	Partial Marks
4(b)	622 or 622.0 to 622.1....	**2**	**M1** for $[\frac{1}{2}\times]\ \pi\times 6^2\times 11$ or $\frac{1}{2}\times\pi\times 6^2[\times 11]$
4(c)(i)	246 or 246.2 to 246.3...	**5**	**M4** for $15\times 20-4\times 4-\frac{270}{360}\times\pi\times 4^2$ oe OR **M2** for $\frac{270}{360}\times\pi\times 4^2$ oe or **M1** for $k\times\pi\times 4^2$, where $k\leq 1$ **M1** for 15×20 or 4×4 oe
4(c)(ii)	80.8 or 80.9 or 80.84 to 80.85...	**3**	**M1** for $15+20+11+16$ oe **M1** for $\frac{3}{4}\times 2\times\pi\times 4$ oe
5(a)(i)(a)	25	**1**	
5(a)(i)(b)	17 to 18	**1**	
5(a)(i)(c)	12	**2**	**B1** for 148 seen
5(a)(i)(d)	30	**2**	**B1** for 104 seen
5(a)(ii)(a)	correct diagram or correct for *their* median and LQ	**3**	**B1** for whiskers at 1 **and** at 70 **B1** for with median **and** LQ at *their* **(a)(i)(a)** and **(a)(i)(b)** **B1** for UQ at 34 Maximum 2 marks if diagram incorrect If 0 scored **SC1** for *their* 5 correct ages plotted
5(a)(ii)(b)	50	**1**	
5(b)	correct histogram	**3**	**B1** for each correct block width 10 height 3.7 width 20 height 1.2 width 30 height 2 If 0 scored **SC1** for correct frequency densities 3.7, 1.2, 2 oe

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Question	Answer	Marks	Partial Marks
6(a)	(5, 2) (2, − 2)	4	**B3** for 3 correct values or answers for *C* and *D* reversed or correct coordinates given on diagram wrongly labelled or **B2** for one correct coordinate pair correctly labelled or **M2** for *A*,*B*,*C* and *D* correctly plotted or **M1** for *A* and *B* correctly plotted If 0 or 1 scored instead award **SC2** for answers (–3, 8) and (–6, 4) or answers (1.5,1.5) and (–2.5, 4.5)
6(b)(i)	(2.5, 3.5) oe	2	**B1** for each
6(b)(ii)	7.07 or 7.071...	3	**M2** for $(6--1)^2+(4-3)^2$ oe or **M1** for $(6--1)$ or $(4-3)$ oe
6(b)(iii)	$\frac{1}{7}$	2	**M1** for $\frac{4-3}{6--1}$ oe
6(b)(iv)	$y=\frac{1}{7}x-\frac{2}{7}$ or $7y=x-2$ oe final answer	3	**M1** for gradient = *their* **(iii)** **M1dep** for substituting (2, 0) in a linear equation with their *m* allow if (2,0) satisfies y=(*their***(b)(iii)** gradient)*x*+c
7(a)(i)	$3(3y-1)(3y+1)$ final answer	3	**B2** for $(9y-3)(3y+1)$ or $(3y-1)(9y+3)$ or or **M1** for $3(9y^2-1)$ or [...]$(3y-1)(3y+1)$ if 0 scored **SC1** for an otherwise correctly completely factorised expression but with fractions within the brackets
7(a)(ii)	$(2-p)(m+k)$ final answer	2	**M1** for $2(m+k)-p(m+k)$ or $m(2-p)+k(2-p)$
7(b)	$-\frac{1}{2}$ oe nfww	5	**B4** $-8x=+4$ oe nfww or **B3** for $\frac{x^2-8x-5}{(x-1)(x+1)}=1$ or better OR **B2** x^2-8x-5 or **M1** for $(x-1)(x-1)-6(x+1)$ or better **B1** $(x-1)(x+1)$ as full denominator or on the right hand side

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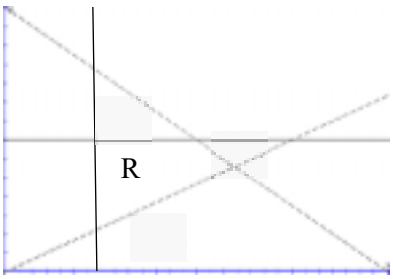
Question	Answer	Marks	Partial Marks
7(c)	$\frac{-(-3)\pm\sqrt{(-3)^2-4(4)(-2)}}{2\times 4}$ oe or $\frac{3}{8}\pm\sqrt{\left(\frac{3}{8}\right)^2+\frac{2}{4}}$ oe	**M2**	**M1** for $\sqrt{(-3)^2-4(4)(-2)}$ or for $\frac{-(-3)+\sqrt{q}}{2(4)}$ or $\frac{-(-3)-\sqrt{q}}{2(4)}$ or for [4]$\left(x-\frac{3}{8}\right)^2$
	−0.43 and 1.18 final ans cao	**A2**	**B1** for each **SC1** for −0.4 ,–0.42 or −0.425.... and 1.2 or 1.17 or 1.175.... or answers 0.43 and –1.18 or −0.43 and 1.18 seen in working
7(d)	$k=\frac{4m}{1-pm}$ or $k=\frac{-4m}{pm-1}$ final answer	**4**	**M1** for clearing fractions **M1** for collecting terms in k **M1** for factorising **M1** for dividing by bracket Maximum 3 marks if answer incorrect
8(a)	$y\leqslant 7$ oe $x+y<14$ oe $y>\frac{2}{3}x$ oe	**3**	**B1** for each
8(b)	$x=4$ solid $y=7$ solid $x+y=14$ dashed $y=\frac{2}{3}x$ dashed	**M4**	**B1** for each
	correct shading everywhere but region R 	**A2**	**M1dep** (dependent on M4 or B1B1B1B0 where the only error is wrong use of solid/dashed lines) for shading the correct side of 3 of the 4 lines.

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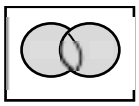
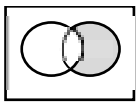
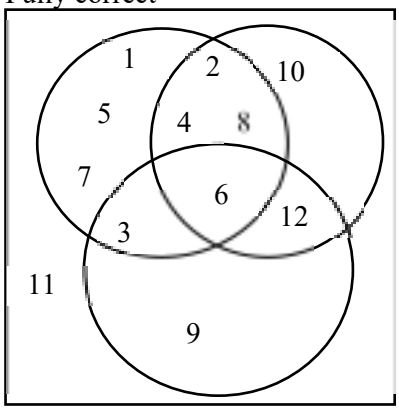
Question	Answer	Marks	Partial Marks
8(c)	4 dresses and 3 shirts	**1**	
8(d)	106	**2**	**M1** for $10x + 6y$ evaluated for (x, y) in *their* region R or **B1** for (7, 6) After 0 scored, **SC1** for answer 112 or 116
9(a)(i)	*r, l, t, e, a*	**1**	
9(a)(ii)	2	**1**	
9(b)		**1**	
		**1**	
9(c)(i)	Fully correct 	**3**	**B2** for 7, 6, or 5 sections correct or **B1** for 4, 3 or 2 sections correct
9(c)(ii)	5	**1FT**	strict FT from their diagram
10(a)(i)	-7	**1**	
10(a)(ii)	$\frac{x-5}{2}$ oe final answer	**2**	**M1** for correct first step e.g. $x = 2y + 5$ or $2x = y - 5$ or $\frac{y}{2} = x + \frac{5}{2}$
10(a)(iii)	$2x^3 - 11x^2 - 8x + 80$ final answer	**4**	**M1** for $(x-4)(2x+5)(x-4)$ oe **B2** for $2x^3 - 8x^2 - 8x^2 + 5x^2 - 20x - 20x + 32x + 80$ or for simplified 4 term expression of the correct form with 3 terms correct in final answer or **B1** for 3 terms correct out of 4 from $x^2 - 4x - 4x + 16$ or $2x^2 - 8x + 5x - 20$

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Question	Answer	Marks	Partial Marks
10(b)	0	**2**	**M1** for g(− 2) or $2(x-4)+5$ oe or $3^x = 1$ or $g\left(f\left(2\right)\right)=1$

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Cambridge Assessment International Education

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CANDIDATE NAME									
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1638716757

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2023**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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

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[Turn over

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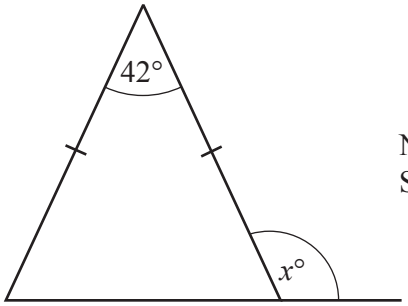
1 **(a)**



NOT TO SCALE

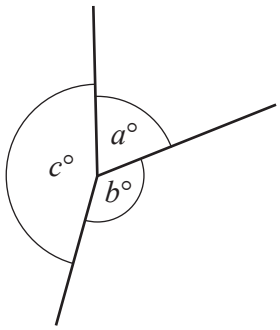
The diagram shows an isosceles triangle with the base extended.

Find the value of x.

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

(b) The diagram shows three lines meeting at a point.
The ratio $a : b : c = 3 : 4 : 5$.

Find the value of c.



NOT TO SCALE

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

(c) A regular pentagon has an exterior angle, d.
A regular hexagon has an interior angle, h.

Find the fraction $\frac{d}{h}$.
Give your answer in its simplest form.

..... [4]

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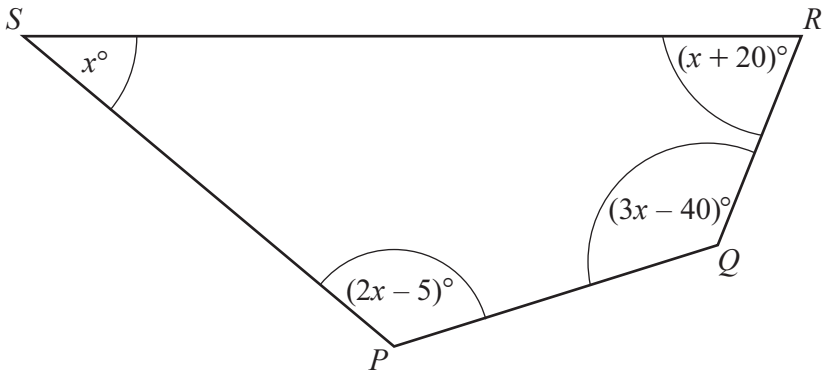
(d)

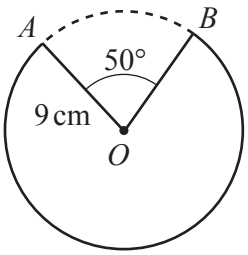


NOT TO SCALE

Show that *PQRS* is a cyclic quadrilateral.

[5]

(e)



NOT TO SCALE

The diagram shows a circle of radius 9 cm, centre *O*.
The minor sector *AOB*, with sector angle 50°, is removed from the circle.

Calculate the length of the major arc *AB*.

..... cm [3]

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2 **(a)** Anil changes \$830 into euros when the exchange rate is 1 euro = \$1.16 .
He spends 500 euros.
He then changes the remaining money back into dollars at the same exchange rate.

Work out how much, in dollars, Anil receives.

\$ ..... [3]

(b) In 2021, Anil earns \$37 000.

(i) He spends \$12 400 on bills in 2021.

Calculate the percentage of his earnings he spends on bills.

..... % [2]

(ii) His earnings of \$37 000 increase by 3.2% in 2022.

Calculate his earnings in 2022.

\$ ..... [2]

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(c) Anil invests $3500 in an account that pays a rate of 2.4% per year compound interest.

(i) Calculate the total interest earned at the end of 5 years.

$ ..... [3]

(ii) Find the number of complete years before Anil has at least $5000 in this account.

..... years [3]

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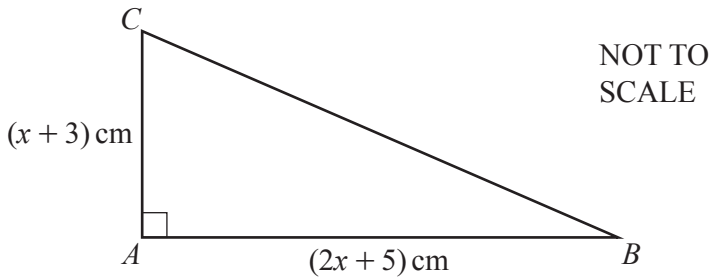
3



The diagram shows a right-angled triangle ABC.

(a) (i) The area of the triangle is $60\,\text{cm}^2$.

Show that $2x^2 + 11x - 105 = 0$.

[3]

(ii) Solve by factorisation.

$$2x^2 + 11x - 105 = 0$$

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

(iii) Calculate angle ACB.

..... [3]

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(b) Triangle ABC is similar to triangle DEF.
Triangle DEF has an area of $93.75\,\text{cm}^2$.

(i) Find the size of the smallest angle of triangle DEF.

..... [1]

(ii) Find the length of the shortest side of triangle DEF.

..... cm [3]

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4 The table shows information about the heights of 80 children.

Height (h metres)	$1.2 < h \leqslant 1.4$	$1.4 < h \leqslant 1.5$	$1.5 < h \leqslant 1.65$	$1.65 < h \leqslant 1.8$	$1.8 < h \leqslant 1.9$
Frequency	2	13	24	32	9

(a) (i) Write down the interval containing the median.

..... $< h \leqslant$ ..... [1]

(ii) Calculate an estimate of the mean height.

..... m [4]

(b) (i) One of these children is chosen at random.
Calculate the probability that they have a height of 1.4 m or less.

..... [1]

(ii) Two of these children are chosen at random.
Calculate the probability that both children are taller than 1.5 m but only one of them is taller than 1.8 m.

..... [3]

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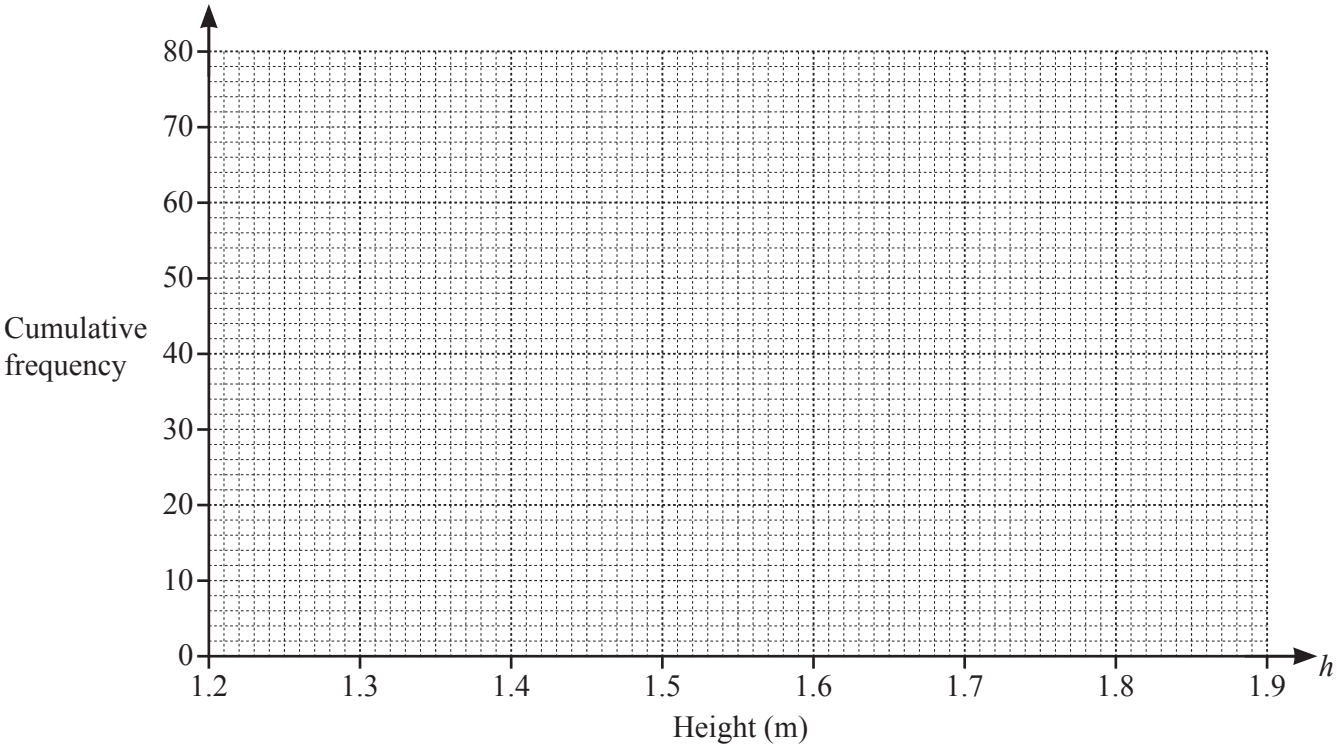
(c) **(i)** Complete the cumulative frequency table for the heights.

Height (h metres)	$h \leqslant 1.4$	$h \leqslant 1.5$	$h \leqslant 1.65$	$h \leqslant 1.8$	$h \leqslant 1.9$
Cumulative frequency	2				

[2]

(ii) On the grid, draw the cumulative frequency diagram.



[3]

(d) Use your diagram to find an estimate of

(i) the interquartile range

..... m [2]

(ii) the 60th percentile.

..... m [2]

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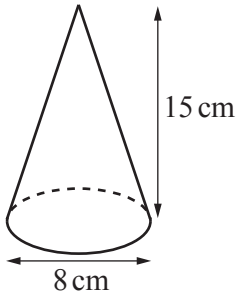
5 (a)



NOT TO SCALE

A cone has base diameter 8 cm and perpendicular height 15 cm.

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

..... cm^3 [2]

(ii) A label completely covers the curved surface area of the cone.

Calculate the area of the label as a percentage of the **total** surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

..... % [5]

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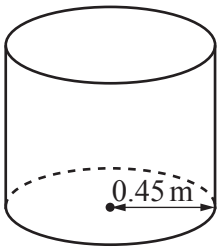
(b)



NOT TO SCALE

An empty cylindrical container has radius 0.45 m.
300 litres of water is poured into the container at a rate of 375 ml per second.

(i) Find the time taken, in minutes and seconds, for all the water to be poured into the container.

..... min ..... s [3]

(ii) Calculate the height of the water in the container.

..... m [3]

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[Turn over

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6 **(a)** A sequence has nth term $\frac{n}{2n+3}$.

(i) Find the first three terms of this sequence.

Give your answers as fractions.

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

(ii) The kth term of this sequence is $\frac{12}{25}$.

Find the value of k.

$k =$ ..... [2]

(b) Find the nth term of each sequence.

(i) 6, 13, 32, 69, 130, …

..... [2]

(ii) 100, 50, 25, 12.5, 6.25, …

..... [2]

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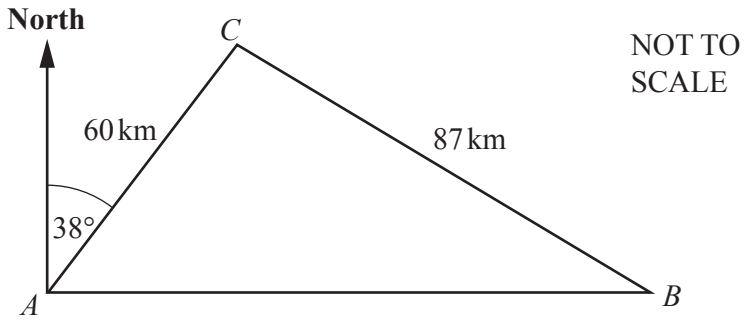
7



The diagram shows the straight roads between town A, town B and town C.
$AC = 60\,\text{km}$, $CB = 87\,\text{km}$ and B is due east of A.
The bearing of C from A is 038°.

(a) Show that angle $ACB = 95.1°$, correct to 1 decimal place.

[5]

(b) Without stopping, a car travels from town A to town C then to town B, before returning directly to town A.
The total time taken for the journey is 3 hours 20 minutes.

Calculate the average speed of the car for this journey.
Give your answer in kilometres per hour.

..... km/h [6]

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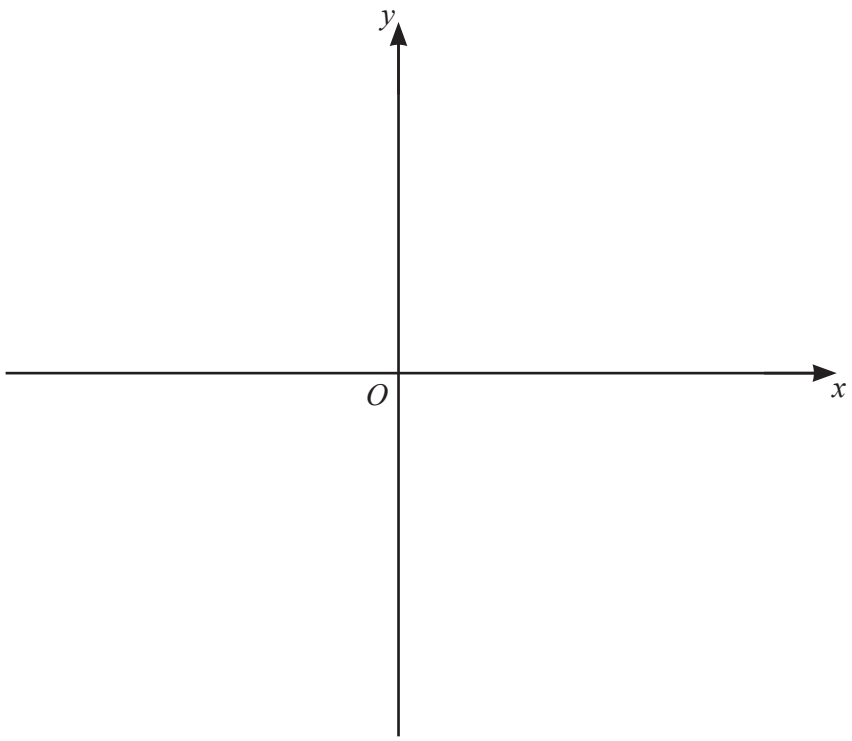
8 **(a)** **(i)** Show that the equation $y = (x-4)(x+1)(x-2)$ can be written as $y = x^3 - 5x^2 + 2x + 8$.

[2]

(ii) On the diagram, sketch the graph of $y = x^3 - 5x^2 + 2x + 8$, indicating the values where the graph crosses the axes.



[4]

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(b) The graph of $y = x^3 - 5x^2 + 2x + 8$ has two tangents with a gradient of 10.

Find the equations of these two tangents.
You must show all your working and give your answers in the form $y = mx + c$.

$y =$ .....

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

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9 **(a)** Simplify.

(i) $(3x^2y^4)^3$

..... [2]

(ii) $\left(\frac{16}{x^{16}y^8}\right)^{-\frac{3}{2}}$

..... [3]

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

$x^2 - 9$

..... [1]

(ii) Simplify.

$$\frac{x^2 - 9}{2xy - 6y + 5x - 15}$$

..... [3]

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(c) Solve the simultaneous equations.
You must show all your working and give your answers correct to 2 decimal places.

$$2x + y = 7$$
$$y = 5x^2 + 2x - 13$$

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

$x =$ ..... , $y =$ ..... [6]

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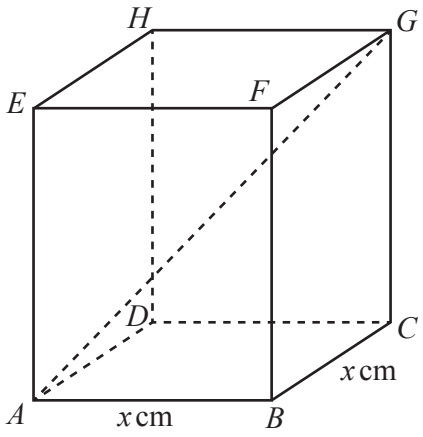
10 (a)



NOT TO SCALE

ABCDEFGH is a cuboid with a square base of side x cm.
$CG = 20$ cm and $AG = 28$ cm.

Calculate the value of x.

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

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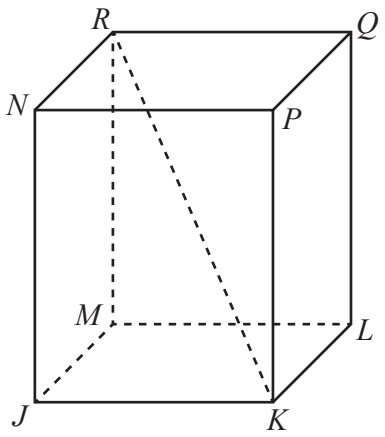
(b)



NOT TO SCALE

The diagram shows a different cuboid $JKLMNPQR$.
$MR = 30$ cm correct to the nearest centimetre.
$KR = 37$ cm correct to the nearest centimetre.

Calculate the lower bound of the angle between KR and the base $JKLM$ of the cuboid.

..... [4]

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MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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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)	111	**3**	**M2** for $180 - \frac{180-42}{2}$ oe or $42 + \frac{180-42}{2}$ oe or **M1** for $\frac{180-42}{2}$ oe
1(b)	150	**3**	**M1** for $k \div (3 + 4 + 5)$ [$\times p$] where $p = 1, 3, 4$ or 5 or $\frac{5}{12}$ oe **B1** for 360 used
1(c)	$\frac{3}{5}$ cao nfww	**4**	**B3** for $\frac{72}{120}$ or **B2** for [d =] 72 or [h =] 120 or **M1** for $360 \div 5$ oe isw or $180 - (360 \div 6)$ isw or for $(6 - 2) \times 180$ [$\div 6$]
1(d)	$x + 2x - 5 + x + 20 + 3x - 40 = 360$	**M1**	Accept equivalent equation e.g. $7x - 25 = 360$
	$7x = 360 + 5 - 20 + 40$ or better	**M1**	**FT** *their* equation, accept e.g. $7x = 385$
	$x = 55$	**B1**	
	55 and 125 or 105 and 75	**B1dep**	**Dep on M1M1B1** Accept $55 + 3 \times 55 - 40 = 180$ or $2 \times 55 - 5 + 55 + 20 = 180$ If B0 scored, **SC1** for 55, 75, 105 and 125
	Opposite angles sum to 180 oe [so $PQRS$ is a cyclic quadrilateral]	**A1**	**Dep on M1M1B1B1**
1(e)	48.7 or 48.69 to 48.70…	**3**	**M2** for $\frac{360-50}{360} \times 2 \times \pi \times 9$ oe or **M1** for $\frac{50}{360} \times 2 \times \pi \times 9$ oe
2(a)	249.98 to 250[.0…]	**3**	**M2** for $830 - 500 \times 1.16$ or **M1** for 500×1.16 OR **M1** for $830 \div 1.16$ **M1** for (*their* 715.5… – 500) × 1.16

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Question	Answer	Marks	Partial Marks
2(b)(i)	33.5 or 33.51…	**2**	**M1** for $\frac{12400}{37000}$ [×100] oe If 0 scored, **SC1** for answer 66.5 or 66.48 to 66.49
2(b)(ii)	38 184 cao	**2**	**M1** for 37 000 × $\left(1+\frac{3.2}{100}\right)$ oe or **B1** for 1184
2(c)(i)	441 or 440.6 or 440.64 to 440.65	**3**	**B2** for answer 3941 or 3940.6 or 3940.64 to 3940.65 or **M2** for 3500 × $\left(1+\frac{2.4}{100}\right)^5$ – 3500 or **M1** for 3500 × $\left(1+\frac{2.4}{100}\right)^5$ oe isw
2(c)(ii)	16	**3**	**B2** for 15[.0] nfww to 15.1 or **M2** for 3500 × $\left(1+\frac{2.4}{100}\right)^{15}$ oe seen or 3500 × $\left(1+\frac{2.4}{100}\right)^{16}$ oe seen or **M1** for (3500 or *their* 3941) × $\left(1+\frac{2.4}{100}\right)^n$ associated with 5000 oe
3(a)(i)	$\frac{(x+3)(2x+5)}{2}=60$	**M1**	Accept $(x + 3)(2x + 5) = 2 \times 60$ or 120 Accept e.g. $(x + 3)(x + 2.5) = 60$ without division by 2 shown for M1 (but not A1)
	$2x^2 + 6x + 5x + 15$ seen	**B1**	Accept $2x^2 + 11x + 15$ seen
	$2x^2 + 11x – 105 = 0$	**A1**	Correct completion after M1B1 with the fraction seen removed with no errors or omissions seen
3(a)(ii)	$(2x + 21)(x – 5)$ [= 0]	**M2**	**M1** for partial factors $2x(x – 5) + 21(x – 5)$ [= 0] or $x(2x + 21) – 5(2x + 21)$ [= 0] OR $(2x + a)(x + b)$ [= 0] where $ab = – 105$ or $2b + a = 11$
	–10.5 and 5	**B1**	

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Question	Answer	Marks	Partial Marks
3(a)(iii)	61.9 or 61.92 to 61.93	**3**	**M2** for tan = $\frac{2\times \textit{their}\,5+5}{\textit{their}\,5+3}$ oe or **B1FT** for 2 × *their* 5 + 5 and *their* 5 + 3
3(b)(i)	28.1 or 28.07 to 28.08	**1**	**FT** *their* 90 – *their* **(a)(iii)** unless *their* **(a)(iii)** < 45, in which case FT *their* **(a)(iii)**
3(b)(ii)	10	**3**	**M2** for $(\textit{their}\,5+3)\times\sqrt{\frac{93.75}{60}}$ oe or **M1** for $\sqrt{\frac{93.75}{60}}$ or $\sqrt{\frac{60}{93.75}}$ oe seen or $\left(\frac{\textit{their}5+3}{x}\right)^2=\frac{60}{93.75}$ oe
4(a)(i)	$1.65 < h \leq 1.8$	**1**	
4(a)(ii)	1.63875	**4**	**M1** for midpoints **soi** **M1** for use of $\sum fh$ with h in correct interval including both boundaries **M1dep on 2nd M1** for $\sum fh \div 80$
4(b)(i)	$\frac{1}{40}$ oe	**1**	
4(b)(ii)	$\frac{63}{395}$ oe	**3**	**M2** for $\frac{56}{80}\times\frac{9}{79}[\times 2]$ oe or **B1** for $\frac{56}{80}$ or $\frac{9}{79}$ or $\frac{9}{80}$ or $\frac{56}{79}$ oe seen If 0 or B1 scored, instead award **SC2** for answer $\frac{117}{632}$ oe or **SC1** for answer $\frac{63}{400}$ oe
4(c)(i)	15, 39, 71, 80	**2**	**B1** for 3 correct or **M1** for 1 error in addition with other values then consistent

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Question	Answer	Marks	Partial Marks
4(c)(ii)	Correct curve	**3**	**B1** for correct horizontal placement for 5 plots **B1FT** for correct vertical placement for 5 plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 5 points If 0 scored **SC1 FT** for 4 out of 5 points correctly plotted
4(d)(i)	Strict FT *their* UQ – *their* LQ	**2dep**	**B1dep** for *their* UQ or *their* LQ seen Dep on increasing curve/polygon for 2 marks or B1
4(d)(ii)	Strict FT *their* reading at 48	**2dep**	**B1** for 48 written
5(a)(i)	251 or 251.3 to 251.4	**2**	**M1** for $\frac{1}{3}\times\pi\times4^2\times15$ oe
5(a)(ii)	79.5 or 79.51…	**5**	**M3** for $\pi\times4\times\sqrt{4^2+15^2}$ oe or **M2** for $\sqrt{15^2+4^2}$ oe or **M1** for $[l^2=]\ 4^2+15^2$ oe or $\pi\times4\times$ *their* l **M1** for $\frac{\textit{their}\text{ curved surface area}}{\textit{their}\text{ curved surface area}+\pi\times4^2}[\times100]$ oe
5(b)(i)	13 min 20 sec	**3**	**B2** for 800 or $\frac{40}{3}$ oe seen or **M1** for figs 3 ÷ figs 375 or figs 3 ÷ 22 500
5(b)(ii)	0.472 or 0.4715 to 0.4716…	**3**	**M2** for $\pi\times0.45^2\times h=0.3$ or $\pi\times45^2\times h=300\,000$ oe or **M1** for $\pi\times\text{figs}45^2\times h=\text{figs}3$ oe
6(a)(i)	$\frac{1}{5}$, $\frac{2}{7}$, $\frac{3}{9}$ final answer	**2**	**B1** for 2 correct terms isw or for 0.2 and (0.286 or 0.2857…) and 0.333…
6(a)(ii)	36	**2**	**M1** for $k=\frac{12(2k+3)}{25}$ or better

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Question	Answer	Marks	Partial Marks
6(b)(i)	$n^3 + 5$ oe final answer	**2**	**B1** for any cubic or common third differences of 6 (at least 2) or for correct answer seen and spoilt
6(b)(ii)	$100 \times 2^{1-n}$ oe final answer	**2**	**B1** for $2^{-n\,[+k]}$ oe or $\left(\frac{1}{2}\right)^{n[+k]}$ oe in answer or for correct answer seen and spoilt
7(a)	Angle $CAB = 52$	**B1**	
	$180 - 52 - \sin^{-1}\left(\frac{60\sin their\,52}{87}\right)$	**M3**	**M2** for $[\sin[...]=]\ \frac{60\sin their 52}{87}$ oe or **M1** for $\frac{60}{\sin B} = \frac{87}{\sin their 52}$ oe
	95.08…	**A1**	
7(b)	77.1 or 77.08 to 77.11	**6**	**B4** for dist travelled = 256.9 to 257[.0…] or **B3** for [AB =] 109.9 to 110[.0…] or **M3** for $60 + 87 + \sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or **M2** for $\sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or $AB^2 = 12093.\ldots$ to $12097.\ldots$ or $\frac{87\sin 95.1}{\sin their 52}$ oe or **M1** for $AB^2 = 60^2 + 87^2 - 2\times60\times87\times\cos 95.1$ oe or $\frac{\sin 95.1}{AB} = \frac{\sin their 52}{87}$ oe **M1** for *their* total distance $\div 3\frac{20}{60}$ oe
8(a)(i)	Correct expansion of a pair of brackets $x^2 - 4x + [1]x - 4$ or $x^2 - 4x - 2x + 8$ or $x^2 + [1]x - 2x - 2$	**M1**	accept $x^2 - 3x - 4$ or $x^2 - 6x + 8$ or $x^2 - [1]x - 2$
	$x^3 - 4x^2 + x^2 - 4x - 2x^2 + 8x - 2x + 8$ leading to and stating $[y =]\ x^3 - 5x^2 + 2x + 8$	**A1**	Accept $x^3 - 3x^2 - 4x - 2x^2 + 6x + 8$ or $x^3 - 6x^2 + [1]\,x^2 + 8x - 6x + 8$ or $x^3 - [1]\,x^2 - 2x - 4x^2 + 4x + 8$ leading to and stating $[y =]\ x^3 - 5x^2 + 2x + 8$

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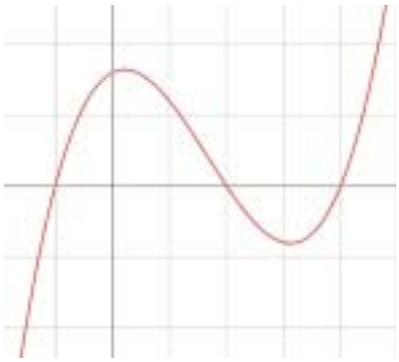
Question	Answer	Marks	Partial Marks
8(a)(ii)	Correct labelled sketch positive cubic Crossing x-axis at –1, 2 and 4 only Crossing y – axis at 8 only 	**4**	**B1** for positive cubic **B2** for three intercepts only with x -axis labelled at – 1, 2 and 4 or **B1** for 1 or 2 correctly labelled x – intercepts **B1** for a single intercept on y-axis labelled at 8 but not if line $y = 8$
8(b)	$3x^2 - 10x - 8$ [= 0]	**M3**	**B2** for derivative = $3x^2 - 10x + 2$ isw OR **B1** for derivative with $3x^2$ or $-10x$ given in expression isw **M1dep on B1** for *their* first derivative = 10
	$x = 4$ and $x = -\frac{2}{3}$	**B1**	
	(4, 0) and $\left(-\frac{2}{3}, \frac{112}{27}\right)$ oe	**B1**	
	$[y =]\ 10x - 40$ and $[y =]\ 10x + \frac{292}{27}$	**B2**	**B1** for each or for two different equations of the form $[y =]\ 10x + c$ (c must be numeric) or for $c = -40$ and $\frac{292}{27}$
9(a)(i)	$27x^6y^{12}$ final answer	**2**	**B1** for two terms correct in answer e.g. $27x^6y^k$ or $27x^ky^{12}$ or kx^6y^{12} or for correct answer seen then spoilt

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Question	Answer	Marks	Partial Marks
9(a)(ii)	$\frac{x^{24}y^{12}}{64}$ final answer	**3**	**B2** for final answer with two correct elements or final answer $\frac{64}{x^{24}y^{12}}$ or $\frac{64^{-1}}{x^{-24}y^{-12}}$ or better or for correct answer seen or **B1** for 64 or x^{24} or y^{12} seen in final answer or final answer $\frac{k}{x^{-24}y^{-12}}$ or **M1** for first correct step seen eg $\left(\frac{x^{16}y^{8}}{16}\right)^{\left[\frac{3}{2}\right]}$ or $\left(\frac{4}{x^{8}y^{4}}\right)^{[-3]}$ or $\left(\frac{4096}{x^{48}y^{24}}\right)^{\left[-\frac{1}{2}\right]}$
9(b)(i)	$(x + 3)(x – 3)$ final answer	**1**	
9(b)(ii)	$\frac{x+3}{2y+5}$ final answer	**3**	**M2** for $(x – 3)(2y + 5)$ or **M1** for $2y(x – 3) + 5(x – 3)$ or $x(2y + 5) – 3(2y + 5)$
9(c)	$5x^2 + 4x – 20$ [= 0] oe or $5y^2 – 78y + 221$ [= 0] oe	**M2**	**M1** for $7 – 2x = 5x^2 + 2x – 13$ oe seen or $y = 5\left(\frac{7-y}{2}\right)^2 + 2\left(\frac{7-y}{2}\right) – 13$ oe seen
	$\frac{-4 \pm \sqrt{(4)^2 – 4(5)(–20)}}{2(5)}$ oe or $-\frac{4}{10} \pm \sqrt{4 + \left(\frac{4}{10}\right)^2}$ oe	**M2**	**FT** *their* 3-term quadratic or **M1** for $\sqrt{(4)^2 – 4(5)(–20)}$ or better or for $\frac{-4+\sqrt{q}}{2\times5}$ or $\frac{-4-\sqrt{q}}{2\times5}$ or for $\left(x + \frac{4}{10}\right)^2$ oe
	$x = 1.64$ $y = 3.72$ and $x = – 2.44$ $y = 11.88$	**B2**	**B1** for one correct pair or both x-values correct or both y – values correct

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Question	Answer	Marks	Partial Marks
10(a)	13.9 or 13.85 to 13.86	**4**	**M3** for $2x^2 = 28^2 - 20^2$ or better or $x = \left(\sqrt{28^2 - 20^2}\right)\sin 45$ oe or **M2** for $x^2 + x^2 + 20^2 = 28^2$ oe or $\sin 45 = \frac{x}{\sqrt{28^2 - 20^2}}$ or **M1** for any correct Pythag in 2D or *their AC* × sin 45 oe dep on trig/Pythagoras attempt for *AC*
10(b)	51.9 or 51.87 to 51.88	**4**	**M3** for $\sin = \frac{29 \text{ to } 30}{37 + 0.5}$ or $\frac{30 - 0.5}{37 \text{ to } 38}$ oe or **M2** for correct trig statement for correct angle with values in range 29 to 31 and 36 to 38 or **M1** for 30 + 0.5 or 30 – 0.5 or 37 + 0.5 or 37 – 0.5 seen or for identifying correct angle *RKM*

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MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2023**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

This document has **20** pages.

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[Turn over

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1 **(a)** Tomas sells a computer, a bike and a phone.
The amounts he receives are in the ratio computer : bike : phone = 14 : 17 : 9.

(i) Calculate the amount he receives for the phone as a percentage of the total.

..... % [2]

(ii) The total amount he receives is $560.

Calculate how much he receives for the bike.

$ ..... [2]

(iii) Tomas originally bought the bike for $195.
He wanted to make a profit of at least 25% when he sold it.

Does Tomas make a profit of at least 25%?
You must show all your working to support your decision.

[3]

(b) Ulla invests $725 for 6 years in an account paying simple interest at a rate of 1.3% per year.

Calculate the total interest earned at the end of 6 years.

$ ..... [2]

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(c) In a sale, all prices are reduced by 24%.
Victor pays $36.86 for a pair of shoes in the sale.

Calculate the original price of the shoes.

$ ..... [2]

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2 **(a)** Anna records the number of text messages she receives for 14 days.

17	15	31	38	31	22	13
18	21	27	28	21	31	29

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

1	
2	
3	

Key: .....

[3]

(ii) Find the median.

..... [1]

(iii) Find the mode.

..... [1]

(iv) Find the range.

..... [1]

(b) In a shop, there are 4 red and 8 grey phones.
Anna and Pete each pick one of these phones at random.

Work out the probability that they both pick a grey phone.

..... [2]

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3 **(a)** The scale drawing shows two sides, AB and BC, of a field.
The scale is 5 centimetres represents 200 metres.

Scale: 5 cm to 200 m

(i) Measure angle ABC.

Angle ABC = ... [1]

(ii) X is a point on BC.
$BX = 332$ m.

Mark the point X on the diagram. [2]

(iii) Find the scale in the form 1 : n.

1: ..... [2]

(b) A bronze statue is 4.5 m high and has a mass of 195 200 kg.
The density of bronze is 8000 kg / m^3.
The volume of a mathematically similar model of the statue is 0.385 m^3.

Calculate the height of the model.
[Density = Mass ÷ Volume]

..... m [5]

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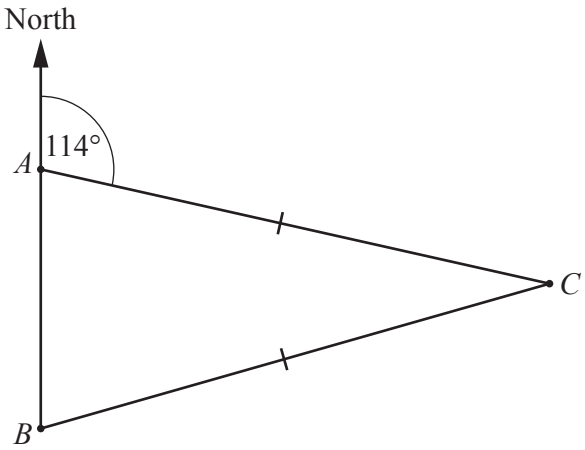
4 **(a)**



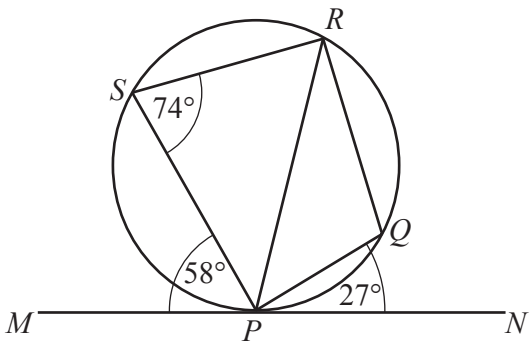
NOT TO SCALE

A, B and C are three towns and the bearing of C from A is 114°.
B is due south of A and $AC = BC$.

Calculate the bearing of B from C.

..... [3]

(b)



NOT TO SCALE

P, Q, R and S lie on a circle.
MPN is a tangent to the circle at P.
Angle $MPS = 58°$, angle $PSR = 74°$ and angle $QPN = 27°$.

(i) Find angle PRS.

Angle PRS = ... [1]

(ii) Find angle PQR.

Angle PQR = ... [1]

(iii) Find angle RPQ.

Angle RPQ = ... [2]

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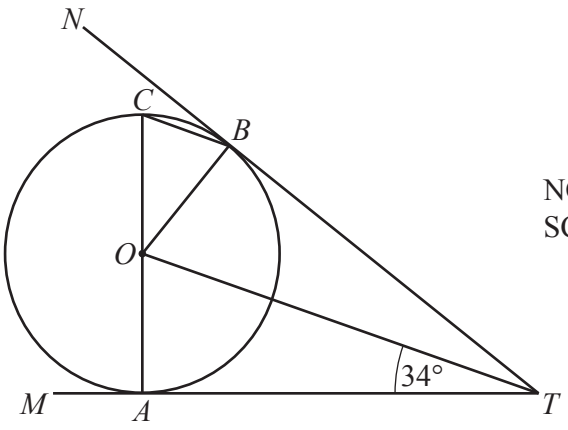
(c)



NOT TO SCALE

A, *B* and *C* lie on a circle, centre *O*, with diameter *AC*.
TAM and *TBN* are tangents to the circle and angle *ATO* = 34°.

Using values and geometrical reasons, complete these statements to show that *CB* is parallel to *OT*.

In triangles *AOT* and *BOT*, *OT* is common.
Angle *OAT* = angle *OBT* = 90° because .....

.....

AT = *BT* because .....

.....

Triangle *AOT* is congruent to triangle *BOT* because of congruence criterion .....

Angle *AOT* = angle *BOT* = 56° because angles in a triangle add up to 180°.

Angle *BOC* = ... ° because .....

Angle *OBC* = ... ° because .....

.....

CB is parallel to *OT* because .....

[6]

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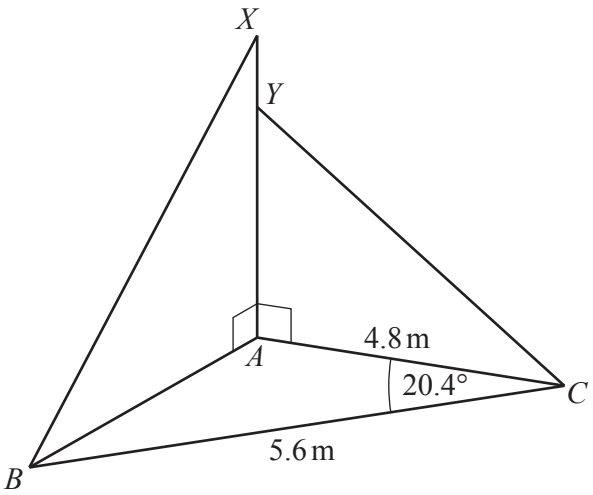
5 (a)



NOT TO SCALE

ABC is a scalene triangle on horizontal ground.
AYX is a straight vertical post, held in place by two straight wires *XB* and *YC*.
AC = 4.8 m, *BC* = 5.6 m and angle *ACB* = 20.4°.

(i) Calculate *AB*.

AB = ... m [3]

(ii) Angle *XBA* = 64°.

Calculate *AX*.

AX = ... m [2]

(iii) *AY* = 2.9 m.

Calculate the area of triangle *YAC*.

..... m^2 [2]

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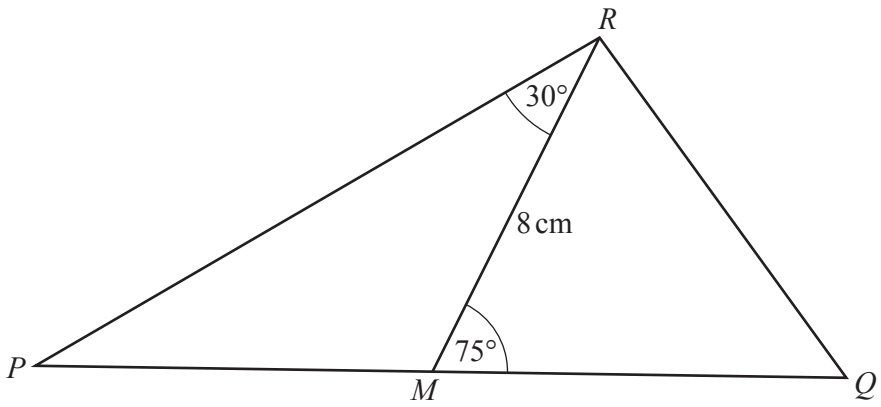
(b)



NOT TO SCALE

In triangle PQR, M is the midpoint of PQ.
$RM = 8$ cm, angle $PRM = 30°$ and angle $RMQ = 75°$.

Calculate PQ.

$PQ =$ ..... cm [5]

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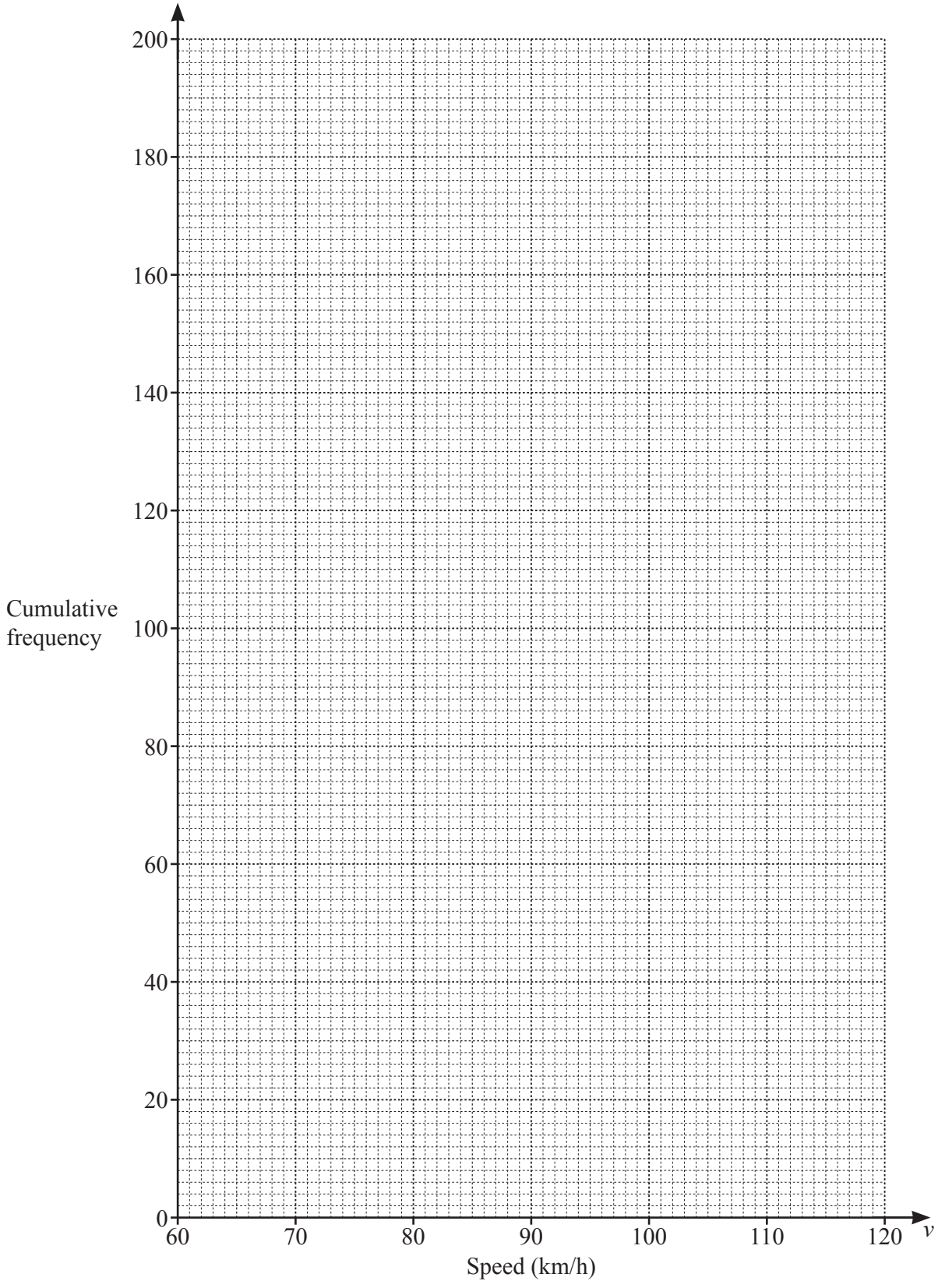
6 **(a)** The cumulative frequency table shows information about the speed of each of 200 cars as they pass a speed camera.

Speed (v km/h)	$v \leqslant 70$	$v \leqslant 80$	$v \leqslant 90$	$v \leqslant 95$	$v \leqslant 100$	$v \leqslant 120$
Cumulative frequency	12	46	115	155	177	200

(i) On the grid, draw the cumulative frequency diagram.



[3]

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(ii) Use your cumulative frequency diagram to find an estimate of

(a) the median

..... km/h [1]

(b) the interquartile range

..... km/h [2]

(c) the number of cars with a speed greater than 110 km/h.

..... [2]

(b) The frequency table shows information about the mass of each of 50 trucks.

Mass (m kg)	$2000 < m \leqslant 2600$	$2600 < m \leqslant 3500$	$3500 < m \leqslant 5000$	$5000 < m \leqslant 5700$
Frequency	12	15	16	7

(i) Calculate an estimate for the mean mass of the trucks.

..... kg [4]

(ii) In a histogram showing this information, the height of the first block is 6 cm.

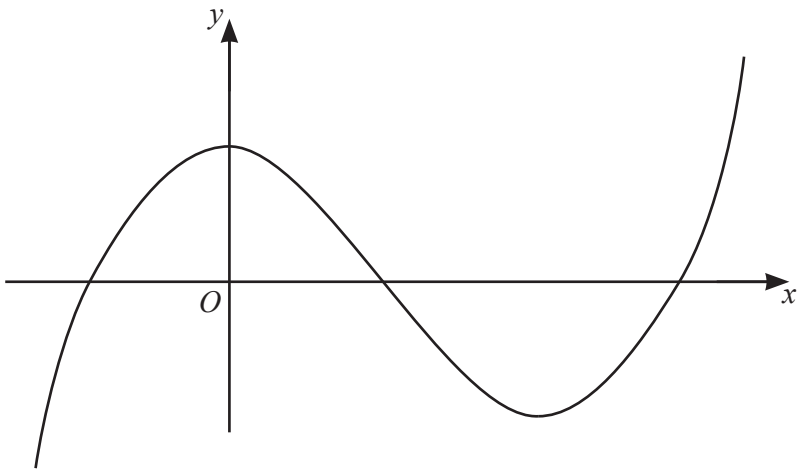
Calculate the heights of the remaining three blocks.

Height of block for $2600 < m \leqslant 3500$ ..... cm

Height of block for $3500 < m \leqslant 5000$ ..... cm

Height of block for $5000 < m \leqslant 5700$ ..... cm [3]

7 **(a)** The diagram shows the graph of a function.

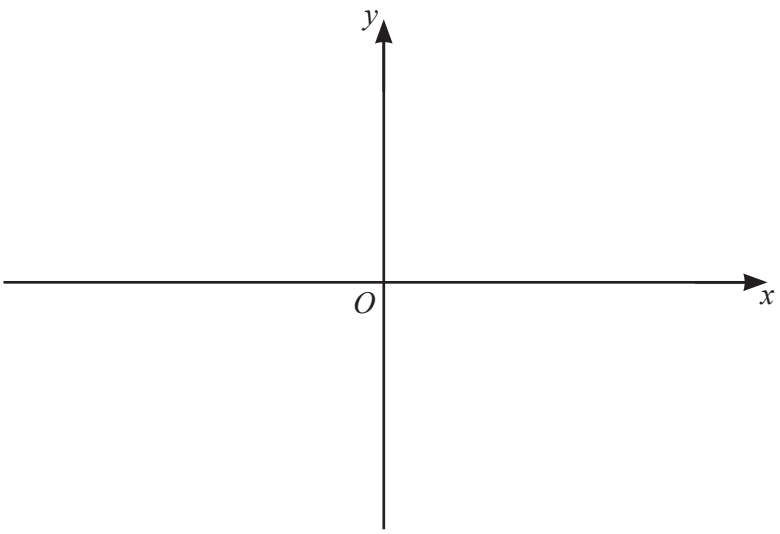


Put a ring around the word which correctly identifies the type of function.

reciprocal quadratic cubic exponential linear

[1]

(b) **(i)**

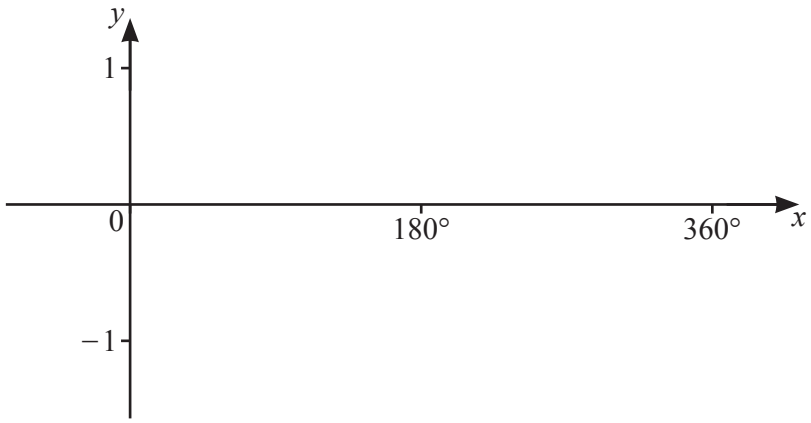


On the diagram, sketch the graph of $y = \frac{1}{2x}$, $x \neq 0$. [2]

(ii) Solve the equation $\frac{1}{2x} = 2x$.

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

(c) (i)



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

(ii) Solve the equation $3\sin x + 1 = 0$ for $0° \leqslant x \leqslant 360°$.

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

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8 **(a)** A shop sells shirts for $\$x$ and jackets for $\$(x + 27)$.
The shop sells 4 shirts and 3 jackets for a total of \$194.75 .

Write down and solve an equation to find the cost of one shirt.

\$ ..... [3]

(b) Solve the simultaneous equations.
You must show all your working.

$$x^2 + 4y = 37$$
$$5x + y = -8$$

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

$x =$ ..... , $y =$ ..... [5]

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(c) A solid cylinder has radius x and height $6x$.
A sphere of radius r has the same surface area as the total surface area of the cylinder.

Show that $r^2 = \frac{7}{2}x^2$.

[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

[4]

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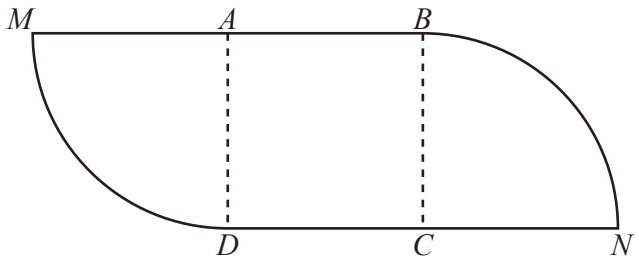
9 (a)



NOT TO SCALE

The diagram shows a shape made from a square *ABCD* and two equal sectors of a circle.
The square has side 11 cm.
MAB and *DCN* are straight lines.

(i) Calculate the area of the shape.

..... cm^2 [3]

(ii) Calculate the perimeter of the shape.

..... cm [3]

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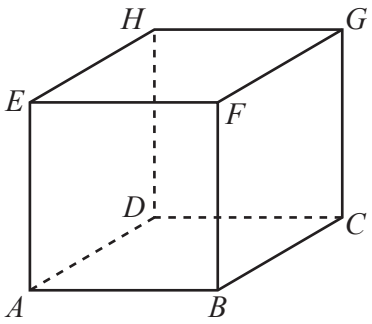
(b)



NOT TO SCALE

The diagram shows a cube $ABCDEFGH$ of edge 7 cm.

Calculate the angle between AG and the base of the cube.

..... [4]

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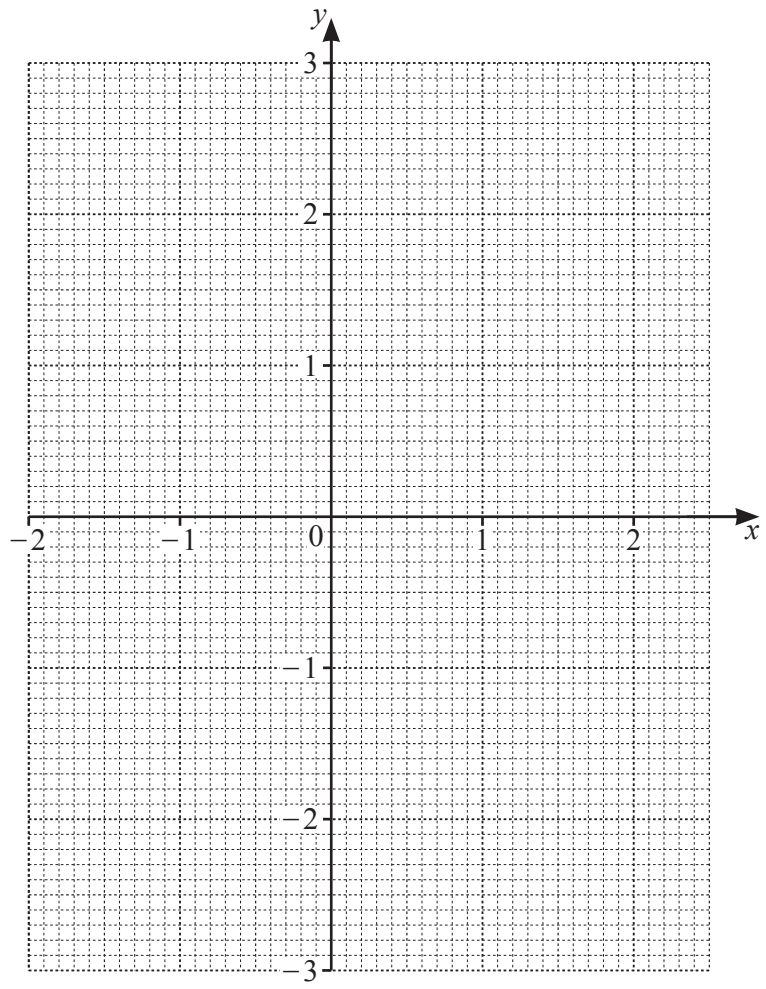
10 The table shows some values for $y = 2^x - 3$.

x	−2	−1	0	0.5	1	1.5	2	2.5
y	−2.75			−1.58		−0.17	1	2.66

(a) Complete the table. [3]

(b) On the grid, draw the graph of $y = 2^x - 3$ for $-2 \leqslant x \leqslant 2.5$.



[4]

(c) Use your graph to solve the equation $2^x - 3 = 2$.

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

(d) By drawing a suitable straight line, solve the equation $2^x - x - 1.5 = 0$.

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

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11 M has coordinates (4, 1) and N has coordinates (−2, −7).

(a) Find the length of MN.

..... [3]

(b) Find the gradient of MN.

..... [2]

(c) Find the equation of the perpendicular bisector of MN.

..... [4]

Question 12 is printed on the next page.

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12 The equation of a curve is $y = x^4 - 8x^2 + 5$.

(a) Find the derivative, $\left(\frac{dy}{dx}\right)$, of $y = x^4 - 8x^2 + 5$.

..... [2]

(b) Find the coordinates of the three turning points.
You must show all your working.

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

(c) Determine which one of these turning points is a maximum.
Justify your answer.

[2]

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MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2023**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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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)	22.5	**2**	**M1** for $\frac{9}{14+17+9}$ [×100]
1(a)(ii)	238	**2**	**FT** *their* 14 + 17 + 9 = *N* seen in **(a)(i)** **M1** for $\frac{560}{\textit{their}\ (14+17+9)} \times k$, where k = 1, 9, 14 or 17
1(a)(iii)	METHOD 1 1.25 × 195 oe	**M2**	**M1** for $\frac{25}{100} \times 195$
	243[.75] and No oe	**A1**	Strict **FT** yes if *their* **(a)(ii)** > 243.75 If M0 scored, then **SC1** for 243.75 and a correct conclusion.
	METHOD 2 $\frac{\textit{their}\ 238}{195} - 1 = 0.22\ldots$ oe	**(M2)**	**M1** for $\frac{\textit{their}\ 238}{195} = 1.22\ldots$ oe
	22[%] (or better) and No oe	**(A1)**	Strict **FT** yes if *their* **(a)(ii)** gives answer > 25 If M0 scored, then **SC1** for 22.05 and a correct conclusion.
	METHOD 3 195 × 0.25 = 48.75 oe **and** *their* 238 – 195 = 43	**(M2)**	**M1** for 0.25 × 195
	43 **and** 48.75 and NO	**(A1)**	Strict **FT** yes if *their* **(a)(ii)** gives profit > 48.75 If M0 scored, then **SC1** for 43 and 48.75 and a correct conclusion.
	METHOD 4 $\frac{\textit{their}\ 238}{125} \times 100$	**(M2)**	**M1** for $x \times \left(1+\frac{25}{100}\right) = \textit{their}\ 238$
	190.4 and NO	**(A1)**	Strict **FT** yes if *their* **(a)(ii)** gives answer > 195 If M0 scored then **SC1** for 190.4 and a correct conclusion.
1(b)	56.55	**2**	**M1** for $\frac{725 \times 1.3[\times 6]}{100}$ oe

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Question	Answer	Marks	Partial Marks
1(c)	48.5[0]	**2**	**M1** for $x \times \left(1-\frac{24}{100}\right) = 36.86$ oe
2(a)(i)	1 | 3 5 7 8 2 | 1 1 2 7 8 9 3 | 1 1 1 8 1 | 7 represents 17 [messages]	**3**	**B2** for fully correct stem-and-leaf diagram OR **B1** for two rows correct or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission **B1** for correct key
2(a)(ii)	24.5	**1**	
2(a)(iii)	31	**1**	
2(a)(iv)	25	**1**	
2(b)	$\frac{14}{33}$ oe	**2**	**M1** for $\frac{8}{12}\times\frac{7}{11}$
3(a)(i)	118	**1**	
3(a)(ii)	X is 8.3 cm from B	**2**	**M1** for (332 ÷ 200) × 5 oe
3(a)(iii)	1 : 4000	**2**	**M1** for 200 ÷ 5 or 200 × 100, both soi
3(b)	1.13 or 1.128 to 1.129	**5**	**M4** for $4.5 \times \sqrt[3]{\frac{0.385\times 8000}{195200}}$ oe or $\sqrt[3]{\frac{4.5^3\times 0.385\times 8000}{195200}}$ oe or **M3** for $\sqrt[3]{\frac{0.385}{their 24.4}}$ or $\sqrt[3]{\frac{their 3080}{195200}}$ or $\frac{0.385}{their 24.4}=\frac{l^3}{4.5^3}$ oe or **M2** for $\frac{their 24.4}{0.385}$ or $\frac{0.385}{their 24.4}$ oe or **B2** for 24.4 or 3080 seen or **M1** for 195 200 ÷ 8000 or for 0.385 × 8000

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Question	Answer	Marks	Partial Marks
4(a)	246	**3**	**B2** for *BCS*(outh) = 66 or *BCA* = 48 **and** *ACN*(orth) = 66 or *BCW*(est) = 24 or *ACS*(outh) = 114 or **B1** for *ABC* = 66 or *BAC* = 66 or *BCA* = 48 or *ACN*(orth) = 66
4(b)(i)	58	**1**	
4(b)(ii)	106	**1**	
4(b)(iii)	47	**2**	**B1** for *PRQ* = 27 or **B1FT** for *SPR*, either = 48 or = 106 – *their* **(b)(i)** or **B1FT** for *RPQ* = *their* **(b)(i)** – 11
4(c)	Radius perpendicular to tangent	**1**	
	Tangents to circle from a/same point oe	**1**	
	RHS	**1**	
	68 angles on a [straight] line add up/sum to 180 oe	**1**	
	56 [base angles of] isosceles triangle	**1**	
	OBC = *BOT* Alternate angles	**1**	Angles and reason required and dependent on *OBC* and *BOT* correct
5(a)(i)	2[.00] or 2.002 to 2.003 nfww	**3**	**M2** for $\sqrt{4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4}$ OR **M1** for $4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4$ **A1** for 4.01[17…] or 4.012
5(a)(ii)	4.1[0] or 4.11 or 4.100 to 4.107 cao	**2**	**M1** for $\tan 64 = \frac{AX}{\textit{their}\ \textbf{(a)(i)}}$ or for $\frac{AX}{\sin 64} = \frac{\textit{their}\ \textbf{(a)(i)}}{\sin(90-64)}$ oe
5(a)(iii)	6.96	**2**	**M1** for $\frac{1}{2} \times 4.8 \times 2.9$ oe

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Question	Answer	Marks	Partial Marks
5(b)	11.3 or 11.31..	**5**	**M4** for $2\times\frac{8}{\sin(45)}\times\sin 30$ or **B4** for *PM* = 5.65[685...] or 5.66 or better OR **B1** for *angle RPM* = 45° **M2** for $\frac{8}{\sin(their\ 45)}\times\sin 30$ or **M1** for implicit form
6(a)(i)	Correct curve	**3**	**B1** for correct horizontal placement for 6 plots **B1** for correct vertical placement for 6 plots **B1 dep on at least B1** for reasonable increasing curve through *their* 6 points If 0 scored, **SC1** for 4 out of 6 points correctly plotted
6(a)(ii)(a)	87 to 89.5	**1**	
6(a)(ii)(b)	12.5 to 14	**2**	**B1** for [LQ =] 80.5 to 81.5 or [UQ =] 94 to 94.5
6(a)(ii)(c)	Strict FT, 200 – *their* cumul freq reading from *their* graph at 110 given to nearest integer	**2**	**B1FT** for correct cumul freq at 110 seen or for non-integer answer
6(b)(i)	3576	**4**	**M1** for midpoints soi **M1** for use of $\sum fx$ where x is in the correct interval including boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 50$
6(b)(ii)	5 3.2 3	**3**	**B1** for each If 0 scored, **SC1** for 3 frequency densities $\frac{12}{600}, \frac{15}{900}, \frac{16}{1500}, \frac{7}{700}$ seen oe to 3sf or better or multiplier 3 or 300
7(a)	Cubic	**1**	

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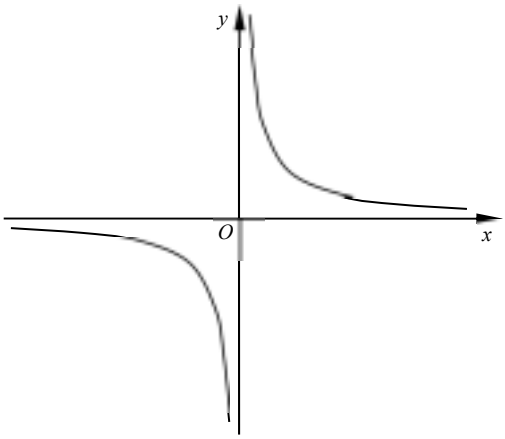
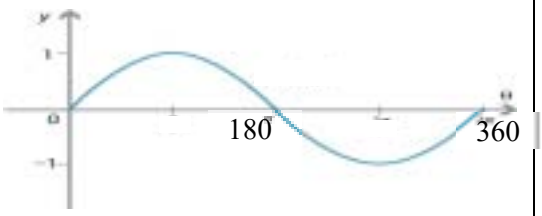
Question	Answer	Marks	Partial Marks
7(b)(i)	Correct sketch 	2	**B1** for one branch correct or an attempt at the correct shape Maximum 1 mark if sketch crosses x-axis or y-axis
7(b)(ii)	$\pm\frac{1}{2}$ **nfww**	2	**M1** for $4x^2 = 1$ oe or **B1** for $\frac{1}{2}$ or $-\frac{1}{2}$ nfww
7(c)(i)	Correct sketch through (0, 0) (180, 0) and (360, 0) with max and min at 1 and –1 resp. 	2	**B1** for correct sine curve shape, starting at the origin, with minimum of 1 cycle.
7(c)(ii)	199.5 or 199.47... and 340.5...	3	**B2** for one correct or **M1** for $\sin x = -\frac{1}{3}$ oe If 0 scored, **SC1** for two reflex angles with a sum of 540 or 2 non-reflex angles with a sum of 180
8(a)	$4x + 3(x + 27) = 194.75$ or $4x + 3x + 81 = 194.75$	**M1**	
	16.25 cao	**B2**	**M1** for $7x = k$ where $k < 194.75$ or **B1** for answer 16.3
8(b)	$x^2 - 20x - 69 [= 0]$ oe or $y^2 + 116y - 861 [= 0]$ oe	**M2**	**M1** for $x^2 + 4(-8 - 5x) = 37$ oe or for $37 - 4y = \left(\frac{-8 - y}{5}\right)^2$ oe or for $x^2 + 4y = 37$ and $20x + 4y = -32$ subtracted with no more than one error

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Question	Answer	Marks	Partial Marks
	$(x + 3)(x – 23)$ [= 0] oe or $(y – 7)(y + 123)$ [= 0] oe	**M1**	correct method to solve *their* quadratic e.g. $x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4 \times 1 \times (-69)}}{2 \times 1}$ or $x – 10 = \pm 13$ or $x – 10 = \pm\sqrt{169}$
	$x = -3$ $y = 7$ $x = 23$ $y = -123$ final answer	**B2**	**B1** for one correct pair or two correct x values or two correct y values
8(c)	$2\pi x \times 6x + 2\pi x^2$ or $2\pi x(6x + x)$	**M2**	or **M1** for $2\pi x \times 6x$ or $2\pi x^2$
	Their $(2\pi x \times 6x + 2\pi x^2) = 4\pi r^2$	**M1**	Dep on at least on M1 earned *Their* LHS must be an area in terms of x only
	At least one further stage of working leading to $r^2 = \frac{7}{2}x^2$	**A1**	with no error seen
9(a)(i)	311 or 311.0 to 311.1	**3**	**M2** for $11 \times 11 + 2 \times \frac{1}{4} \times \pi \times 11^2$ oe or **M1** for [2 ×] $\frac{1}{4} \times \pi \times 11^2$ or 11×11 oe
9(a)(ii)	78.6 or 78.55 to 78.56...	**3**	**M2** for $4 \times 11 + 2 \times \frac{1}{4} \times 2 \times \pi \times 11$ oe or **M1** for [2 ×] $\frac{1}{4} \times 2 \times \pi \times 11$ or 4×11 oe
9(b)	35.2 or 35.3 or 35.239… to 35.28	**4**	**M3** for [tan =] $\frac{7}{\sqrt{7^2 + 7^2}}$ or [sin =] $\frac{7}{\sqrt{7^2 + 7^2 + 7^2}}$ or [cos =] $\frac{\sqrt{7^2 + 7^2}}{\sqrt{7^2 + 7^2 + 7^2}}$ OR **M2** for $AG = \sqrt{7^2 + 7^2 + 7^2}$ or for $\sqrt{7^2 + \left(\frac{7}{\sin 45}\right)^2}$ oe or for $AC = \sqrt{7^2 + 7^2}$ or $\frac{7}{\sin 45}$ oe OR **M1** for $7^2 + 7^2$ or for implicit trigonometry or identifying correct angle

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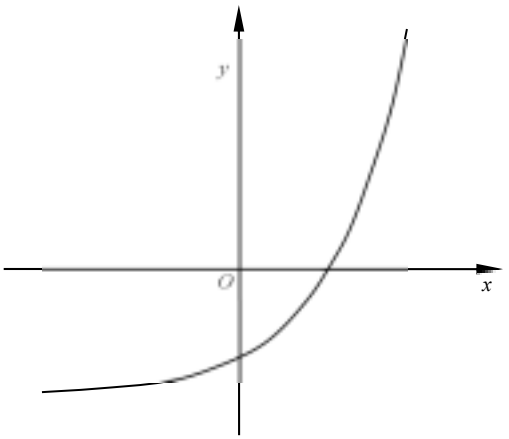
Question	Answer	Marks	Partial Marks
10(a)	–2.5 –2 –1	**3**	**B1** for each
10(b)	Correct curve 	**4**	**B3 FT** for 8 or 7 correct plots **B2 FT** for 6 or 5 correct plots **B1 FT** for 4 or 3 correct plots
10(c)	2.3 to 2.4	**1**	
10(d)	ruled line $y = x - 1.5$	**M2**	**M1** for $y = x - 1.5$ soi or for $2^x - 3 = x - 1.5$ seen. or $y = x + k$ or $y = kx - 1.5$ drawn Do not accept $y = -1.5$
	–1 and 1.55 to 1.7	**A2**	**A1** for each
11(a)	10	**3**	**M2** for $(1 - -7)^2 + (4 - -2)^2$ oe or **M1** for $(1 - -7)$ or $(4 - -2)$ oe
11(b)	$\frac{4}{3}$ or $\frac{8}{6}$	**2**	**M1** for $\frac{1 - -7}{4 - -2}$ oe
11(c)	$y = -\frac{3}{4}x - \frac{9}{4}$ or $4y + 3x + 9 = 0$ oe **final answers**	**4**	**B3** for $-\frac{3}{4}x - \frac{9}{4}$ OR **B1** for midpoint $(1, -3)$ **M1** for gradient $-\frac{3}{4}$ or $-\frac{1}{\textit{their}\ \textbf{(b)}}$ **M1** for substituting *their* $(1, -3)$ into $y = (\textit{their}\ m)x + c$ or for *their* $m = \frac{y - -3}{x - 1}$ oe
12(a)	$4x^3 - 16x$ cao	**2**	**M1** for $4x^3 + kx$ or $kx^3 - 16x$ or $4x^3 - 16x + k$ or $4x^3 - 16$ as final answers

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Question	Answer	Marks	Partial Marks
12b	*Their* $\frac{dy}{dx} = 0$ or stating $\frac{dy}{dx} = 0$	**B1**	
	Correct method to solve *their* $4x^3 - 16x = 0$	**M1**	e.g. $4x(x^2 - 4)$ or $4x(x - 2)(x + 2)$ oe
	$[x =]$ 0, –2, 2	**A1**	Or **B1** for (–2, –11) and (2, –11)
	(0, 5) (–2, –11) (2, –11)	**A1**	
12(c)	(0, 5) with correct reasoning	**2**	**M1** for any of • correct use of 2nd derivative $12x^2 - 16$ • evaluates correctly both values of y on either side • evaluates correctly the gradient on either side • reasonable correct sketch