Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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0086434689

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2021**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

This document has **12** pages.

[Turn over

1 P is a prime number where $60 < P < 80$.
P is 2 less than a square number.

Find the value of P.

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

2 Hank flies from Los Angeles to Shanghai.

(a) The flight departs on Friday 22 July at 21 40.
The flight takes 13 hours 35 minutes.
The local time in Shanghai is 15 hours ahead of the local time in Los Angeles.

Find the day, date and time in Shanghai when Hank's flight arrives.

Day ....., Date ....., Time ..... [3]

(b) The cost of the flight is \$920.
The exchange rate is \$1 = 6.87 Chinese yuan.

Find the cost of the flight in yuan.

..... yuan [1]

3 Calculate.

$$\frac{4.87-2.7}{-0.2+\sqrt[3]{0.729}}$$

..... [1]

4 The number of items that each of 22 people buy in a supermarket is shown in the stem-and-leaf diagram.

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

Key: 1 | 1 represents 11 items

(a) Find the mode.

..... [1]

(b) Find the median.

..... [1]

5 The table shows the relative frequency of the games won by a football team.

Result of game	won	lost	drawn
Relative frequency	0.1		

The number of games lost is twice the number of games drawn.

Complete the table.

[3]

6 The scale drawing shows the positions of two towns, P and Q.
The scale is 1 cm represents 4 km.

Scale: 1 cm to 4 km

(a) Find the actual distance between town P and town Q.

..... km [2]

(b) Measure the bearing of town Q from town P.

..... [1]

(c) Town X is 28 km from town P on a bearing of 140°.

On the scale drawing, mark the position of town X. [2]

7 **Without using a calculator**, work out $1\frac{5}{6}+\frac{2}{5}$.
You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

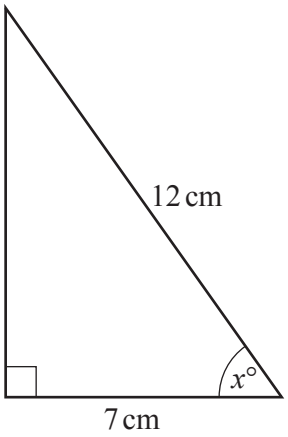
8 Solve the simultaneous equations.
You must show all your working.

$$4x-2y=-13$$
$$-3x+4y=\ \ 11$$

$x=$ .....

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

9



NOT TO SCALE

Calculate the value of x.

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

10 A regular polygon has an interior angle of 174°.

Find the number of sides of this polygon.

..... [2]

11 Line L has equation $y = 4 - 5x$.

Find the equation of a line that is perpendicular to line L and passes through the point (0, 6).

..... [3]

12 Chai invests some money.
By the end of the first year, the value of the investment has decreased by 35%.
By the end of the second year, the value of the investment has increased by 40% of its value at the end of the first year.

Find the overall percentage change in the value of the investment.

..... % [3]

13 Solve.

$$4-3x \geqslant \frac{6-x}{5}$$

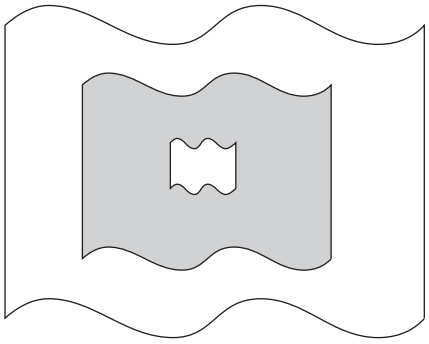
..... [3]

14 y is inversely proportional to the square root of $(x-2)$.
When $x = 4.25$, $y = 12$.

Find x when $y = 3$.

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

15



NOT TO SCALE

The diagram shows three shapes that are mathematically similar.
The heights of the shapes are in the ratio small : medium : large = 1 : 5 : 8.

Find the ratio shaded area : total unshaded area.
Give your answer in its simplest form.

..... : ..... [4]

16 Find the *n*th term of each sequence.

(a) 8, 15, 34, 71, 132, ...

..... [2]

(b) $\frac{2}{1}$, $\frac{3}{4}$, $\frac{4}{16}$, $\frac{5}{64}$, $\frac{6}{256}$, ...

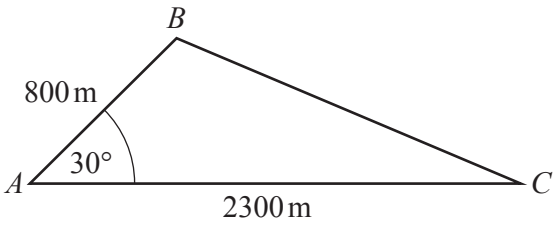
..... [3]

17 $y = \dfrac{3x-2}{1-x}$

Make x the subject of the formula.

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

18



NOT TO SCALE

The diagram shows some land in the shape of a triangle ABC.
Houses are built on this land.
Each house requires $400\,m^2$ of land.

Find the greatest number of houses that can be built on this land.

..... [3]

19 Write as a single fraction in its simplest form.

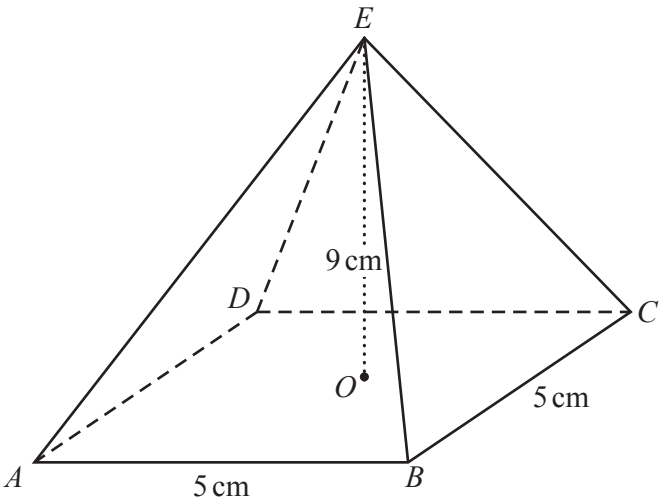
$$\frac{2}{x+3} - \frac{x+2}{7}$$

..... [3]

20 Solve $3(2+\cos x) = 5$ for $0° \leqslant x \leqslant 360°$.

..... [3]

21



NOT TO SCALE

The diagram shows a pyramid $ABCDE$.
The pyramid has a square horizontal base $ABCD$ with side 5 cm.
The vertex E is vertically above the centre O of the base.
The height OE of the pyramid is 9 cm.

Calculate the angle that EC makes with the base $ABCD$.

..... [4]

Question 22 is printed on the next page.

22 **(a)** Simplify.

$$\frac{x^{\frac{2}{3}}}{x^{\frac{8}{3}}}$$

..... [1]

(b) $16 = 64^{k}$

Find the value of k.

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

(c) Solve.

$$3^{3x} \times \left(\frac{1}{9}\right)^{4-3x} = 3$$

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

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MARK SCHEME

Maximum Mark: 70

Published

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[Turn over

PUBLISHED

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

Abbreviations

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

Question	Answer	Marks	Partial Marks
1	79	**2**	**B1** for 64 or 81 seen or for answer 61, 62, 67, 71 or 73
2(a)	Sunday 24 [July] 02 15	**3**	**B1** for Sunday 24th [July] as final answer **B2** for 02 15 oe as final answer or **B1** for sight of any of these 12 40 oe, 11 15 oe, 28h 35min, 50 15, 35 15 or 0215 oe spoilt or **M1** for departure time + 13h35min + 15h evaluated as a time with one interval correctly added
2(b)	6320.4[0]	**1**	
3	3.1	**1**	
4(a)	22	**1**	
4(b)	30	**1**	
5	lost | drawn 0.6 oe | 0.3 oe	**3**	**B2** for 0.6 oe or 0.3 oe or **M1** for 1 – 0.1 or 0.9 seen
6(a)	32.8	**2**	**M1** for 8[cm] to 8.4[cm] seen or for *their* measurement [in cm] multiplied by 4
6(b)	065	**1**	
6(c)	X correctly placed 7 cm from P on a bearing of 140°	**2**	**M1** for X on bearing of 140 from P or for X 7 cm from P If 0 scored **SC1** for X on bearing of 140 from Q **and** 7 cm from Q
7	$\frac{25 \text{ or } 55}{30}$ and $\frac{12}{30}$	**M1**	Accept $\frac{25k \text{ or } 55k}{30k}$ and $\frac{12k}{30k}$
	$2\frac{7}{30}$ cao	**A2**	**A1** for $\frac{67k}{30k}$ or $1\frac{37k}{30k}$

Question	Answer	Marks	Partial Marks
8	Correctly eliminates one variable	**M1**	
	$[x =] -3$, $[y =] 0.5$ oe	**A2**	**A1** for either correct If M0 scored, **SC1** for 2 values satisfying one of the original equations If 0 scored, **SC1** for correct answers from no working
9	54.3 or 54.31…	**2**	**M1** for $\cos [x] = \frac{7}{12}$ oe
10	60	**2**	**M1** for $360 \div (180 - 174)$ or for $\frac{180(n-2)}{n} = 174$ oe
11	$y = \frac{1}{5}x + 6$ oe final answer	**3**	**B2** for $y = \frac{1}{5}x + c$ oe or $\frac{1}{5}x + 6$ oe or $y = mx + 6$ oe or **B1** for [gradient =] $\frac{1}{5}$ oe or $mx + 6$
12	[–] 9	**3**	**M2** for $[k \times] \left(1 - \frac{35}{100}\right) \times \left(1 + \frac{40}{100}\right)$ oe or better or for $[k \times] \left(\frac{35}{100} - \left(1 - \frac{35}{100}\right) \times \frac{40}{100}\right)$ or **M1** for $[k \times] \left(1 - \frac{35}{100}\right)$ oe or $[k \times] \left(1 + \frac{40}{100}\right)$ or better
13	$x \leqslant 1$ final answer	**3**	**M1** for $20 - 15x \geqslant 6 - x$ or $4 - 3x \geqslant \frac{6}{5} - \frac{x}{5}$ **M1** for correctly isolating terms in x FT *their* first step of dealing with the 5 $20 - 6 \geqslant -x + 15x$ or $-3x + \frac{x}{5} \geqslant \frac{6}{5} - 4$

Question	Answer	Marks	Partial Marks
14	38	**3**	**M2** for $12\times\sqrt{4.25-2}=3\times\sqrt{x-2}$ OR **M1** for $y=\frac{k}{\sqrt{x-2}}$ oe **M1** for $3=\frac{their\ k}{\sqrt{x-2}}$ oe
15	3 : 5 nfww	**4**	**M3** for 5^2-1 oe and 8^2-5^2+1 oe or **M2** for 5^2-1 oe or 8^2-5^2+1 oe or **M1** for 5^2 oe or 8^2 oe seen
16(a)	n^3+7 oe final answer	**2**	**B1** for any cubic or for 3rd differences of 6
16(b)	$\frac{n+1}{4^{n-1}}$ oe final answer	**3**	**B1** for $n+1$ **B2** for 4^{n-1} oe or **B1** for 4^{n-k} oe k can be 0 Maximum 2 marks if not correctly combined as a fraction
17	$[x=]\ \frac{y+2}{y+3}$ oe final answer	**4**	**M1** $y(1-x)=3x-2$ or better **M1** for correctly isolating x terms on one side FT *their* first step/bracket expansion **M1dep** for correctly removing factor of x FT *their* previous step **M1dep** for correct division to isolate x Max 3 marks for an incorrect answer
18	1150	**3**	**M2** for $\left(\frac{1}{2}\times800\times2300\times\sin30\right)\div400$ oe or **M1** for $\frac{1}{2}\times800\times2300\times\sin30$ oe
19	$\frac{8-5x-x^2}{7(x+3)}$ or $\frac{8-5x-x^2}{7x+21}$ final answer	**3**	**B1** for $7\times2-(x+2)(x+3)$ or better seen **B1** for common denominator $7(x+3)$ oe isw

Question	Answer	Marks	Partial Marks
20	109.4 to 109.5 and 250.5 to 250.6	**3**	**B2** for one correct angle or **M1** for cos $x = \frac{5}{3} - 2$ or better If 0 scored **SC1** for two angles that sum to 360
21	68.6 or 68.55 to 68.56	**4**	**M3** for tan[..] = $\frac{9}{\frac{1}{2}\sqrt{5^2+5^2}}$ oe or **M2** for $\frac{1}{2}\sqrt{5^2+5^2}$ oe or **M1** for $5^2 + 5^2$ oe or $2.5^2 + 2.5^2$ oe or $x^2 + x^2 = 5^2$ oe or **B1** for indicating required angle
22(a)	x^{-2} or $\frac{1}{x^2}$ final answer	**1**	
22(b)	$\frac{2}{3}$	**1**	
22(c)	1 nfww	**3**	**M1** for $3^{-2(4-3x)}$ oe or better or $9^{\frac{3x}{2}} \times 9^{-(4-3x)} = 9^{\frac{1}{2}}$ oe or better **M1** for $3x + (their - 2) \times (4 - 3x) = 1$ oe or better or $their\frac{3x}{2} - (4-3x) = their\frac{1}{2}$ oe or better

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MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2021**

1 hour 30 minutes

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[Turn over

1 The temperature at midnight is −8.5 °C.
The temperature at 11 am is −1 °C.

Work out the difference between the temperature at midnight and the temperature at 11 am.

..... °C [1]

2 The stem-and-leaf diagram shows the age, in years, of each of 15 women.

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

Key: 3 | 1 represents 31 years

Complete these statements.

The modal age is .....

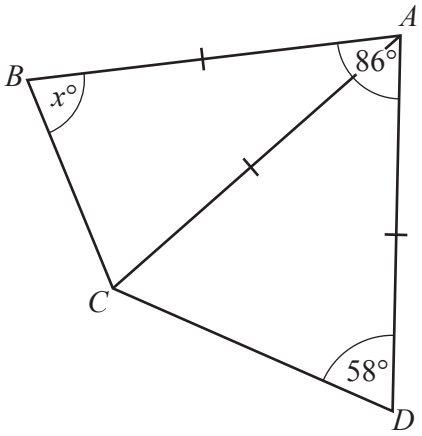
The median age is .....

The percentage of women that are older than 51 years is ..... %. [3]

3 Change 2.15 hours into minutes.

..... min [1]

4



NOT TO SCALE

Triangle ABC and triangle ACD are isosceles.
Angle $DAB = 86°$ and angle $ADC = 58°$.

Find the value of x.

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

5 Angelique rents a room for a party.
The cost of renting the room is \$15.50 for the first hour and then \$7.25 for each additional hour.
She pays \$95.25 in total.

Work out the total number of hours she rents the room for.

..... hours [3]

6 **Without using a calculator**, work out $\frac{1}{3} \div \frac{7}{6} + \frac{1}{5}$.

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

..... [4]

7 Katy has 5 white flowers, x red flowers and $(2x + 1)$ yellow flowers.
She picks a flower at random.

The probability that it is white is $\frac{1}{12}$.

Find the probability that it is yellow.

..... [4]

8 Calculate $\sqrt[4]{39\frac{1}{16}}$.

..... [1]

9 2.1×10^{-1} $0.\dot{2}$ 22% $\sqrt{0.2}$ $\frac{24}{1000}$

Write these values in order of size, starting with the smallest.

..... < ..... < ..... < ..... < ..... [2]
smallest

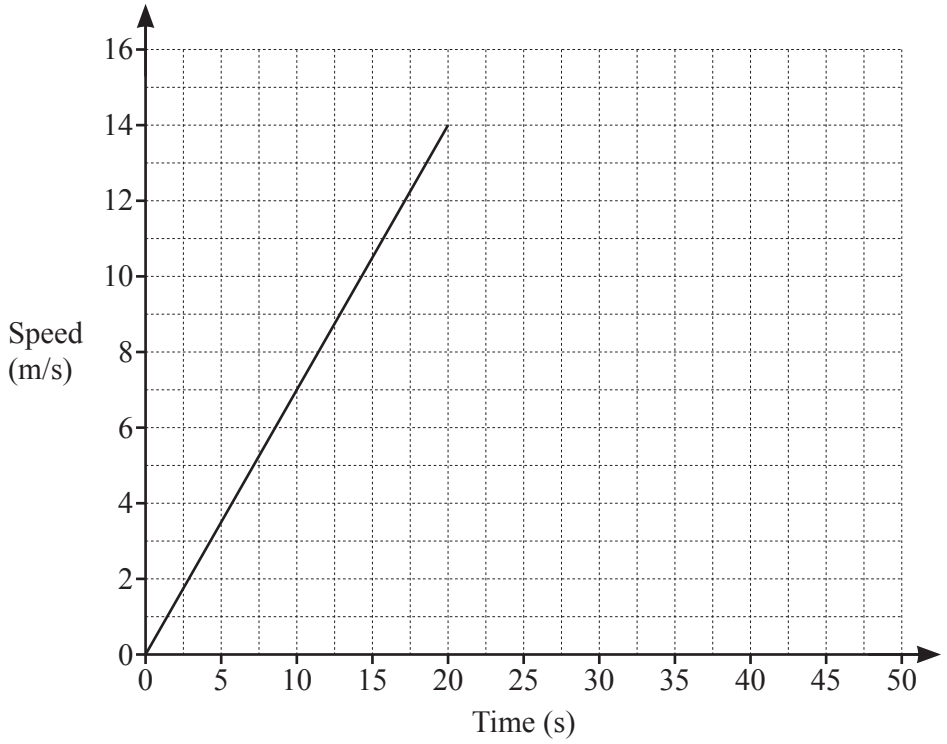
10 The interior angle of a regular polygon is 156°.

Work out the number of sides of this polygon.

..... [2]

11 A car starts its journey by accelerating from rest at a constant rate of 0.7 m/s^2 for 20 seconds, before reaching a constant speed of 14 m/s.
It then travels at 14 m/s for a distance of 210 m.
The car then decelerates at a constant rate of 1.4 m/s^2, before coming to a stop.

On the grid, complete the speed–time graph for the car's journey.



[3]

12 The table shows the first five terms of sequences A, B and C.

	1st term	2nd term	3rd term	4th term	5th term	nth term
Sequence A	8	3	-2	-7	-12	
Sequence B	2	$\frac{3}{2}$	$\frac{4}{3}$	$\frac{5}{4}$	$\frac{6}{5}$	
Sequence C	$\frac{1}{2}$	1	2	4	8	

Complete the table to show the nth term of each sequence.

[5]

13 **(a)** Write 243×27^{2n} as a single power of 3 in terms of n.

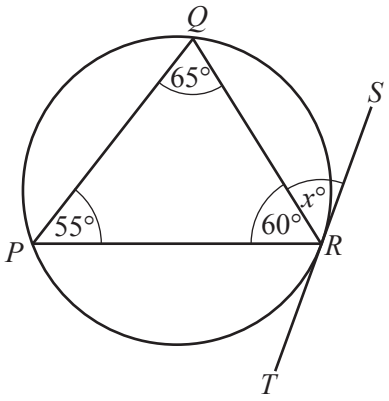
..... [2]

(b) $k = 2 \times 3^2 \times p^3$, where p is a prime number greater than 3.

Write $6k^2$ as a product of prime factors in terms of p.

..... [2]

14



NOT TO SCALE

P, Q and R are points on a circle.
ST is a tangent to the circle at R.

(a) Write down the value of x.
Give a geometrical reason for your answer.

$x =$ ..... because.....

..... [2]

(b) Another tangent from the point S touches the circle at V.

Give a geometrical reason why triangle SVR is isosceles.

.....

..... [1]

15 **(a)** A is the point (3, 16) and B is the point (8, 31).

Find the equation of the line that passes through A and B.
Give your answer in the form $y = mx + c$.

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

(b) The line CD has equation $y = 0.5x - 11$.

Find the gradient of a line that is perpendicular to the line CD.

..... [1]

[Turn over

16 Sachin picks a number at random from the first three multiples of 3.
He then picks a number at random from the first three prime numbers.
He adds the two numbers to find a score.

(a) Complete the table.

		Multiples of 3		
		3		9
Prime numbers	2	5		11
	3	6		

[2]

(b) Given that the score is even, find the probability that one of the numbers he picks is 9.

..... [2]

17 Solve.

$(5x-3)(2x+7)=0$

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

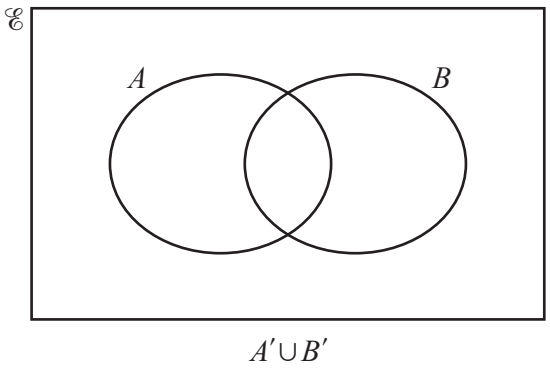
18 Solve the simultaneous equations.
You must show all your working.

$$y = x^2 - 9x + 21$$
$$y = 2x - 3$$

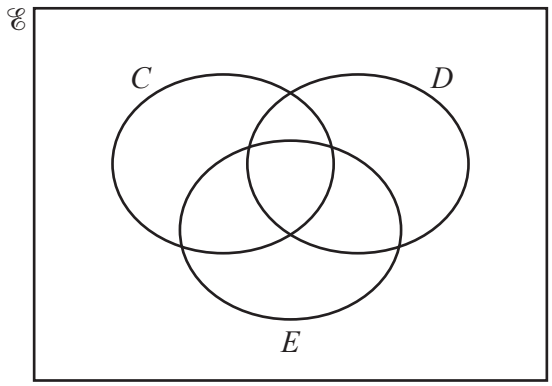
$x =$ ..... $y =$ .....

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

19 In these Venn diagrams, shade the given regions.



$A' \cup B'$



$(C \cup D) \cap E'$

[2]

20 $\mathrm{f}(x) = 2^{x-3}$ $\mathrm{g}(x) = 2x - 1$ $\mathrm{h}(x) = \dfrac{5}{x-4}$

(a) Find ff(6).

..... [2]

(b) Find $\mathrm{g}^{-1}\mathrm{g}(x+21)$.

..... [1]

(c) Find x when $\mathrm{f}(x) = \mathrm{h}(84)$.

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

21 Expand and simplify.

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

..... [3]

22 Solve the equation $7\sin x + 2 = 0$ for $0° \leqslant x \leqslant 360°$.

..... [3]

Question 23 is printed on the next page.

23 Simplify.

$$\frac{3xy + 36y - 5x - 60}{2x^2 - 288}$$

..... [4]

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GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

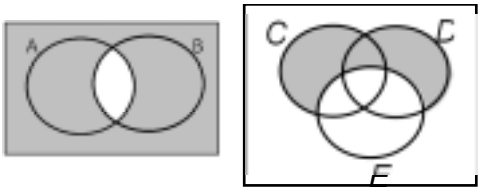
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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

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

Question	Answer	Marks	Partial Marks
1	7.5	**1**	
2	41 43 20	**3**	**B1** for each
3	129	**1**	
4	79 nfww	**3**	**M2** for $x + x + 58 + 58 + 86 = 360$ oe or $86 – (180 – 2 \times 58)$ implied by $CAB = 22$ or **B1** for $DCA = 58$ or $BCA = x$ or $DAC = 64$
5	12	**3**	**M2** for $(95.25 – 15.5) \div 7.25$ oe or $(95.25 – (15.5 – 7.25)) \div 7.25$ oe or **M1** for $95.25 – 15.5$ or **B1** for 79.75
6	$\frac{1}{3} \times \frac{6}{7}$ oe or $\frac{2}{6} \div \frac{7}{6}$ oe	**M1**	
	$\frac{2}{7}$ oe	**A1**	
	their $\frac{2}{7} + \frac{1}{5}$ with a correct method to find fractions with a common denominator	**M1**	e.g. $\frac{10}{35} + \frac{7}{35}$ oe
	$\frac{17}{35}$ cao	**A1**	If order of operations not correct **SC2** for answer $\frac{10}{41}$ with correct working for $\frac{1}{3} \div \left(\frac{7}{6} + \frac{1}{5}\right)$ or **SC1** for $\frac{35}{30} + \frac{6}{30}$ oe
7	$\frac{37}{60}$ oe	**4**	**B3** for $x = 18$ or 37 [yellow] or **SC2** for answer $\frac{5}{12}$ or **M2** for $\frac{1}{12} = \frac{5}{5+x+2x+1}$ oe or **M1** for $5 + x + 2x + 1$ oe or [total number of flowers =] 60

Question	Answer	Marks	Partial Marks
8	2.5 oe	**1**	
9	$\frac{24}{1000} < 2.1 \times 10^{-1} < 22\% < 0.\dot{2} < \sqrt{0.2}$	**2**	**M1** for four values in the correct order or for conversion to consistent comparable form e.g. 0.21, 0.22…, 0.22, 0.4.., 0.024
10	15	**2**	**M1** for $360 \div (180 - 156)$ or $\frac{180(n-2)}{n} = 156$ oe
11	Straight line from (20, 14) to (35, 14) and straight line from (35, 14) to (45, 0)	**3**	**M1** for $210 \div 14$ soi **M1** for $14 \div 1.4$ or any line with gradient –1.4 ending at x axis
12	$13 - 5n$ oe final answer $\frac{n+1}{n}$ oe final answer 2^{n-2} oe final answer	**5**	**B2** for $13 - 5n$ oe final answer or **B1** for $-5n + c$ or $13 - kn$ $k \neq 0$ or $13 - 5n$ seen then spoilt **B1** for $\frac{n+1}{n}$ oe final answer **B2** for 2^{n-2} oe final answer or **B1** for 2^{n-k} oe k can be 0
13(a)	3^{6n+5} final answer	**2**	**B1** for 3^5 or $(3^3)^{2n}$ or better or answer $6n + 5$
13(b)	$2^3 \times 3^5 \times p^6$ final answer	**2**	**B1** for two parts correct or $2 \times 3 \times 2 \times 3^2 \times p^3 \times 2 \times 3^2 \times p^3$ or $1944p^6$ or $k^2 = 2^2 \times 3^4 \times p^6$
14(a)	55 Alternate segment theorem	**2**	**B1** for 55
14(b)	Tangents from an external point are equal in length	**1**	
15(a)	$[y =] 3x + 7$ final answer	**3**	**M1** for $\frac{31-16}{8-3}$. oe **M1** for correct substitution of (3, 16) or (8, 31) into $y = (\textit{their } m)x + c$
15(b)	–2	**1**	

Question	Answer	Marks	Partial Marks
16(a)	Multiples of 3 Prime numbers + | 3 | **6** | 9 2 | 5 | **8** | 11 3 | 6 | **9** | **12** **5** | **8** | **11** | **14**	**2**	**B1** for at least 4 correct entries
16(b)	$\frac{2}{5}$ oe	**2**	**B2FT** for $\frac{their\,2}{their\,5}$ or **B1FT** for $\frac{their\,2}{k}$ k is any integer in the range $1 \leqslant k \leqslant 7$ or $\frac{c}{their\,5}$ c is 0, 1 or 2
17	$\frac{3}{5}$ oe and $-\frac{7}{2}$ oe	**1**	
18	$x^2 - 11x + 24$ [= 0] or $y^2 - 16y + 39$ [= 0]	**M2**	**M1** for $x^2 - 9x + 21 = 2x - 3$ oe or $y = \left(\frac{y+3}{2}\right)^2 - 9\left(\frac{y+3}{2}\right) + 21$ oe
	$(x - 8)(x - 3)$ [= 0] or $(y - 13)(y - 3)$ [= 0]	**M1**	or for correct factors for *their* quadratic equation or for correct use of quadratic formula for *their* equation
	[x =] 3 [y =] 3 [x =] 8 [y =] 13	**B2**	**B1** for one correct pair or two correct x values or two correct y values. If B0 scored **and** at least 2 method marks scored **SC1** for correct substitution of both of *their* x values or *their* y values into $y = x^2 - 9x + 21$ or $y = 2x - 3$
19		**2**	**B1** for each
20(a)	32	**2**	**M1** for f(6) = 8 or $\text{ff}(x) = 2^{\left(2^{x-3}\right)-3}$ oe

Question	Answer	Marks	Partial Marks
20(b)	$x + 21$	**1**	
20(c)	-1	**2**	**M1** for $\frac{1}{16}$ oe or 2^{-4} oe
21	$2x^3 - 7x^2 - 12x + 45$ final answer	**3**	**B2** for unsimplified expansion of the three brackets with at most one error or for simplified four-term expression of correct form with three terms correct or **B1** for correct expansion of two of the given brackets with at least three terms out of four correct
22	196.6 or 196.60… and 343.4 or 343.39…	**3**	**B2** for one correct angle or **M1** for $\sin x = -\frac{2}{7}$ or better If 0 scored **SC1** for two angles that sum to 540°
23	$\frac{3y-5}{2(x-12)}$ or $\frac{3y-5}{2x-24}$ final answer	**4**	**SC3** for answer $\frac{3y-5}{x-12}$ or **B3** for $(3y - 5)(x + 12)$ **and** $2(x - 12)(x + 12)$ or $(2x - 24)(x + 12)$ or **B2** for $(3y - 5)(x + 12)$ or $2(x - 12)(x + 12)$ or $(2x - 24)(x + 12)$ or $(2x + 24)(x - 12)$ or **B1** for $3y(x + 12) - 5(x + 12)$ or $x(3y - 5) + 12(3y - 5)$ or $2(x^2 - 144)$ or $(x - 12)(x + 12)$

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CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

2897957022

MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2021**

1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

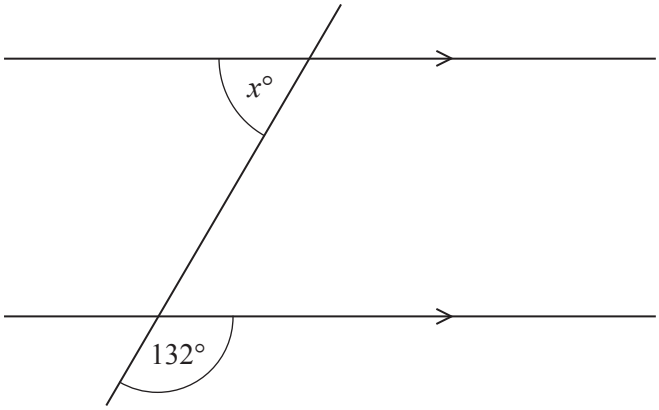
- The total mark for this paper is 70.
- The number of marks for each question or part question is shown in brackets [ ].

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

1 Write 26 g as a percentage of 208 g.

..... % [1]

2



NOT TO SCALE

The diagram shows two parallel lines intersecting a straight line.

Find the value of x.

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

3

11 13 15 17 19

From this list, write down the number that is both a prime number and a factor of 195.

..... [1]

4 **(a)** = ≠ > <

Put a ring around each of the symbols that make this statement correct.

0.5 ..... 5% [1]

(b) Insert one pair of brackets to make this statement correct.

$7 - 3 - 1 + 2 = 7$ [1]

5 Nina changes 153 euros into dollars when the exchange rate is \$1 = 0.9 euros.

Calculate the amount Nina receives.

\$ ..... [1]

6 Marek buys a computer for \$420.
He sells it at a loss of 15%.

Calculate the selling price of this computer.

\$ ..... [2]

7 Simplify.

$32g^{32} \div 4g^{4}$

..... [2]

8 Beatrice walks 1 km at a speed of 4 km/h and then 2 km at a speed of 4.5 km/h.

Work out Beatrice's average speed for the whole journey.

..... km/h [3]

9 Write the recurring decimal $0.\dot{2}\dot{7}$ as a fraction.

..... [1]

10 These are the first four terms of a sequence.

$$3 \quad -1 \quad -5 \quad -9$$

(a) Find the next term in this sequence.

..... [1]

(b) Find the nth term.

..... [2]

11 $P = M(g^2 + h^2)$

(a) Find the value of P when $M = 100$, $g = 3$ and $h = 4.5$.

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

(b) Rearrange the formula to write g in terms of P, M and h.

$g =$ ..... [3]

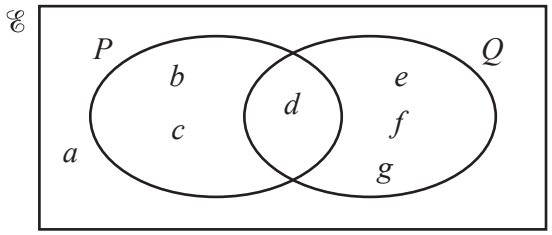
12 **Without using a calculator**, work out $\frac{11}{12} + \frac{3}{4}$.
You must show all your working and give your answer as a mixed number in its simplest form.

..... [3]

13 Calculate $0.04^2 + 0.03 \times 0.28$.
Give your answer in standard form.

..... [2]

14



(a) Complete the statement.

$P \cup Q = \{$ ..... $\}$ [1]

(b) Find $n(Q)$.

..... [1]

(c) Find $n(P' \cap Q)$.

..... [1]

15 The cost of a train journey is increased by 6% to a new cost of \$153.70 .

Calculate the original cost of the train journey.

\$ ..... [2]

16 Jo and Mo share \$26.
Jo receives \$5 more than Mo.

Find the ratio Jo's money : Mo's money.
Give your answer in its simplest form.

..... : ..... [3]

17 Each interior angle of a regular polygon is 178.5°.

Calculate the number of sides of this polygon.

..... [2]

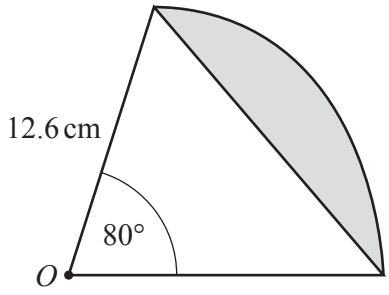
18 Find the equation of the straight line that passes through the points (2, −2) and (3, 10).

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

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

[Turn over

19



NOT TO SCALE

The diagram shows a sector of a circle, centre O, radius 12.6 cm.

Calculate the perimeter of the shaded segment.

..... cm [4]

20 A lake has an area of 3 km^2.
On a map the area of the lake is 18.75 cm^2.

Find the scale of the map in the form 1 : n.

1 : ..... [3]

21 Simplify fully.

$$\left(243y^{10}\right)^{\frac{3}{5}}$$

..... [2]

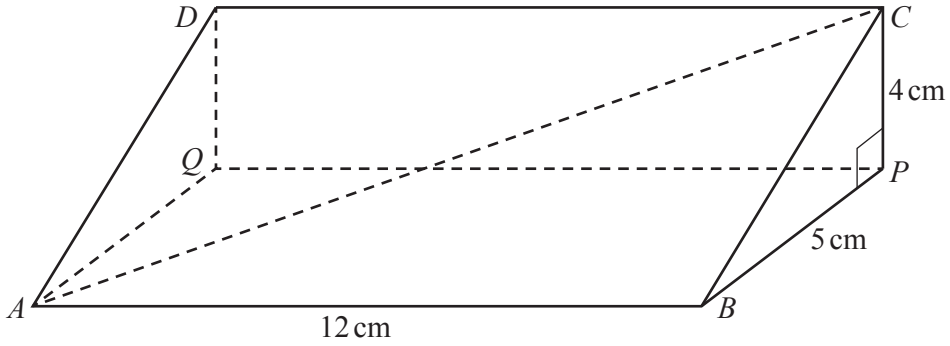
22 Solve the simultaneous equations.
You must show all your working.

$$y = x^2 - 3x - 13$$
$$y = x - 1$$

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

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

23



NOT TO SCALE

The diagram shows a triangular prism.
Angle $BPC = 90°$.

(a) Calculate AC.

$AC =$ ..... cm [3]

(b) Calculate the angle between AC and the base $ABPQ$.

..... [3]

24 $\tan x = \sqrt{3}$ and $0° \leqslant x \leqslant 360°$.

Find all the possible values of x.

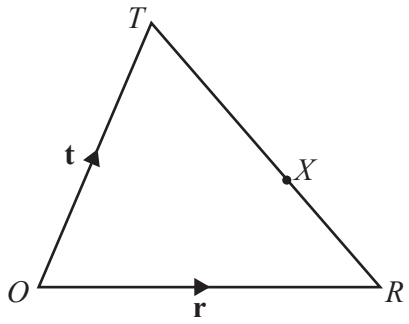
..... [2]

25 Simplify.

$$\frac{3x^2 - 18x}{ax - 6a + 2cx - 12c}$$

..... [4]

26



NOT TO SCALE

ORT is a triangle.
X is a point on *TR* so that $TX : XR = 3 : 2$.
O is the origin, $\overrightarrow{OR} = \mathbf{r}$ and $\overrightarrow{OT} = \mathbf{t}$.

Find the position vector of *X*.
Give your answer in terms of **r** and **t** in its simplest form.

..... [3]

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MATHEMATICS **0580/23**

Paper 2 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 70

Published

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

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

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

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

[Turn over

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

Abbreviations

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

Question	Answer	Marks	Partial Marks
1	12.5	**1**	
2	48	**2**	**B1** for 132 or 48 in the correct position on the diagram or **M1** for 180 – 132
3	13	**1**	
4(a)	$\neq$ and $>$ indicated	**1**	
4(b)	$7 - (3 - 1) + 2 = 7$ cao	**1**	
5	170	**1**	
6	357	**2**	**M1** for $\left(1-\frac{15}{100}\right)\times 420$ oe or **B1** for 63
7	$8g^{28}$ final answer	**2**	**B1** for kg^{28} or $8g^{k}$ as final answer or correct answer seen and spoilt
8	4.32	**3**	**B1** for $\frac{1}{4}$ oe or $\frac{2}{4.5}$ oe seen **M1 dep** on **B1** for $\frac{1+2}{their\frac{1}{4}+their\frac{2}{4.5}}$ oe
9	$\frac{3}{11}$ oe fraction	**1**	
10(a)	–13	**1**	
10(b)	$-4n + 7$ oe final answer	**2**	**B1** for $-4n + k$ or $jn + 7$ ($j \neq 0$) or for a correct answer spoilt
11(a)	2925	**2**	**M1** for $100(3^2 + 4.5^2)$ or **B1** for 29.25 seen
11(b)	$[\pm]\sqrt{\frac{P}{M}-h^2}$ or $[\pm]\sqrt{\frac{P-Mh^2}{M}}$ final answer	**3**	**M1** for correct division by M **M1** for correct re-arrangement to isolate g or g^2 **M1** for correct square root of two term expression Max **2** marks for an incorrect answer
12	$\frac{11}{12}+\frac{9}{12}$ oe	**M1**	Allow any correct common denominator $12k$
	$1\frac{2}{3}$ cao	**A2**	**A1** for $\frac{20}{12}$ or equivalent improper fraction or mixed number

Question	Answer	Marks	Partial Marks
13	$1[.0] \times 10^{-2}$ cao	**2**	**B1** for 0.01 oe
14(a)	*b*, *c*, *d*, *e*, *f*, *g*	**1**	
14(b)	4	**1**	
14(c)	3	**1**	
15	145	**2**	**M1** for $x\left(1+\frac{6}{100}\right) = 153.7$ oe or better
16	31 : 21	**3**	**B2** for equivalents e.g. 15.5 oe and 10.5 oe or for an equivalent ratio e.g. 3.1 : 2.1 or **M1** for e.g. $x + 5 + x = 26$ oe or $x - 5 + x = 26$ oe
17	240	**2**	**M1** for $360 \div (180 - 178.5)$ oe or for $\frac{180(n-2)}{n} = 178.5$ oe
18	[y =] $12x - 26$ final answer	**3**	**M1** for $\frac{10 - -2}{3 - 2}$ oe **M1** for correct substitution of (2, –2) or (3, 10) into $y = (their\ m)x + c$ oe
19	33.8 or 33.78 to 33.80	**4**	**M2** for $2 \times 12.6 \times \sin 40$ oe or **M1** for $\sin 40 = \frac{(...)}{12.6}$ oe **M1** for $\frac{80}{360} \times 2 \times \pi \times 12.6$ oe
20	40 000	**3**	**B2** for 1 cm to 0.4 km or 2.5 cm to 1 km or 1 600 000 000 or **M2** for $\sqrt{\frac{3 \times 10^k}{18.75}}$ oe where $k > 5$ or **M1** for 1 cm^2 to 0.16 km^2 or 6.25 cm^2 to 1 km^2 or for 3×10^{10} oe or 1.875×10^{-9} oe or 3×10^6 oe **and** 1.875×10^{-3} oe
21	$27y^6$ final answer	**2**	**B1** for ky^6 or $27y^k$ as final answer or correct answer seen and spoilt

Question	Answer	Marks	Partial Marks
22	$x^2 - 4x - 12$ [= 0] or $y^2 - 2y - 15$ [= 0]	**M2**	**M1** for $x^2 - 3x - 13 = x - 1$ or for $y = (y + 1)^2 - 3(y + 1) - 13$
	$(x - 6)(x + 2)$ [= 0] or $(y - 5)(y + 3)$ [= 0]	**M1**	or for correct factors for *their* quadratic equation or for correct use of quadratic formula or completing the square for *their* equation
	[x =] 6, [y =] 5 [x =] –2, [y =] –3	**B2**	**B1** for one correct pair or two correct x values or two correct y values If **B0** scored **and** at least 2 method marks scored **SC1** for correct substitution of both of *their* x values or *their* y values into $y = x^2 - 3x - 13$ or $y = x - 1$
23(a)	13.6 or 13.60…	**3**	**M2** for $12^2 + 5^2 + 4^2$ or **M1** for $5^2 + 4^2$ or $12^2 + 4^2$ or $12^2 + 5^2$
23(b)	17.1 or 17.08 to 17.10…	**3**	**M2** for $\sin = \frac{4}{\textit{their}\ \textbf{(a)}}$ oe or $\tan = \frac{4}{\textit{their}\ AP}$ or $\cos = \frac{\textit{their}\ AP}{\textit{their}\ \textbf{(a)}}$ or **M1** for recognising angle CAP.
24	60 and 240	**2**	**B1** for 60 or 240 If 0 scored **SC1** for two answers with a difference of 180°
25	$\frac{3x}{a + 2c}$ final answer	**4**	**B1** for $3x(x - 6)$ **B2** for $(x - 6)(a + 2c)$ or **B1** for $a(x - 6) + 2c(x - 6)$ or $x(a + 2c) - 6(a + 2c)$
26	$\frac{3}{5}\mathbf{r} + \frac{2}{5}\mathbf{t}$ or $\frac{1}{5}(3\mathbf{r} + 2\mathbf{t})$	**3**	**M2** for $\mathbf{r} + \frac{2}{5}(-\mathbf{r} + \mathbf{t})$ oe or $\mathbf{t} + \frac{3}{5}(\mathbf{r} - \mathbf{t})$ oe or **M1** for $\overrightarrow{RT} = -\mathbf{r} + \mathbf{t}$ oe or $\overrightarrow{TR} = \mathbf{r} - \mathbf{t}$ **M1** for $\overrightarrow{OR} + \overrightarrow{RX}$ or $\overrightarrow{OT} + \overrightarrow{TX}$ any other correct route.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7746514111

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

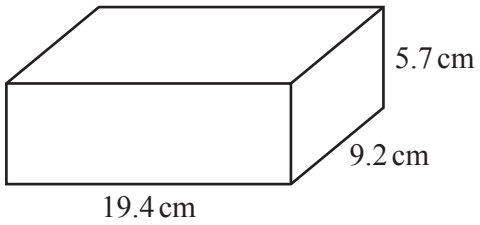
INFORMATION

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

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

[Turn over

1 **(a)**



NOT TO SCALE

The diagram shows a brick in the shape of a cuboid.

(i) Calculate the total surface area of the brick.

..... cm^2 [3]

(ii) The density of the brick is $1.9\,g/cm^3$.

Work out the mass of the brick.
Give your answer in kilograms.
[Density = mass ÷ volume]

..... kg [3]

(b) 9000 bricks are needed to build a house.
200 bricks cost $175.

Work out the cost of the bricks needed to build 5 houses.

$ ..... [3]

(c) Saskia builds a wall using 1500 bricks.
She can build at the rate of 40 bricks each hour.
She works for 9 hours each day.
Saskia starts work on 6 July and works every day until the wall is completed.

Find the date when she completes the wall.

..... [3]

(d) Rafa has a cylindrical tank.
The cylinder has a height of 105 cm and a diameter of 45 cm.

Calculate the capacity of the tank in litres.

..... litres [3]

2 Bob, Chao and Mei take part in a run for charity.

(a) Their times to complete the run are in the ratio Bob : Chao : Mei = 4 : 5 : 7.

(i) Find Chao's time as a percentage of Mei's time.

..... % [1]

(ii) Bob's time for the run is 55 minutes 40 seconds.

Find Mei's time for the run.
Give your answer in minutes and seconds.

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

(b) Chao collects $47.50 for charity.

(i) Bob collects 28% more than Chao.

Find the amount Bob collects.

$ ..... [2]

(ii) Chao collects 60% less than Mei.

Find how much more money Mei collects than Chao.

$ ..... [3]

(c) When running, Chao has a stride length of 70 cm, correct to the nearest 5 cm.
Chao runs a distance of 11.2 km, correct to the nearest 0.1 km.

Work out the minimum number of strides that Chao could take to complete this distance.

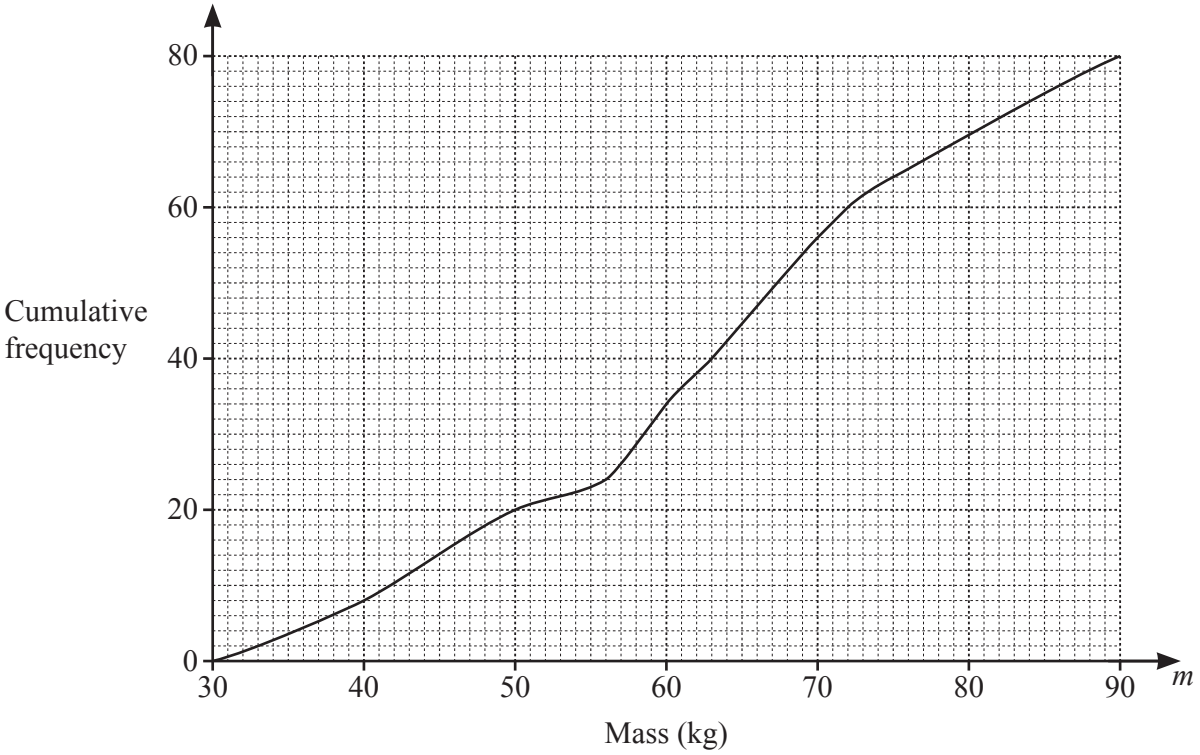
..... [4]

(d) In 2015, a charity raised a total of $1.6 million.
After 2015, this amount increased exponentially by 2.4% each year for the next 5 years.

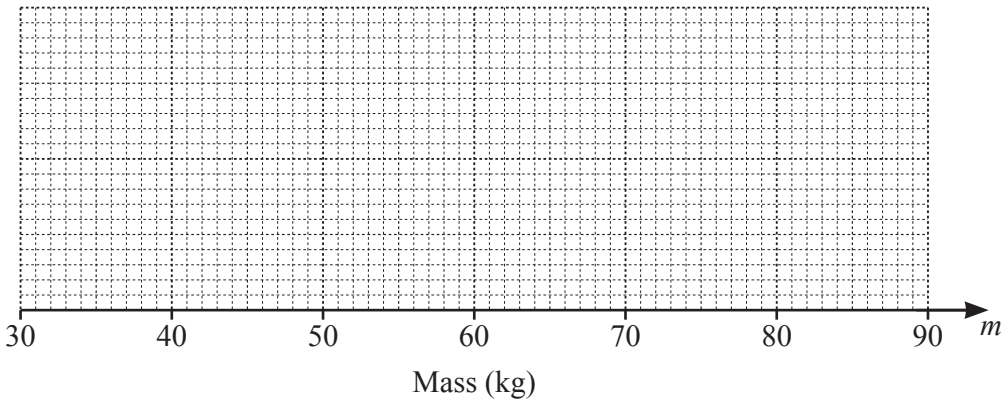
Work out the amount raised by the charity in 2020.

$ ..... million [2]

3 The cumulative frequency diagram shows information about the mass, m kg, of each of 80 boys.



(a)



On the grid, draw a box-and-whisker plot to show the information in the cumulative frequency diagram. [4]

(b) Use the cumulative frequency diagram to find an estimate of

(i) the 30th percentile,

..... kg [2]

(ii) the number of boys with a mass greater than 75 kg.

..... [2]

(c) (i) Use the cumulative frequency diagram to complete this frequency table.

Mass (m kg)	$30 < m \leqslant 40$	$40 < m \leqslant 50$	$50 < m \leqslant 60$	$60 < m \leqslant 70$	$70 < m \leqslant 80$	$80 < m \leqslant 90$
Frequency	8	12			14	10

[1]

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

..... kg [4]

(iii) Two boys are chosen at random from those with a mass greater than 70 kg.

Find the probability that one of them has a mass greater than 80 kg and the other has a mass of 80 kg or less.

..... [3]

[Turn over

4 **(a)** Solve.

(i) $6(7-2x) = 3x-8$

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

(ii) $\frac{2x}{x-5} = \frac{2}{3}$

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

(b) Factorise completely.

(i) $2x^2 - 288y^2$

..... [3]

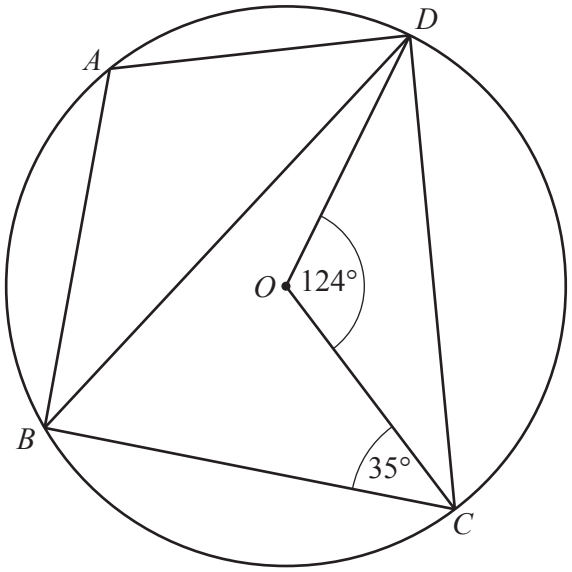
(ii) $5x^2 + 17x - 40$

..... [2]

(c) Solve $x^3 + 4x^2 - 17x = x^3 - 9$.
You must show all your working and give your answers correct to 2 decimal places.

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

5 (a)



NOT TO SCALE

A, B, C and D are points on a circle, centre O.
Angle $COD = 124°$ and angle $BCO = 35°$.

(i) Work out angle CBD.
Give a geometrical reason for your answer.

Angle CBD = ... because .....

..... [2]

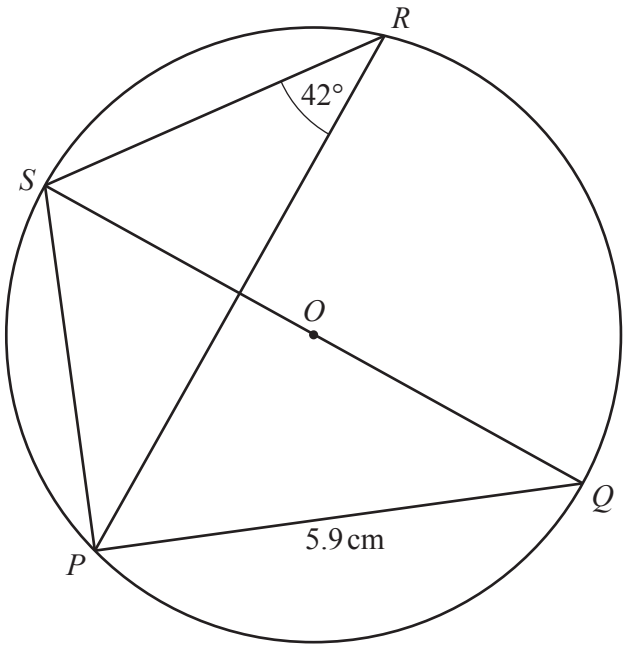
(ii) Work out angle BAD.
Give a geometrical reason for each step of your working.

Angle BAD = ... because .....

.....

..... [4]

(b)



NOT TO SCALE

P, Q, R and S are points on a circle, centre O.
QS is a diameter.
Angle $PRS = 42°$ and $PQ = 5.9$ cm.

Calculate the circumference of the circle.

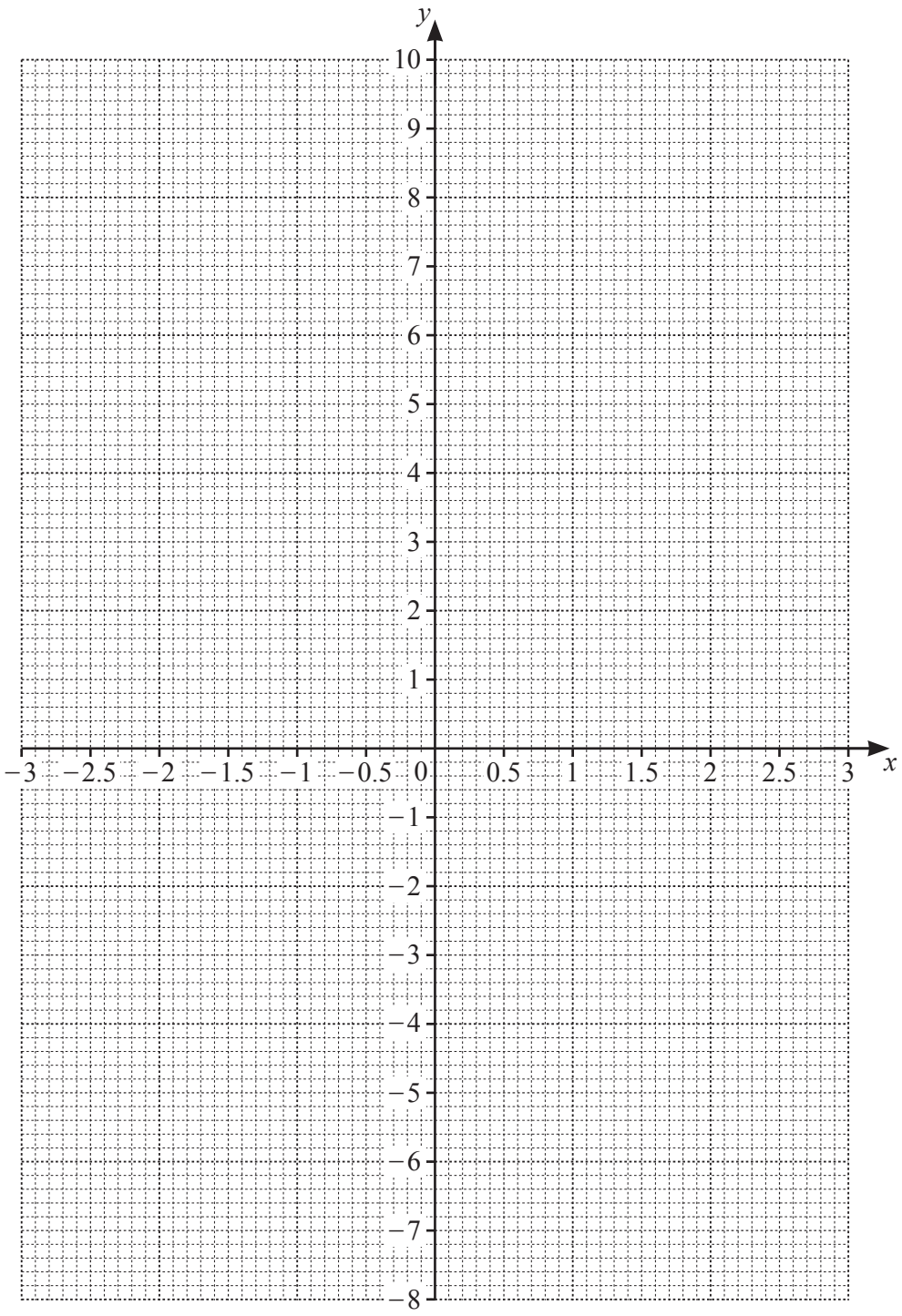
..... cm [5]

6 The table shows some values for $y = x^2 - \frac{3}{2x}$, $x \neq 0$, given correct to 1 decimal place.

x	-3	-2	-1	-0.5	-0.2		0.2	0.5	1	2	3
y			2.5	3.3	7.5		-7.5	-2.8	-0.5	3.3	

(a) (i) Complete the table. [3]

(ii) On the grid, draw the graph of $y = x^2 - \frac{3}{2x}$ for $-3 \leqslant x \leqslant -0.2$ and $0.2 \leqslant x \leqslant 3$.



[5]

(b) By drawing a suitable straight line on the grid, solve the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ for $-3 \leqslant x \leqslant -0.2$ and $0.2 \leqslant x \leqslant 3$.

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

(c) The solutions to the equation $x^2 - \frac{3}{2x} = \frac{24}{5} - 2x$ are also the solutions to an equation of the form $ax^3 + bx^2 + cx - 15 = 0$ where a, b and c are integers.

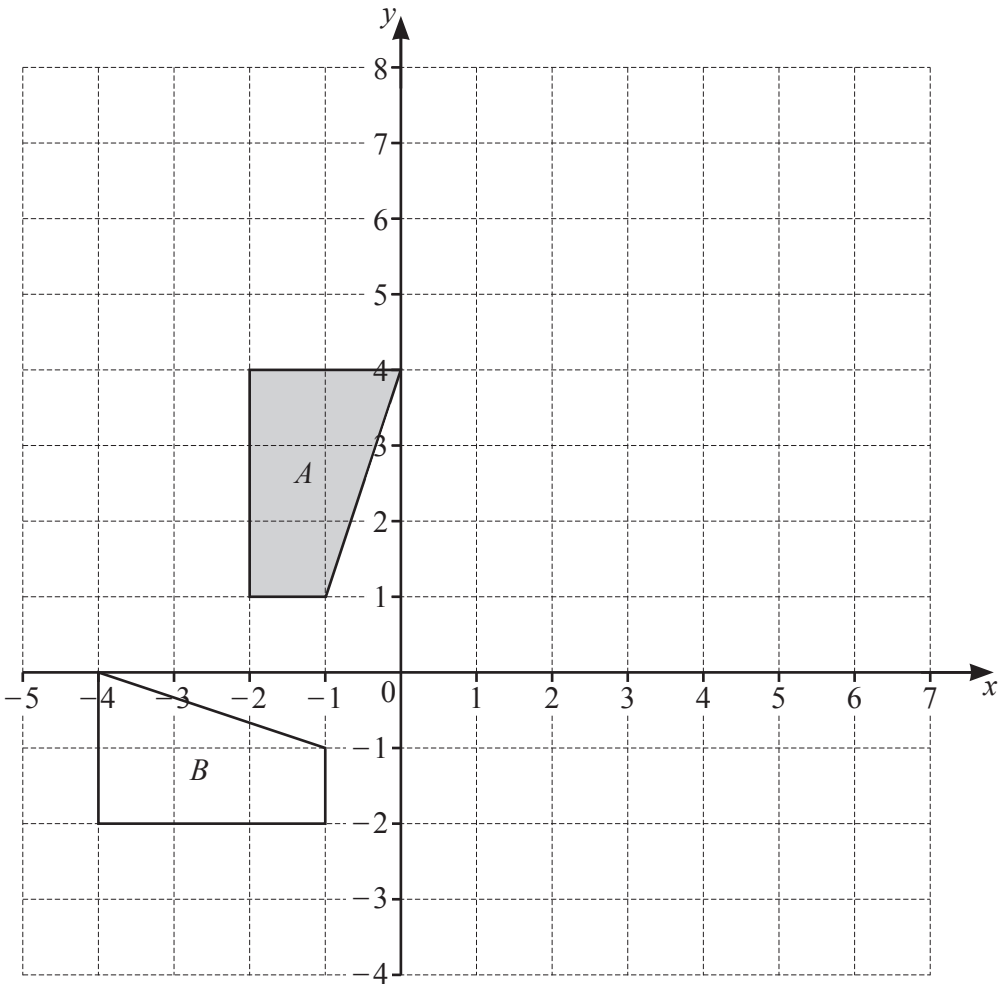
Find the values of a, b and c.

$a =$ .....

$b =$ .....

$c =$ ..... [4]

7 (a)



(i) On the grid, draw the image of

(a) shape A after an enlargement, scale factor 2, centre (0, 1), [2]

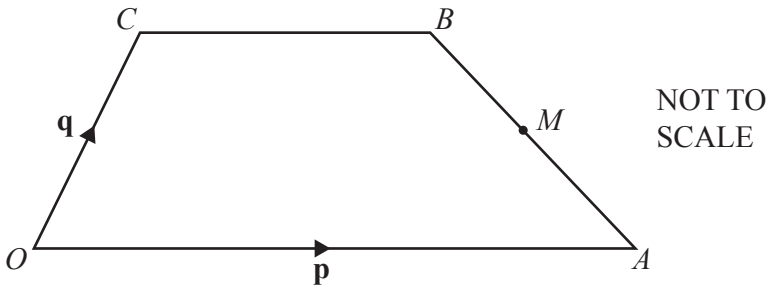
(b) shape A after a reflection in the line $y = x - 1$. [3]

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

.....

..... [3]

(b)



NOT TO SCALE

$OABC$ is a trapezium and O is the origin.
M is the midpoint of AB.
$\overrightarrow{OA} = \mathbf{p}$, $\overrightarrow{OC} = \mathbf{q}$ and $OA = 2CB$.

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

..... [3]

8 **(a)** $f(x) = 3 - 5x$

(i) Find x when $f(x) = -5$.

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

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

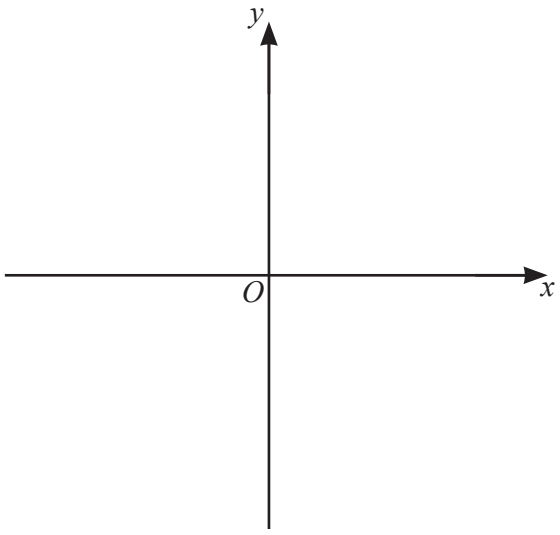
$f^{-1}(x) =$ ..... [2]

(b) $g(x) = 18 - 3x - x^2$

(i) Write $g(x)$ in the form $b - (a + x)^2$.

..... [3]

(ii) Sketch the graph of $y = g(x)$.
On your sketch, show the coordinates of the turning point.

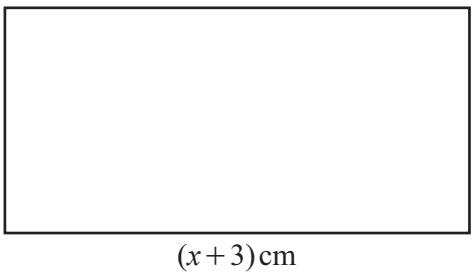


[3]

(iii) Find the equation of the tangent to the graph of $y = 18 - 3x - x^2$ at $x = 4$.
Give your answer in the form $y = mx + c$.

$y =$ ..... [6]

9 **(a)**



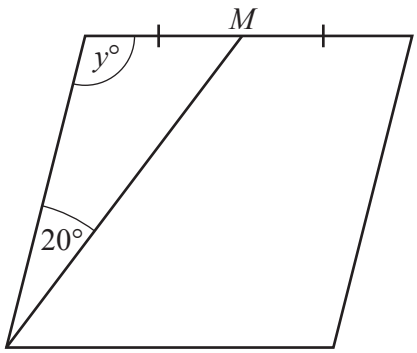
NOT TO SCALE

This rectangle has perimeter 20 cm.

Find the value of x.

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

(b)



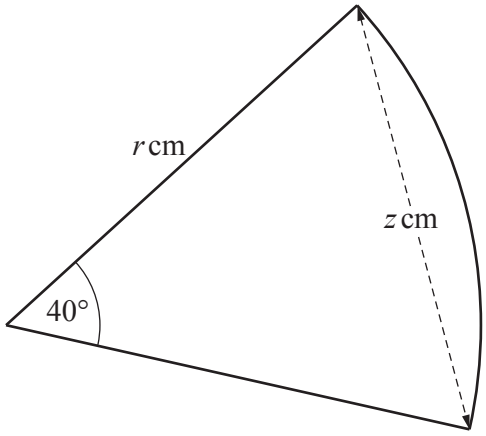
NOT TO SCALE

This rhombus has perimeter 20 cm and angle y is obtuse.
M is the midpoint of one of the sides.

Find the value of y.

$y =$ ..... [5]

(c)



NOT TO SCALE

This sector of a circle has radius r and perimeter 20 cm.

Find the value of z.

$z =$ ..... [6]

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Cambridge Assessment International Education

Cambridge IGCSE™

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

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

[Turn over

PUBLISHED

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

Abbreviations

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

Question	Answer	Marks	Partial Marks
1(a)(i)	683	**3**	**M2** for [2]((19.4 × 9.2) + (5.7 × 9.2) + (19.4 × 5.7)) oe or **M1** for one of 19.4 × 9.2 or 5.7 × 9.2 or 19.4 × 5.7
1(a)(ii)	1.93[0] or 1.932 to 1.933	**3**	**M2** for 19.4 × 9.2 × 5.7 × 1.9 or **M1** for 19.4 × 9.2 × 5.7
1(b)	39 375	**3**	**M2** for 9000 ÷ 200 × 175 × 5 or **M1** for 9000 ÷ 200 soi or for $\frac{175}{200}$ soi
1(c)	10th July	**3**	**B2** for 4.1 to 4.2 or $4\frac{1}{6}$ or 4 days 1.5 hours Or **M2** for answer 9th July or 11th July or **M1** for 1500 ÷ (9 × 40)
1(d)	167 or 166.9 to 167.0…	**3**	**B2** for answer with figs 167 or figs 1669 to 1670.. or **M1** for $\pi \times 22.5^2 \times 105$ oe If 0 scored **SC1** for answer 668 or 667.9 to 668.1
2(a)(i)	71.4 or 71.42 to 71.43	**1**	
2(a)(ii)	97 [min] 25 [s]	**3**	**B2** for 13 min 55 sec seen or 97.4 or 97.41 to 97.42 seen or 5845 seen OR **M2** for 55.66… ÷ 4 × 7 oe or 3340 ÷ 4 × 7 oe or for 7/4 × 55 + 7/4 × 40 oe or **M1** for 55 min 40 sec ÷ 4 oe or **M1** for **total time** ÷ 16 soi
2(b)(i)	60.8[0]	**2**	**M1** for $47.5 \times \left(1+\frac{28}{100}\right)$ oe or **B1** for 13.3[0]
2(b)(ii)	71.25	**3**	**B2** for 118.75 Or **M2** for $47.50 \div \left(1-\frac{60}{100}\right) - 47.50$ or **M1** for $x \times \left(1-\frac{60}{100}\right) = 47.50$ oe or better

Question	Answer	Marks	Partial Marks
2(c)	15 380	**4**	**M3** for (1 120 000 – 5000) ÷ (70 + 2.5) oe or **B2** for answer figs 15 379 to figs 15 380 or **M2** for (1 120 000 ± 5000) ÷ (70 ± 2.5) oe or **M1** for one of figs 675, 725, 1115, 1125 seen
2(d)	1.8[0] or 1.801 to 1.802 [million] nfww	**2**	**M1** for figs $16 \times \left(1+\frac{2.4}{100}\right)^5$ oe
3(a)	Correct box-and-whisker plot	**4**	**B1** for lowest value and highest value at 30 and 90 **B1** for LQ and UQ at 50 and 72 **B1** for median at 63
3(b)(i)	56	**2**	**M1** for 24 soi
3(b)(ii)	16	**2**	**B1** for 64 written
3(c)(i)	14, 22	**1**	
3(c)(ii)	61.5	**4**	**M1** for 35, 45, 55, 65, 75, 85 soi **M1** for Σfx **M1 dep** for *their* Σfx ÷ (8 + 12 + *their* 14 + *their* 22 + 14 + 10) or Σfx ÷ 80
3(c)(iii)	$\frac{35}{69}$ oe	**3**	**M2** for [2] $\left(\frac{10}{24}\times\frac{14}{23}\right)$ oe or **M1** for $\frac{10}{24}$ or $\frac{14}{24}$ oe seen If 0 scored, **SC1** for answer $\frac{35}{72}$ oe
4(a)(i)	$\frac{10}{3}$ or $3\frac{1}{3}$ or 3.33[3…]	**3**	**M1** for $42 - 12x = 3x - 8$ oe or for $7 - 2x = \frac{3x}{6} - \frac{8}{6}$ oe **M1** for reaching $ax = b$ correctly FT *their* first step
4(a)(ii)	–2.5 or $-2\frac{1}{2}$ or $-\frac{5}{2}$	**3**	**M1** for $3 \times 2x = 2(x - 5)$ oe **M1** for reaching $ax = b$ correctly FT *their* first step

Question	Answer	Marks	Partial Marks
4(b)(i)	$2(x + 12y)(x – 12y)$ final answer	**3**	**B2** for $(2x + 24y)(x – 12y)$ or $(2x – 24y)(x + 12y)$ or for $2(x + 12y)(x – 12y)$ seen OR **M2** for $k(x + 12y)(x – 12y)$ or **M1** for $2(x^2 – 144y^2)$
4(b)(ii)	$(5x – 8)(x + 5)$ final answer	**2**	**M1** for $5x(x + 5) – 8(x + 5)$ or $x(5x – 8) + 5(5x – 8)$ or for $(5x + a)(x + b)$ where $ab = – 40$ or $a + 5b = 17$
4(c)	$4x^2 – 17x + 9$ [= 0] oe	**B1**	
	$\frac{[- -]17 \pm \sqrt{([-]17)^2 - 4(4)(9)}}{2 \times 4}$	**B2**	**FT** *their* 3 term quadratic **B1FT** for $\sqrt{([-]17)^2 - 4(4)(9))}$ or better or $\left(x - \frac{17}{8}\right)^2$ oe or $\sqrt{\frac{([-]17)^2 - 4(4)(9)}{4}}$ or better and **B1FT** for $\frac{[- -]17 + \sqrt{q}}{2(4)}$ or $\frac{[- -]17 - \sqrt{q}}{2(4)}$ or better or $\frac{17}{8} + \sqrt{\frac{145}{64}}$ oe or $\frac{17}{8} - \sqrt{\frac{145}{64}}$ oe or $\frac{\frac{[- -]17}{2} + \sqrt{q}}{4}$ or $\frac{\frac{[- -]17}{2} - \sqrt{q}}{4}$
	0.62 and 3.63 cao	**B2**	**B1** for each **SC1** for 0.6[0] or 0.619 to 0.620 **and** 3.6[0] or 3.6301 to 3.6302 or 0.62 and 3.63 seen in working or –0.62 and–3.63 as final answers
5(a)(i)	62 and Angle at centre is twice angle at circumference oe	**2**	**B1** for either
5(a)(ii)	117 and Isosceles [triangle] and Opposite angles in a cyclic quadrilateral are supplementary	**4**	**B2** for 117 or **B1** for [angle *OCD* =] 28 **B1dep** for isosceles [triangle] and **B1** for opposite angles in a cyclic quadrilateral are supplementary

Question	Answer	Marks	Partial Marks
5(b)	24.9 or 24.94 to 24.95	**5**	**B1** for angle $PQS = 42$ **M2** for $QS = 5.9 \div \cos 42$ oe or **M1** for $\cos 42 = \frac{5.9}{QS}$ oe **M1**dep for *their* $SQ \times \pi$ oe
6(a)(i)	9.5, 4.8 and 8.5	**3**	**B1** for each
6(a)(ii)	correct curve	**5**	**B4** for correct curve, but branches joined or touching y axis or **B3FT** for 9 or 10 correct plots or **B2FT** for 7 or 8 correct plots or **B1FT** for 5 or 6 correct plots AND **B1 indep** two separate branches not touching or cutting y-axis
6(b)	$y = \frac{24}{5} - 2x$ ruled and – 0.4 to – 0.2 and 1.45 to 1.7	**4**	**B2** for correct ruled line crossing curve twice or **B1** for correct freehand or for short ruled line or for line with negative gradient through (0, 4.8) or for line with gradient – 2 **B1** for each value
6(c)	[a =] 10 [b =] 20 [c =] – 48	**4**	**B3** for $10x^3 - 15 = 48x - 20x^2$ oe or better or **B2** for 2 correct values or **B1** for 1 correct value or for $5x^2 - \frac{15}{2x} = 24 - 10x$ or better or for $2x^3 - 3 = \frac{48}{5}x - 4x^2$ or better or for $x^3 - \frac{3}{2} = \frac{24}{5}x - 2x^2$ After 0 scored SC1 for correct elimination of a denominator of 5, x or $2x$ from a four term expression.
7(a)(i)(a)	Shape at (–2, 1) (–4, 1) (–4, 7) (0, 7)	**2**	**B1** for 3 correct points or for enlargement SF2 from any centre
7(a)(i)(b)	Shape at (2, –2) (2, –3) (5, –1) (5, –3)	**3**	**B2** for correct orientation but wrong position or for 3 correct points or **B1** for $y = x - 1$ drawn

Question	Answer	Marks	Partial Marks
7(a)(ii)	Rotation 90 [anticlockwise] oe (0, 0) oe	**3**	**B1** for each
7(b)	$\frac{3}{4}\mathbf{p}+\frac{1}{2}\mathbf{q}$ or $\frac{1}{4}(3\mathbf{p}+2\mathbf{q})$ or $\frac{3\boldsymbol{p}+2\boldsymbol{q}}{4}$ final answer	**3**	**M2** for $AM = \overrightarrow{AM} = \frac{1}{2}\left(\mathbf{-p}+\mathbf{q}+\frac{1}{2}\mathbf{p}\right)$ oe or **M1** for correct route for $\overrightarrow{AB}$ oe soi by $-\frac{1}{2}\,\mathbf{p}+\mathbf{q}$ or for $\overrightarrow{OM}$ soi
8(a)(i)	1.6 oe	**2**	**M1** for $3-5x=-5$
8(a)(ii)	$\frac{3-x}{5}$ oe final answer	**2**	**M1** for $x = 3 - 5y$ or $\frac{y}{5}=\frac{3}{5}-x$ or better, or $y - 3 = -5x$ oe
8(b)(i)	$20.25-(1.5+x)^2$	**3**	Method 1 **B1** for $(\pm 1.5 \pm x)^2$ seen **B1** for [b =] 18 + *their* 1.5^2 OR Method 2 **B1** for $b-a^2-2ax-x^2$ or for b = 20.25 **B1** for a = 1.5
8(b)(ii)	Correct sketch with max in correct quadrant at $(-1.5, 20.25)$	**3**	**FT** *their* $20.25-(\textit{their}1.5+x)^2$ provided in that form **B1** for ∩ shape or for ∪ shape if in form $c+(d+x)^2$ in part **(b)(i)** **B1** for TP at $(-1.5, k)$ or $(k, 20.25)$ FT *their* $20.25 \pm (\textit{their}1.5+x)^2$ or for (–1.5, 20.25) seen
8(b)(iii)	[y =] 34 – 11x	**6**	**B2** for –3 – 2x or **B1** for either kx –3, $k \neq 0$ or –2x + n or for 18 – 3 – 2x **M1dep** for gradient = *their* (–3 – 2(4)) **B1** for y-value at x = 4, is –10 **M1dep** for *their* –10 = (*their* –11)4 + c oe

Question	Answer	Marks	Partial Marks
9(a)	3.5 oe	**3**	**M1** for $2(x + x + 3) = 20$ oe **M1** for correct $ax = b$ for *their* linear equation
9(b)	116.8 or 116.83 to 116.85 nfww	**5**	**M2** for $\sin p = \frac{5\sin 20}{2.5}$ or **M1** for $\frac{2.5}{\sin 20} = \frac{5}{\sin p}$ **A1** for 43.2 or 43.15 to 43.17 **M1**dep for 180 – (20 + *their* 43.2) After 0 scored, **SC1** for length of side = 5
9(c)	5.07 or 5.068 to 5.071	**6**	**B3** for 7.41 or 7.412 to 7.413 or **M2** for $r + r + \frac{40}{360} \times 2 \times \pi \times r = 20$ oe or **M1** for $\frac{40}{360} \times 2 \times \pi \times r$ oe seen **M2** for $2 \times 7.41 \times \sin 20$ oe or $7.41^2 + 7.41^2 - 2(7.41^2) \cos 40$ oe or $\frac{7.41\sin 40}{\sin 70}$ oe or **M1** for implicit version

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8048931246

MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

INFORMATION

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

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

[Turn over

1 **(a)** Malena has 450 fruit trees.
The fruit trees are in the ratio apple : pear : plum = 8 : 7 : 3.

(i) Show that Malena has 200 apple trees.

[2]

(ii) Find the number of plum trees.

..... [1]

(iii) Malena wants to increase the number of pear trees by 32%.

Calculate the number of extra pear trees she needs.

..... [2]

(iv) Each apple tree produces 48.5 kg of apples.
The apples have an average mass of 165 g each.

Calculate the total number of apples produced by the 200 trees.
Give your answer correct to the nearest 1000 apples.

..... [3]

(b) Malena's land is valued at three million and seventy-five thousand dollars.

(i) Write this number in figures.

..... [1]

(ii) Write your answer to **part (b)(i)** in standard form.

..... [1]

(c) In 2020, each plum tree produced 37.7 kg of plums.
This was 16% more than in 2019.

Calculate the mass of plums produced by each plum tree in 2019.

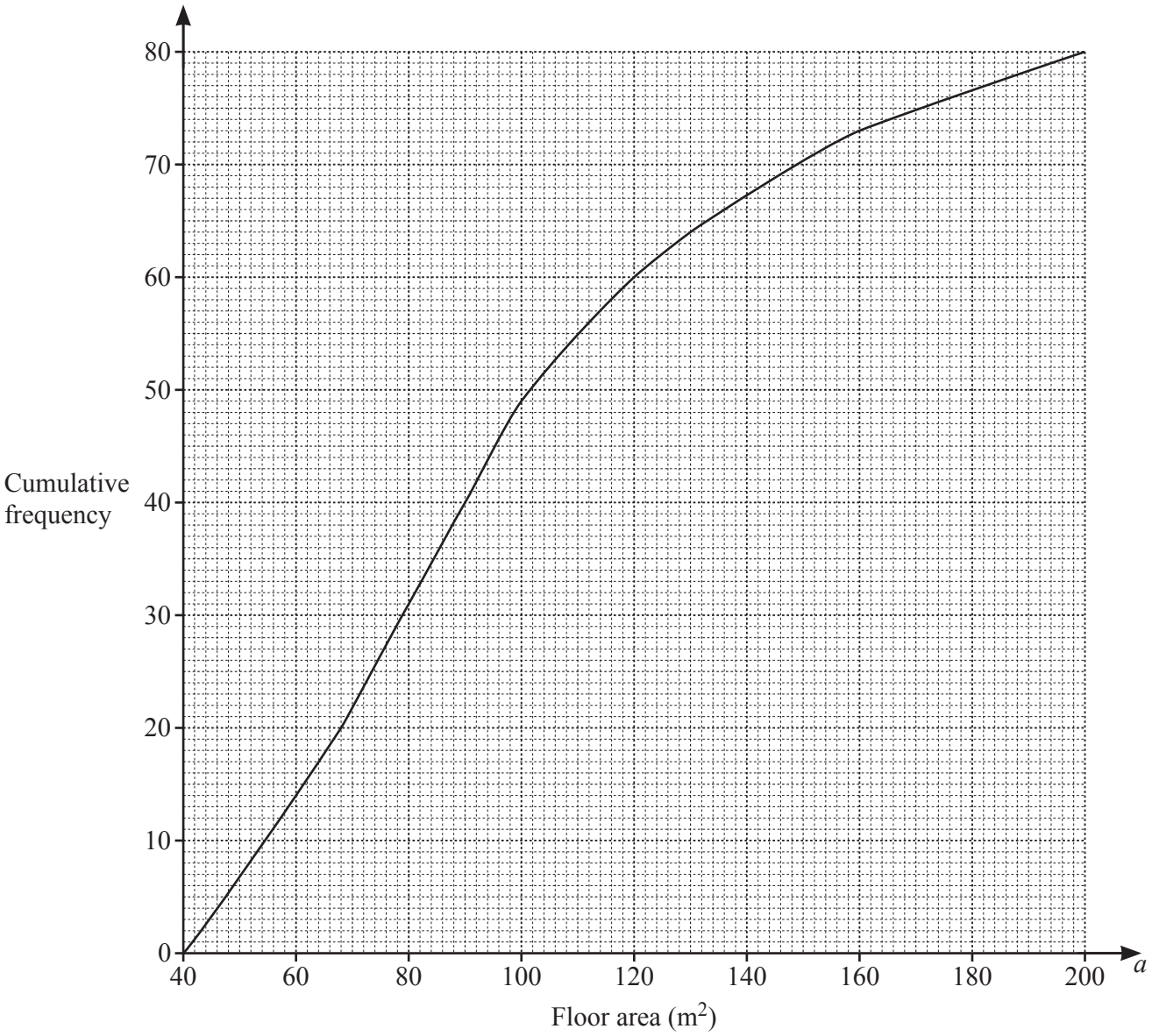
..... kg [2]

(d) Malena invests $1800 at a rate of 2.1% per year compound interest.

Calculate the value of her investment at the end of 15 years.

$ ..... [2]

2 **(a)** The cumulative frequency diagram shows information about the floor area, $a\,m^2$, of each of 80 houses.



Use the diagram to find an estimate of

(i) the median,

..... m^2 [1]

(ii) the lower quartile,

..... m^2 [1]

(iii) the interquartile range,

..... m^2 [1]

(iv) the number of houses with a floor area greater than $120\,m^2$.

..... [2]

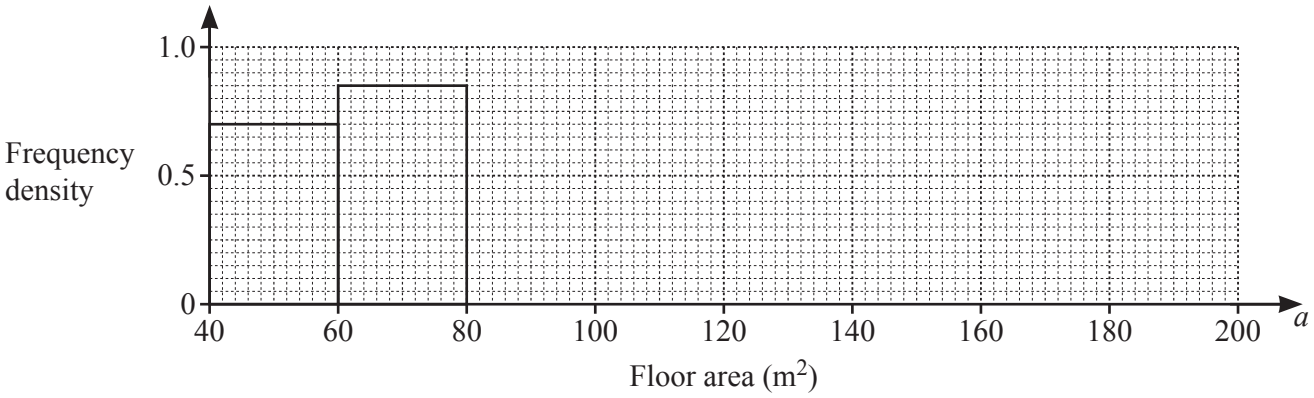
(b) The information about the 80 floor areas is shown in this frequency table.

Floor area ($a\,m^2$)	$40 < a \leqslant 60$	$60 < a \leqslant 80$	$80 < a \leqslant 100$	$100 < a \leqslant 130$	$130 < a \leqslant 160$	$160 < a \leqslant 200$
Frequency	14	17	18	15	9	7

(i) Calculate an estimate of the mean floor area.

..... m^2 [4]

(ii) Complete the histogram to show the information in the frequency table.



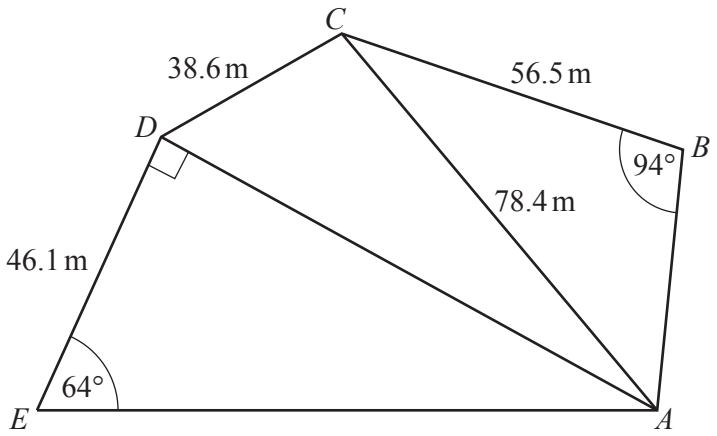
[4]

(iii) Two of the houses are picked at random.

Find the probability that one of the houses has a floor area greater than $130\,m^2$ and the other has a floor area $60\,m^2$ or less.

..... [3]

3 **(a)**



NOT TO SCALE

ABCDE is a pentagon.

(i) Calculate *AD* and show that it rounds to 94.5 m, correct to 1 decimal place.

[2]

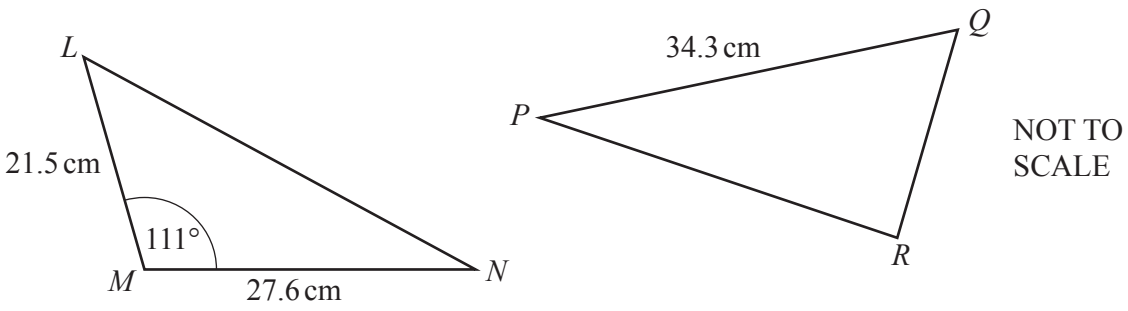
(ii) Calculate angle *BAC*.

Angle *BAC* = ... [3]

(iii) Calculate the largest angle in triangle *CAD*.

..... [4]

(b)

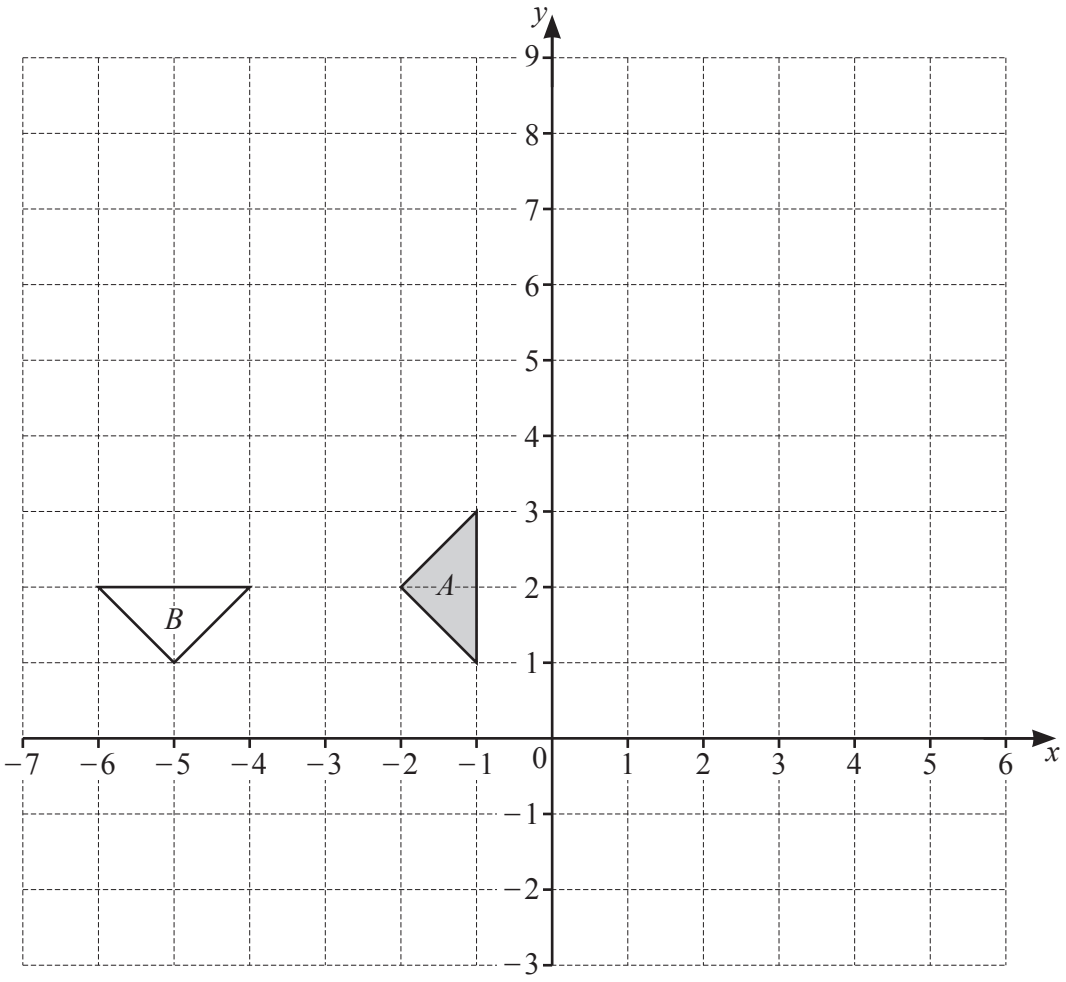


Triangle *PQR* has the same area as triangle *LMN*.

Calculate the shortest distance from *R* to the line *PQ*.

..... cm [3]

4



(a) On the grid, draw the image of triangle A after

(i) a translation by the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$, [2]

(ii) a reflection in the line $x = 1$, [2]

(iii) an enlargement, scale factor 2 and centre $(-5, -2)$. [2]

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

.....

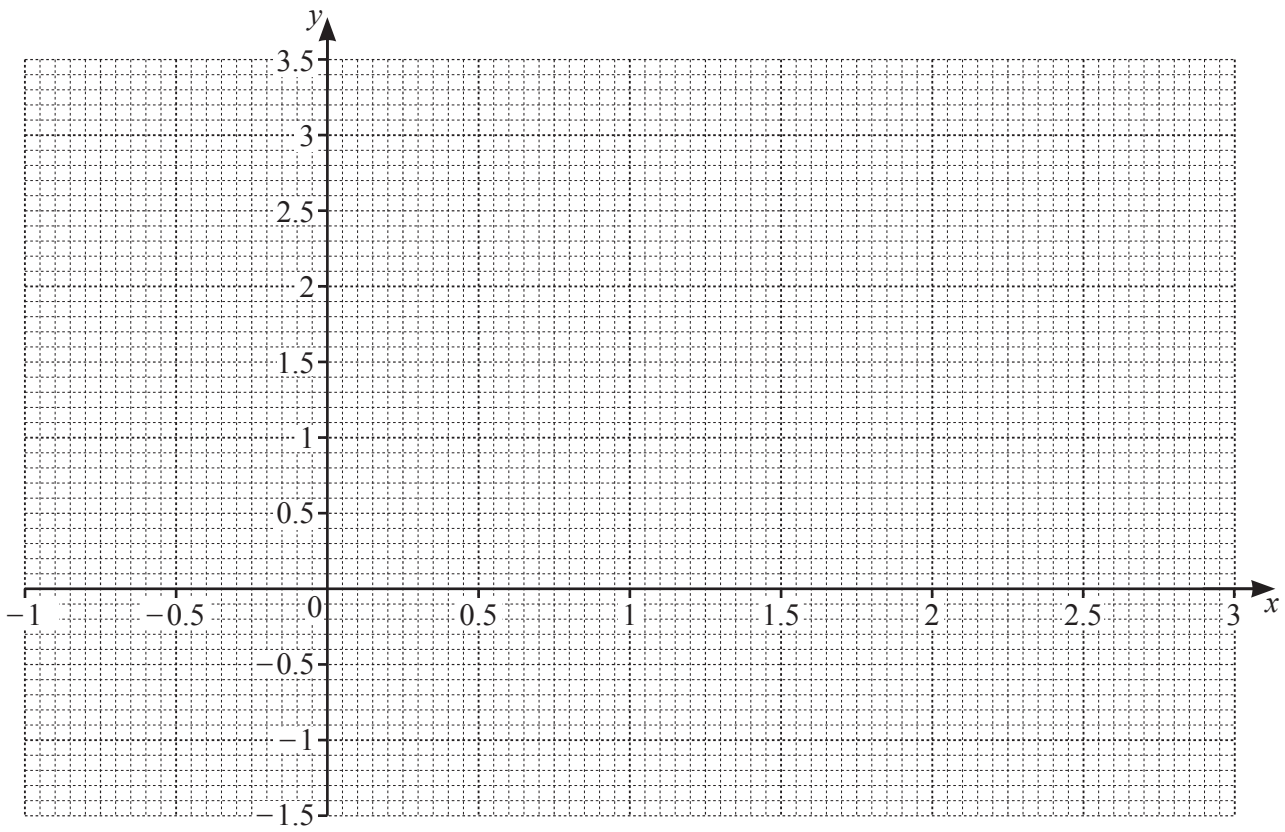
..... [3]

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

x	-1	-0.5	0	0.5	1	1.5	2	2.5	3
y		2.125	3	2.375	1		-1	-0.125	

(a) Complete the table. [3]

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



[4]

(c) By drawing a suitable straight line on the grid, solve the equation $x^3 - 3x^2 + x + 1 = 0$.

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

6 **(a)** Solve.

(i) $4(2x-3)=24$

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

(ii) $6x+14>6$

..... [2]

(b) Rearrange the formula $V=2x^3-3y^3$ to make y the subject.

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

(c) Show that $(2n-5)^2-13$ is a multiple of 4 for all integer values of n.

[3]

(d) The expression $5+12x-2x^2$ can be written in the form $q-2(x+p)^2$.

(i) Find the value of p and the value of q.

$p =$ ..... , $q =$ ..... [3]

(ii) Write down the coordinates of the maximum point of the curve $y = 5+12x-2x^2$.

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

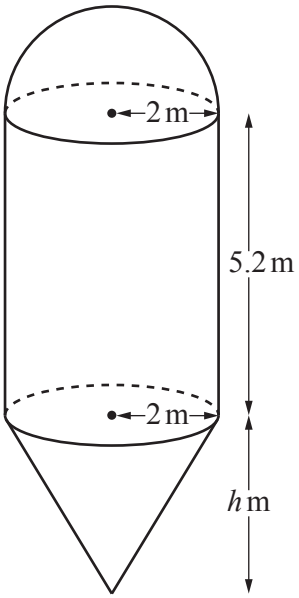
(e) The energy of a moving object is directly proportional to the square of its speed.
The speed of the object is increased by 30%.

Calculate the percentage increase in the energy of the object.

..... % [2]

7 **(a)** The diagram shows a container for storing grain.

The container is made from a hemisphere, a cylinder and a cone, each with radius 2 m. The height of the cylinder is 5.2 m and the height of the cone is h m.



NOT TO SCALE

(i) Calculate the volume of the hemisphere. Give your answer as a multiple of π.

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

..... m^3 [2]

(ii) The total volume of the container is $\frac{88\pi}{3}$ m^3.

Calculate the value of h.

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

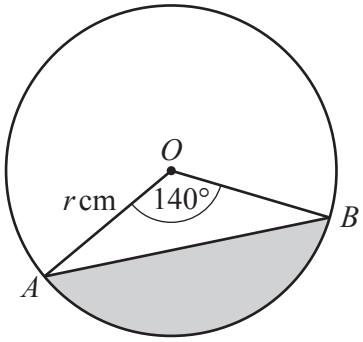
$h =$ ..... [4]

(iii) The container is full of grain.
Grain is removed from the container at a rate of 35 000 kg per hour.
$1\,m^3$ of grain has a mass of 620 kg.

Calculate the time taken to empty the container.
Give your answer in hours and minutes.

..... h ..... min [3]

(b)



NOT TO SCALE

A and B are points on a circle, centre O, radius r cm.
The area of the shaded segment is $65\,cm^2$.

Calculate the value of r.

$r =$ ..... [4]

8 **(a)** Kaito runs along a 12 km path at an average speed of x km/h.

(i) Write down an expression, in terms of x, for the number of hours he takes.

..... hours [1]

(ii) Yuki takes 1.5 hours longer to walk along the same path as Kaito.
She walks at an average speed of $(x-4)$ km/h.

Write down an equation, in terms of x, and show that it simplifies to $x^2-4x-32=0$.

[4]

(iii) Solve by factorisation.

$$x^2-4x-32=0$$

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

(iv) Find the number of hours it takes Yuki to walk along the 12 km path.

..... hours [2]

(b) A bus travels 440 km, correct to the nearest 10 km.
The time taken to complete the journey is 6 hours, correct to the nearest half hour.

Calculate the lower bound of the speed of the bus.

..... km/h [3]

9 **(a)** F is the point $(5, -2)$ and $\overrightarrow{FG} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$.

Find

(i) the coordinates of point G,

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

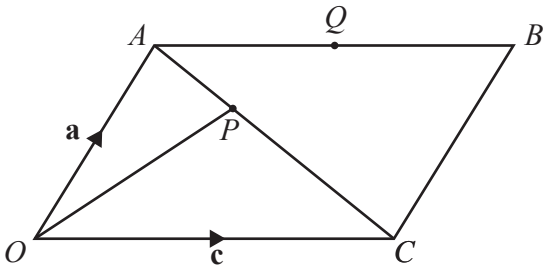
(ii) $5\overrightarrow{FG}$,

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

(iii) $\left|\overrightarrow{FG}\right|$.

..... [2]

(b)



NOT TO SCALE

$OABC$ is a parallelogram.
P is a point on AC and Q is the midpoint of AB.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

(i) Find, in terms of **a** and/or **c**

(a) $\overrightarrow{AQ}$,

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

(b) $\overrightarrow{OQ}$.

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

(ii) $\overrightarrow{OP} = \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}$

(a) Show that O, P and Q lie on a straight line.

[2]

(b) Write down the ratio OP : OQ.
Give your answer in the form 1 : n.

1 : ..... [1]

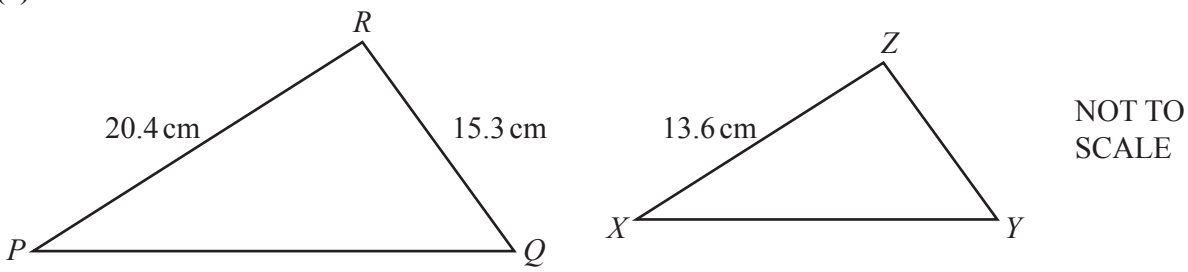
10 **(a)** Find the coordinates of the turning points of the graph of $y = x^3 - 12x + 6$.
You must show all your working.

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

(b) Determine whether each turning point is a maximum or a minimum.
Show how you decide.

[3]

11 **(a)**



Triangle PQR is mathematically similar to triangle XYZ.

(i) Find YZ.

$YZ =$ ..... cm [2]

(ii) The area of triangle XYZ is $63.6\,\text{cm}^2$.

Calculate the area of triangle PQR.

..... cm^2 [3]

(b) Two containers are mathematically similar.
The larger container has a capacity of 64.8 litres and a surface area of $0.792\,\text{m}^2$.
The smaller container has a capacity of 37.5 litres.

Calculate the surface area of the smaller container.

..... m^2 [3]

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MATHEMATICS **0580/42**

Paper 4 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

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

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

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

Abbreviations

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

Question	Answer	Marks	Partial Marks
1(a)(i)	$\frac{450}{8+7+3}\times 8$ oe	2	**M1** for $\frac{450}{8+7+3}$
1(a)(ii)	75	1	
1(a)(iii)	56	2	**M1** for $\frac{32}{100}\times(450-200-$ *their* 75) oe or $\frac{32}{100}\times\frac{450}{8+7+3}\times 7$ oe If 0 scored, **SC1** for answer 231
1(a)(iv)	59 000 nfww	3	**B2** for 58 600 to 58 800 or **B1** for 293 to 294 or **M1** for $\frac{\text{figs}485\times 200}{165}$ oe If 0 scored, **SC1** for *their* more accurate answer seen and rounded to the nearest 1000
1(b)(i)	3 075 000	1	
1(b)(ii)	3.075×10^6	1	**FT** *their* (b)(i)
1(c)	32.5	2	**M1** for $x\times\left(1+\frac{16}{100}\right)=37.7$ or better
1(d)	2460 or 2458. …	2	**M1** for $1800\left(1+\frac{2.1}{100}\right)^{15}$ oe
2(a)(i)	90	1	
2(a)(ii)	68	1	
2(a)(iii)	52	1	**FT** 120 – *their* (a)(ii)
2(a)(iv)	20	2	**B1** for 60 in working or as answer
2(b)(i)	97.5	4	**M1** for mid-points soi (50, 70, 90, 115, 145, 180) **M1** for use of Σfm with m in correct interval including both boundaries **M1** for (dep on 2nd M1) for $\Sigma fm \div 80$
2(b)(ii)	Bars with heights 0.9, 0.5, 0.3, 0.175 and with correct widths	4	**B1** for each correct bar If 0 scored, **SC1** for 3 or 4 correct frequency densities

Question	Answer	Marks	Partial Marks
2(b)(iii)	$\frac{28}{395}$ oe	**3**	**M2** for [2 ×] $\frac{16}{80}\times\frac{14}{79}$ oe or **M1** for $\frac{16}{80}$ or $\frac{16}{79}$ oe or $\frac{14}{80}$ oe or $\frac{14}{79}$ oe seen If 0 scored, **SC1** for answer $\frac{7}{100}$ oe
3(a)(i)	$\frac{AD}{46.1}$ = tan 64 oe or better	**M1**	
	94.51 to 94.52	**A1**	
3(a)(ii)	46[.0] or 45.96… nfww	**3**	**M2** for $56.5\times\frac{\sin 94}{78.4}$ oe or **M1** for $\frac{56.5}{\sin BAC}=\frac{78.4}{\sin 94}$ oe
3(a)(iii)	102.3 or 102.4 or 102.34 to 102.38	**4**	**M2** for [cos$C$ =] $\frac{38.6^2+78.4^2-94.5^2}{2\times 38.6\times 78.4}$ or **M1** for $94.5^2=38.6^2+78.4^2-2\times 38.6\times 78.4\times\cos C$ and **A1** for –0.214 or –0.2144 to –0.2137 If 0 scored, **SC2** for [CAD =] 23.5 or 23.51 to 23.52 or for [CDA =] 54.1 or 54.14…
3(b)	16.2 or 16.15…	**3**	**M2** for $\frac{1}{2}\times 21.5\times 27.6\sin 111=\frac{1}{2}\times 34.3\times d$ oe or **M1** for $\frac{1}{2}\times 21.5\times 27.6\sin 111$ seen or $\frac{1}{2}\times 34.3\times d$ oe soi
4(a)(i)	Image at (–5, 6) (–5, 8) (–6, 7)	**2**	**B1** for translation by $\begin{pmatrix}-4\\k\end{pmatrix}$ or $\begin{pmatrix}k\\5\end{pmatrix}$
4(a)(ii)	Image at (3, 1) (3, 3) (4, 2)	**2**	**B1** for reflection in $y = 1$ or $x = k$
4(a)(iii)	Image at (3, 4) (3, 8) (1, 6)	**2**	**B1** for enlargement, sf 2, in wrong position
4(b)	Rotation 90º [anticlockwise] oe (–3, 0)	**3**	**B1** for each

Question	Answer	Marks	Partial Marks
5(a)	–1, –0.375, 3	**3**	**B1** for each
5(b)	Correct graph	**4**	**B3FT** for 8 or 9 correct points or **B2FT** for 6 or 7 correct points or **B1FT** for 4 or 5 correct points
5(c)	$y = 2 - x$ ruled correctly AND –0.45 to –0.35 1 2.35 to 2.45	**4**	**B2** for $y = 2 - x$ ruled or **B1** for [$y =$] $2 - x$ soi or $y = k - x$ ruled or $y = kx + 2$ ruled, but not $y = 2$ **B2** for all three values or **B1** for any two values
6(a)(i)	4.5, $4\frac{1}{2}$ or $\frac{9}{2}$	**3**	**M1** for $8x - 12 = 24$ or $2x - 3 = 6$ **M1** for reaching $ax = b$ correctly FT *their* first step
6(a)(ii)	$x > -\frac{4}{3}$ or $x > -1\frac{1}{3}$ final answer	**2**	**M1** for $6x > 6 - 14$ or $x + \frac{14}{6} > 1$
6(b)	[$y =$] $\sqrt[3]{\frac{2x^3 - V}{3}}$ oe final answer	**3**	**M1** for isolating term in y **M1** for division by 3 or FT *their* first step **M1** for cube root or FT *their* previous step to the final answer
6(c)	$4n^2 - 20n + 12$	**M2**	**B1** for $4n^2 - 10n - 10n + 25$
	$4(n^2 - 5n + 3)$ or correct explanation linked to expression	**A1**	with no errors seen e.g. 4, [–]20 and 12 are all multiples of 4 or divides each term or each coefficient by 4
6(d)(i)	$p = -3$ and $q = 23$	**3**	**B2** for $23 - 2(x - 3)^2$ OR **M1** for [q] $- 2x^2 - 4px - 2p^2$ or $-2(x - 3)^2$ seen **B1** for either $p = -3$ or $q = 23$ or **FT** $q = 5 + 2(\textit{their } p)^2$
6(d)(ii)	(3, 23)	**1**	**FT** *their* (d)(i)
6(e)	69	**2**	**M1** for figs 13^2 oe
7(a)(i)	$\frac{16\pi}{3}$ or $5\frac{1}{3}\pi$ final answer	**2**	**M1** for $\frac{1}{2} \times \frac{4}{3}\pi \times 2^3$ oe

Question	Answer	Marks	Partial Marks
7(a)(ii)	2.4[0]	**4**	**B3** for answer in range 2.396… to 2.40… OR **M3** for *their* $\frac{16\pi}{3} + \pi \times 2^2 \times 5.2 + \frac{1}{3}\pi \times 2^2 \times h = \frac{88\pi}{3}$ oe or **M2** for $\frac{88\pi}{3}$ – *their* $\frac{16\pi}{3} - \pi \times 2^2 \times 5.2$ oe or **M1** for $\pi \times 2^2 \times 5.2$ oe or $\frac{1}{3}\pi \times 2^2 \times h$ oe soi
7(a)(iii)	1 hour 38 min or 1 hour 37.8 min to 1 hour 37.9… min	**3**	**B2** for 1.63[2…] or 98 [mins] or 97.8 to 97.9…] or **M1** for $\frac{\frac{88\pi}{3} \times 620}{35000}$ [× 60] oe
7(b)	8.5[0] or 8.496 to 8.497	**4**	**M3** for [r=] $\sqrt{\frac{65}{\frac{140}{360}\pi - \frac{1}{2}\sin 140}}$ oe or **M2** for $\frac{140}{360}\pi \times r^2 - \frac{1}{2} r^2 \times \sin 140$ [=65] oe or **M1** for either area expression seen
8(a)(i)	$\frac{12}{x}$ or $12 \div x$ final answer	**1**	
8(a)(ii)	$\frac{12}{x-4}$ – *their* $\frac{12}{x} = 1.5$ oe	**M1**	Accept 3 or more term equivalents
	$12x - 12(x-4) = 1.5x(x-4)$ or $\frac{12x - 12(x-4)}{x(x-4)}$ [= 1.5]	**M1**	Correctly clearing fractions, or correctly collecting into a 'single fraction' FT *their* expression dep on two fractions both with algebraic denominators
	$12x - 12x + 48 = 1.5x^2 - 6x$	**M1**	Correctly multiplying *their* two sets of brackets FT *their* expression dep on two fractions both with algebraic denominators or first M1 given
	[$1.5x^2 - 6x - 48 = 0$] $x^2 - 4x - 32 = 0$	**A1**	One further step either 3 term equation or division throughout by 1.5 leading to solution With no errors or omissions seen, dep on **M3**

Question	Answer	Marks	Partial Marks
8(a)(iii)	$(x + 4)(x – 8)$	**M2**	**M1** for $(x + a)(x + b)$ where $ab = –32$ or $a + b = –4$ or for $x(x + 4) – 8(x + 4)$ or $x(x – 8) + 4(x – 8)$
	–4 and 8	**B1**	
8(a)(iv)	3	**2**	**FT** $\frac{12}{their\ 8 - 4}$ **M1** for $\frac{12}{their\ 8 - 4}$ or $\frac{12}{their\ 8} + 1.5$ oe or for answer $\frac{12}{their\ 8}$
8(b)	69.6	**3**	**M2** for $\frac{430 \text{ to } 440}{6 + 0.25}$ or $\frac{440 - 5}{6 \text{ to } 6.5}$ oe or **M1** for 440 + 5 oe or 440 – 5 oe or 6 + 0.25 oe or 6 – 0.25 oe seen
9(a)(i)	(3, 1)	**1**	
9(a)(ii)	$\begin{pmatrix} -10 \\ 15 \end{pmatrix}$	**1**	
9(a)(iii)	3.61 or 3.605 to 3.606	**2**	**M1** for $(–2)^2 + 3^2$ oe
9(b)(i)(a)	$\frac{1}{2}\mathbf{c}$	**1**	
9(b)(i)(b)	$\mathbf{a} + \frac{1}{2}\mathbf{c}$ oe	**1**	FT **a** + *their* (b)(i)(a)

Question	Answer	Marks	Partial Marks
9(b)(ii)(a)	$\overrightarrow{OP} = \frac{1}{3}(2\mathbf{a} + \mathbf{c})$ oe and $\overrightarrow{OQ} = \frac{1}{2}(2\mathbf{a} + \mathbf{c})$ oe OR $\overrightarrow{OP} = \frac{2}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ OR $\overrightarrow{PQ} = \frac{1}{3}(\mathbf{a} + \frac{1}{2}\mathbf{c})$ **and** correct comment e.g. have the same base vector or that they are multiples of one another **and** they share a common point OR e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$	**2**	**B1** for $\overrightarrow{OP}$ or $\overrightarrow{PQ}$ factorised or for correct multiplicative statement on relationship without factorised vectors e.g. $\overrightarrow{OQ} = 1.5\overrightarrow{OP}$, $\frac{2}{3}\overrightarrow{OQ} = \overrightarrow{OP}$, $2\overrightarrow{PQ} = \overrightarrow{OP}$, $1.5\left(\frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{c}\right) = \mathbf{a} + \frac{1}{2}\mathbf{c}$
9(b)(ii)(b)	1.5 oe	**1**	
10(a)	(2, –10) and (–2, 22)	**5**	**B2** for $3x^2 - 12$ isw or **B1** for $3x^2 + k$ or $px^2 - 12$ ($p \neq 0$) or for $3x^2 - 12 + 6$ isw **M1** for setting *their* derivative = 0 or $\frac{dy}{dx} = 0$ **B1** for $x = \pm 2$ or for one correct coordinate pair
10(b)	(2, –10) minimum with correct reason or sketch (–2, 22) maximum with correct reason or sketch	**3**	**B2** for 1 correct with correct reasoning or **B2FT** for correct evaluation with correct 2nd derivative for both of *their* different x values or **M1** for showing [2nd derivative =] $6x$ or gradients for one value on either side of one correct stationary point or for reasonable sketch of cubic
11(a)(i)	10.2	**2**	**M1** for $\frac{YZ}{13.6} = \frac{15.3}{20.4}$ oe or better

Question	Answer	Marks	Partial Marks
11(a)(ii)	143.1	**3**	**M2** for $\left(\frac{20.4}{13.6}\right)^2 \times 63.6$ oe or **M1** for $\left(\frac{20.4}{13.6}\right)^2$ or $\left(\frac{13.6}{20.4}\right)^2$ oe **Alt method** **M2** for ½ × 20.4 × 15.3 × sin R where R is $\sin^{-1}\left(\frac{63.6}{0.5\times 13.6\times \textit{their}(a)(i)}\right)$ or **M1** for $R = \sin^{-1}\left(\frac{63.6}{0.5\times 13.6\times \textit{their}(a)(i)}\right)$
11(b)	0.55	**3**	**M2** for [ratio of areas] = $\left(\sqrt[3]{\frac{37.5}{64.8}}\right)^2$ or $\left(\sqrt[3]{\frac{64.8}{37.5}}\right)^2$ oe or **M1** for [ratio of lengths] = $\sqrt[3]{\frac{37.5}{64.8}}$ or $\sqrt[3]{\frac{64.8}{37.5}}$ oe or for $\left(\frac{0.792}{x}\right)^3 = \left(\frac{64.8}{37.5}\right)^2$ oe

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CENTRE NUMBER						CANDIDATE NUMBER				

4724588545

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2021**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

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

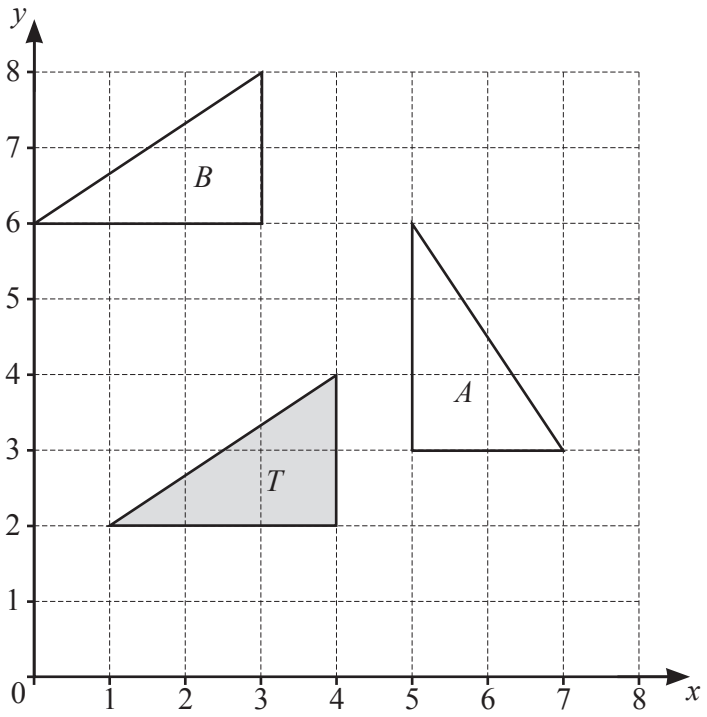
INFORMATION

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

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

[Turn over

1 The diagram shows three triangles, T, A, and B, drawn on a 1 cm^2 grid.



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

.....

..... [3]

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

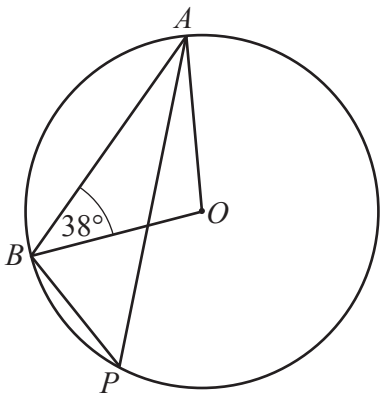
.....

..... [2]

(ii) Calculate the distance that each point of triangle T moves when it is mapped onto triangle B.

..... cm [2]

2 **(a)**



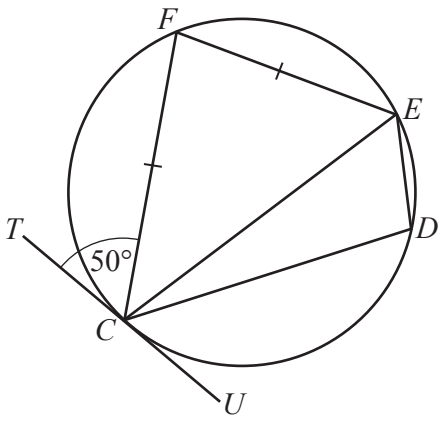
NOT TO SCALE

A, B and P are points on a circle, centre O and angle $OBA = 38°$.

Find angle APB.

Angle APB = ... [3]

(b)



NOT TO SCALE

$CDEF$ is a cyclic quadrilateral and $FC = FE$.
TU is a tangent to the circle at C and angle $TCF = 50°$.

Find

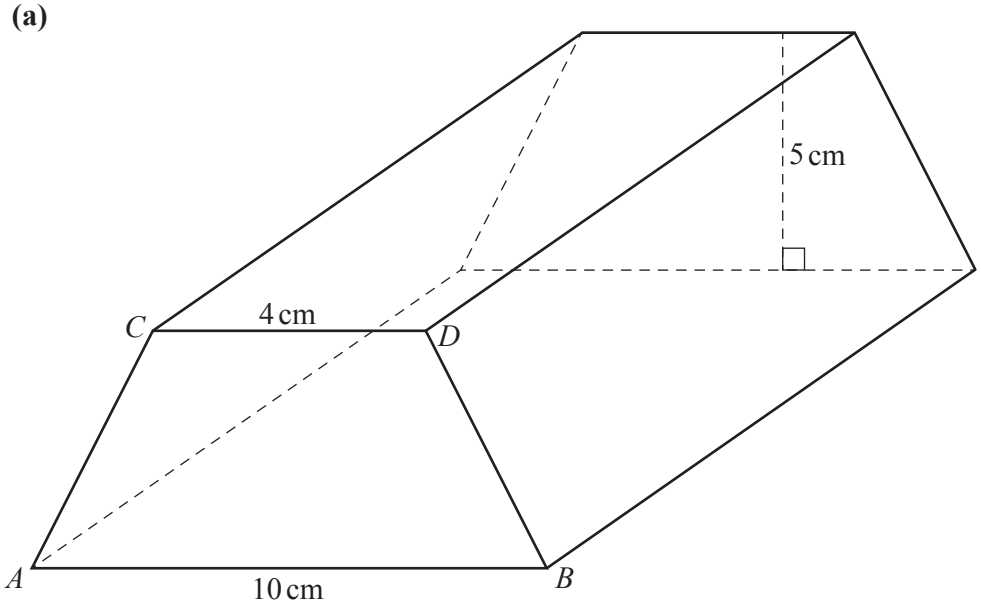
(i) angle EFC,

Angle EFC = ... [2]

(ii) angle CDE.

Angle CDE = ... [1]

3 **(a)**



NOT TO SCALE

The diagram shows a prism.
The cross-section of the prism is a trapezium with CD parallel to AB and $AC = BD$.

$AB = 10$ cm, $CD = 4$ cm and the height of the trapezium is 5 cm.
The volume of the prism is 525 cm^3.

(i) The prism is made of iron.
1 cm^3 of iron has a mass of 7.8 g.

Calculate the mass of the prism.
Give your answer in kilograms.

..... kg [2]

(ii) Calculate the length of the prism.

..... cm [3]

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

..... cm^2 [6]

(iv) In a mathematically similar prism, the height of the trapezium is 10 cm.

Calculate the volume of this prism.

..... cm^3 [3]

(b) A cuboid measures 10 cm by 4 cm by 6 cm.
Each side is measured correct to the nearest centimetre.

Complete the inequality for the volume, V, of this cuboid.

..... $cm^3 \leqslant V <$ ..... cm^3 [3]

4 **(a)** Solve the simultaneous equations.
You must show all your working.

$$2p - q = 7$$
$$3p + 2q = 7$$

$p =$ .....

$q =$ ..... [3]

(b) Solve the equation.

$$\frac{x}{4} + \frac{2x}{3} = 1$$

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

(c) $-8 < 3x - 2 \leqslant 7$

(i) Solve the inequality.

..... [3]

(ii) Find the integer values of x that satisfy the inequality.

..... [1]

(d) Factorise completely.

$$16a - 4a^2$$

..... [2]

(e) Write each of the following as a single fraction, in its simplest form.

(i) $\frac{1}{2a} \div \frac{3}{4b}$

..... [2]

(ii) $2 - \frac{x}{x-1}$

..... [2]

5 **(a)** $500 is invested at a rate of 3% per year.

Calculate the total interest earned at the end of 7 years when

(i) simple interest is paid,

$ ..... [2]

(ii) compound interest is paid.

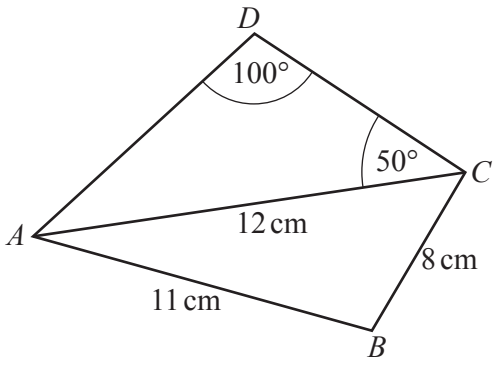
$ ..... [3]

(b) The value of a car decreases exponentially by 10% each year.
The value now is $6269.40 .

Calculate the value of the car 3 years ago.

$ ..... [3]

6



NOT TO SCALE

(a) Calculate AD.

$AD =$ ..... cm [3]

(b) Calculate angle BAC and show that it rounds to 40.42°, correct to 2 decimal places.

[4]

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

..... cm^2 [3]

(d) Calculate the shortest distance from B to AC.

..... cm [3]

7 **(a)** Amir buys 3 cakes that cost c cents each and 2 loaves of bread that cost $(2c - 11)$ cents each.
He spends a total of \$5.87 .

Find the value of c.

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

(b) A bottle of water costs \$$w$.
A bottle of juice costs \$$(w + 1)$.

Alex spends \$22 on bottles of water and \$42 on bottles of juice.
The number of bottles of water is equal to the number of bottles of juice.

Find the value of w.

$w =$ ..... [3]

(c) Alicia walks a distance of 9 km at a speed of x km/h.
She then runs a distance of 5 km at a speed of $(2x + 1)$ km/h.

The total time Alicia takes is 2.5 hours.

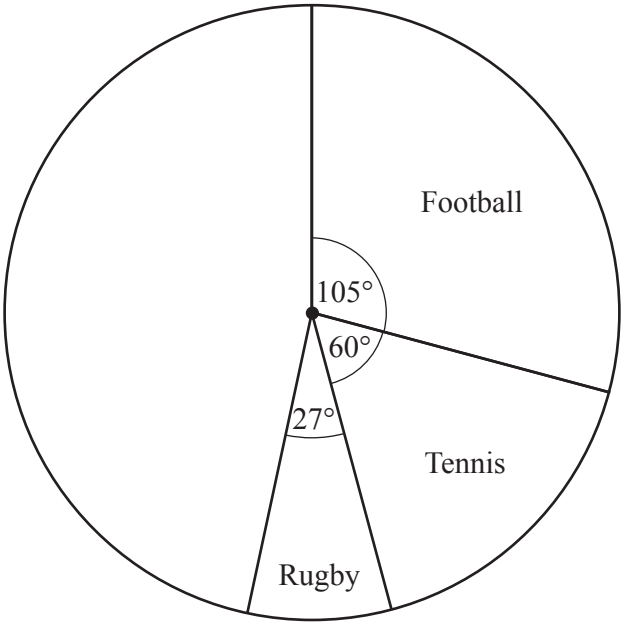
(i) Show that $10x^2 - 41x - 18 = 0$.

[4]

(ii) Work out Alicia's running speed.
You must show all your working.

..... km/h [4]

8 **(a)** Jean asks 600 people to choose their favourite sport.
The pie chart shows some of this information.



(i) Show that 100 people choose tennis.

[1]

(ii) Work out how many people choose rugby.

..... [2]

(iii) 125 people choose cricket and the rest choose swimming.

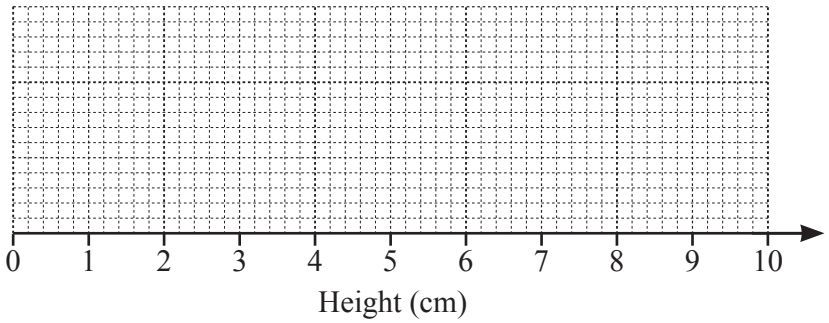
Complete the pie chart to show this information.

[2]

(b) The heights of some plants are measured:

- smallest height = 0.6 cm
- range = 8.1 cm
- median = 5.2 cm
- lower quartile = 3.4 cm
- interquartile range = 4.1 cm.

On the grid, draw a box-and-whisker plot to show this information.



[3]

(c) A dice is rolled 100 times.
The frequency table shows the results.

Score	1	2	3	4	5	6
Frequency	16	25	17	19	8	15

Find

(i) the range,

..... [1]

(ii) the mode,

..... [1]

(iii) the median.

..... [1]

(d) 50 students answer a mathematics question.
The table shows the time, t seconds, taken by each student to answer the question.

Time (t seconds)	$10 < t \leqslant 20$	$20 < t \leqslant 25$	$25 < t \leqslant 30$	$30 < t \leqslant 50$	$50 < t \leqslant 80$
Frequency	2	8	12	16	12

Calculate an estimate of the mean.

..... s [4]

9 $f(x) = x(x-1)(x-2)$

(a) Find the coordinates of the points where the graph of $y = f(x)$ crosses the x-axis.

(..... , ...)

(..... , ...)

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

(b) Show that $f(x) = x^3 - 3x^2 + 2x$.

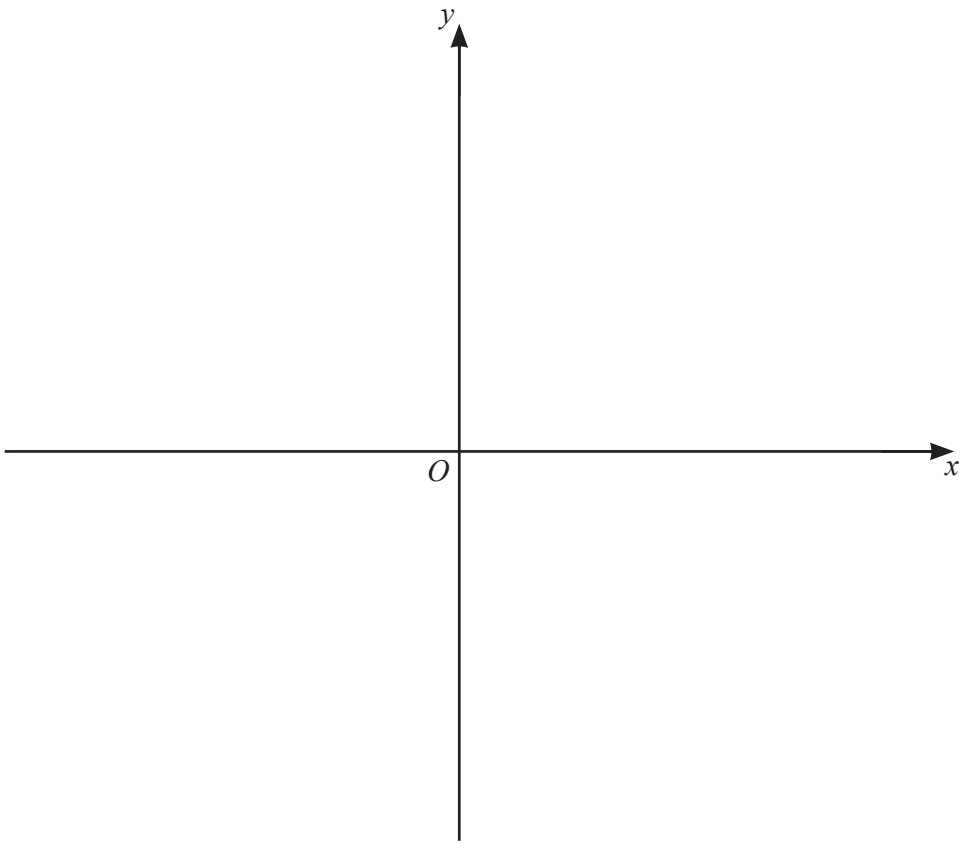
[2]

(c) Find the coordinates of the turning points of the graph of $y = f(x)$.
Show all your working and give your answers correct to 1 decimal place.

(..... , ...)

(..... , ...) [8]

(d) Sketch the graph of $y = f(x)$.



[2]

10 **(a)** Sarah spins a fair four-sided spinner numbered 0, 1, 1 and 3.

(i) What number is the spinner most likely to land on?

..... [1]

(ii) Sarah spins the spinner twice.

Find the probability that it lands on the number 1 both times.

..... [2]

(iii) Sarah spins the spinner until it lands on the number 3.

The probability that this happens on the nth spin is $\frac{729}{16384}$.

Find the value of n.

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

(b) Scott takes an examination.
The examination is in two parts, a theory test and a practical test.
Both parts must be passed to pass the examination.

The probability that Scott passes the theory test is 0.9 .
The probability that Scott passes the practical test is 0.8 .

Find the probability that

(i) Scott passes the examination,

..... [2]

(ii) Scott passes the theory test or the practical test but not both.

..... [3]

11 $f(x) = 2x - 1$ $g(x) = x^2 + 2x$ $h(x) = 4^x$ $j(x) = 2^x$

(a) Find the value of

(i) h(3),

..... [1]

(ii) fh(3).

..... [1]

(b) Solve the equation $gf(x) = 0$.

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

(c) $p^{-1}(x) = f(x)$

Find $p(x)$.

..... [2]

(d) $\mathrm{h}(x)\mathrm{j}(x) = \dfrac{1}{\sqrt{2}}$

Find the value of x.

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

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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

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

[Turn over

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

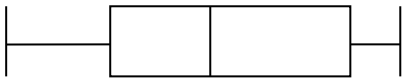
Abbreviations

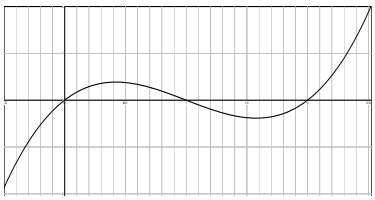
cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfww	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	Rotation 90° clockwise oe [centre] (5, 2)	**3**	**B1** for each
1(b)(i)	Translation $\begin{pmatrix}-1\\4\end{pmatrix}$	**2**	**B1** for each
1(b)(ii)	4.12 or 4.123...	**2**	**M1** for (*their* (–1))^2 + (*their* 4)^2
2(a)	52°	**3**	**M1** for 180 – 2 × 38, implied by 104 **M1** for *their AOB* ÷ 2
2(b)(i)	80°	**2**	**B1** for *FEC* =50 or *FCE* = 50
2(b)(ii)	100°	**1**	**FT** 180 – *their* **(i)**
3(a)(i)	4.095	**2**	**B1** for figs 4095 or **M1** for $\frac{525\times7.8}{1000}$
3(a)(ii)	15	**3**	**B2** for 35 OR **M2** for $\frac{1}{2}(10+4)\times5\times L=525$ oe **M1** for $\frac{1}{2}(10+4)\times5$ oe
3(a)(iii)	455 or 454.9...	**6**	**M3** for *their* [*BD* =] $\sqrt{3^2+5^2}$ × (*their* 15) [× 2] or **B2** for $\sqrt{34}$ or 5.83 or 5.830 to 5.831 or **M1** for $5^2+\left(\frac{1}{2}(10-4)\right)^2$ and **M1** for *their* 35 × 2 **M1** for (*their* 15) × 10 and (*their* 15) × 4
3(a)(iv)	4200	**3**	**M2** for $525\times\left(\frac{10}{5}\right)^3$ oe or **M1** for $\left(\frac{10}{5}\right)^3$ or $\left(\frac{5}{10}\right)^3$ oe

Question	Answer	Marks	Partial Marks
3(b)	182.875 ... 307.125 final answer	**3**	**B2** for either seen or **M1** for 10 ± 0.5 or 6 ± 0.5 or 4 ± 0.5 oe
4(a)	Correctly eliminate one variable	**M1**	
	$p = 3$ $q = -1$	**A2**	**A1** for each If M0, **SC1** for 2 values satisfying one of original equations If 0 scored **SC1** for correct answers with no working
4(b)	$1\frac{1}{11}$ or $\frac{12}{11}$ 1.09 or 1.090 to 1.091	**2**	**M1** for $\frac{3x}{12}+\frac{8x}{12}=1$ or better
4(c)(i)	$-2 < x \leqslant 3$	**3**	**B2** for $-2 < x$ or $x \leqslant 3$ or **M1** for $-8 + 2 < 3x$ or $3x \leqslant 7 + 2$
4(c)(ii)	$-1, 0, 1, 2, 3$	**1**	**FT** dep on –ve and +ve values in *their* **(c)(i)**
4(d)	$4a(4-a)$ final answer	**2**	**B1** for any correct partial factorisation
4(e)(i)	$\frac{2b}{3a}$ final answer	**2**	**M1** for $\frac{1}{2a}\times\frac{4b}{3}$ or better
4(e)(ii)	$\frac{x-2}{x-1}$ final answer nfww	**2**	**B1** for $2(x-1)-x$ oe seen.
5(a)(i)	105	**2**	**M1** for $\frac{3}{100}\times 500[\times 7]$
5(a)(ii)	115 or 114.9...	**3**	**M2** for $500\times\left(1+\frac{3}{100}\right)^{7}[-500]$ or **M1** for $500\times\left(1+\frac{3}{100}\right)^{k}$, k integer $\geqslant 2$
5(b)	8600	**3**	**M2** for $\frac{6269.4}{\left(1-\frac{10}{100}\right)^{3}}$ oe or **M1** for $C\times\left(1-\frac{10}{100}\right)^{3}=6269.4$ oe
6(a)	9.33 or 9.334...	**3**	**M2** for $\frac{12\sin 50}{\sin 100}$ or **M1** for $\frac{\sin 100}{12}=\frac{\sin 50}{AD}$ oe

Question	Answer	Marks	Partial Marks
6(b)	[cos =] $\frac{11^2+12^2-8^2}{2\times11\times12}$	**M2**	**M1** for $8^2 = 11^2+12^2-2\times11\times12\cos(BAC)$
	40.415...	**A2**	**A1** for 0.761... or $\frac{201}{264}$ or $\frac{67}{88}$
6(c)	70.8 or 70.77 to 70.79...	**3**	**M1** for $\frac{1}{2}\times12\times$ *their* **(a)** $\times\sin(180-100-50)$ **M1** for $\frac{1}{2}\times12\times11\times\sin(40.42)$
6(d)	7.13 or 7.131 to 7.132...	**3**	**M2** for $\frac{\text{dist}}{11}=\sin(40.42)$ or **M1** for recognition that shortest distance is perpendicular to AC
7(a)	87	**3**	**M2** for $3c + 4c = 587 + 22$ or better or **M1** for $3c + 2(2c - 11)$ [= 587 or 5.87]
7(b)	1.1[0]	**3**	**M2** for $22w + 22 = 42w$ or better or **M1** for $\frac{22}{w} = \frac{42}{w+1}$ oe OR **B2** for number of bottles = 20 or **M1** for $Nw = 22$ and $N(w+1) = 42$
7(c)(i)	$\frac{9}{x}+\frac{5}{2x+1}=2.5$ oe	**M2**	**M1** for $\frac{9}{x}$ or $\frac{5}{2x+1}$
	$9(2x+1)+5x=2.5x(2x+1)$ oe or $\frac{9(2x+1)+5x}{x(2x+1)}$ [= 2.5 oe]	**M1**	Correctly clearing fractions, or correctly collecting into a single fraction FT *their* expression dep on two fractions both with algebraic denominators
	All brackets expanded leading to $10x^2-41x-18=0$ with no errors or omissions	**A1**	

Question	Answer	Marks	Partial Marks
7(c)(ii)	$(2x-9)(5x+2)$ or $\frac{-(-41)\pm\sqrt{(-41)^2-4(10)(-18)}}{2(10)}$	**M2**	**B1** for $(ax+b)(cx+d)$ with $ac = 10$ and $bd = -18$ or $ad + bc = -41$ or $\sqrt{(-41)^2-4(10)(-18)}$ or $\frac{-(-41)+\sqrt{q}}{2(10)}$ oe or $\frac{-(-41)-\sqrt{q}}{2(10)}$ oe or both or **M1** for $\left(x-\frac{41}{20}\right)^2-\frac{18}{10}-\left(\frac{41}{20}\right)^2=0$ or better
	10	**A2**	**A1** for $[x =]\ \frac{9}{2}$ oe or **M1** for $2 \times$ *their* positive root + 1
8(a)(i)	$\frac{60}{360}\times 600$ oe	**1**	
8(a)(ii)	45	**2**	**M1** for $\frac{27}{360}\times 600$ oe
8(a)(iii)	Correct straight line on the pie chart	**2**	**B1** for 75
8(b)	Correct diagram  0.6 3.4 5.2 7.5 8.7	**3**	**B1** for any three of 0.6, 3.4, 5.2, 7.5, 8.7 correctly placed **B1** for 7.5 and 8.7 seen
8(c)(i)	5	**1**	
8(c)(ii)	2	**1**	
8(c)(iii)	3	**1**	
8(d)	39.2	**4**	**M1** for mid-values soi **M1** for Σfx with x in correct interval including boundaries **M1 dep** for $\frac{\Sigma fx}{50}$ dep on second M1
9(a)	(0, 0), (1, 0), (2, 0)	**2**	**B1** for any two correct If 0 scored, SC1 for all three x values clearly identified

Question	Answer	Marks	Partial Marks
9(b)	$x\left(x^2-x-2x+2\right)$ or $\left(x^2-x\right)(x-2)$ or $(x-1)\left(x^2-2x\right)$ leading to x^3-3x^2+2x with no errors or omissions	**2**	**B1** for $x\left(x^2-x-2x+2\right)$ or $\left(x^2-x\right)(x-2)$ or $(x-1)\left(x^2-2x\right)$
9(c)	$3x^2-6x+2$	**B2**	**B1** for 2 correct terms
	their $\frac{dy}{dx}=0$	**M1**	
	their $\frac{-(-6)\pm\sqrt{(-6)^2-4(3)(2)}}{2(3)}$	**M2**	**M1** for $\sqrt{(-6)^2-4(3)(2)}$ or for $p=-(-6)$ and $r=2(3)$ if in form $\frac{p\pm\sqrt{q}}{r}$
	(0.4, 0.4) (1.6, –0.4)	**B3**	**B2** for 0.4 or 0.42... **and** 1.6 or 1.57 to 1.58 or for one correct pair of coordinates or **B1** for 0.4 or 0.42... **or** 1.6 or 1.57 to 1.58 If 0 scored **SC1** for $1+\sqrt{\frac{1}{3}}$ and $1-\sqrt{\frac{1}{3}}$ or better or for one correct pair of coordinates in any form
9(d)	Correct sketch 	**2**	**FT** *their* **(c)** but must be cubic i.e. correct shape cubic through origin and max and min in correct quadrants **B1** for cubic shape sketch
10(a)(i)	1	**1**	
10(a)(ii)	$\frac{1}{4}$ oe **nfww**	**2**	**M1** for $\frac{2}{4}\times\frac{2}{4}$ oe
10(a)(iii)	7	**2**	**M1** for trials with $\left(\frac{3}{4}\right)^k\times\frac{1}{4}$ soi
10(b)(i)	0.72 oe	**2**	**M1** for 0.9×0.8
10(b)(ii)	0.26 oe	**3**	**M2** for $0.9\times0.2+0.1\times0.8$ or $1-$ *their* **(b)(i)** -0.1×0.2 or **M1** for 0.9×0.2 or 0.1×0.8 or $1-$ *their* **(b)(i)** or $1-0.1\times0.2$
11(a)(i)	64	**1**	

Question	Answer	Marks	Partial Marks
11(a)(ii)	127	1	**FT** 2 × *their* **(a)(i)** – 1
11(b)	$\pm\frac{1}{2}$ oe nfww	4	**M1** for $(2x-1)^2+2(2x-1)$ **B1** for $4x^2-2x-2x+1$ or $(2x-1)(2x-1+2)$ **B1** for $4x^2-1$ [= 0] or $(2x-1)(2x+1)$ [= 0] OR **M1** for $x(x+2)=0$ (solving g(x) = 0) **A1** for $x = 0$ or –2 **B1** for $2x-1=0$ or $2x-1=-2$
11(c)	$\frac{x+1}{2}$ oe final answer	2	**M1** for $y+1=2x$ or $\frac{y}{2}=x-\frac{1}{2}$ or $x=2y-1$
11(d)	$-\frac{1}{6}$ oe nfww	3	**B2** for $3x=-\frac{1}{2}$ oe OR **M1** for $2^{2x}\times 2^x$ oe or $4^{\frac{1}{2}x}\times 4^x$ oe or 8^x oe **M1** for $2^{-\frac{1}{2}}$ or $4^{-\frac{1}{4}}$ or $8^{-\frac{1}{6}}$ soi