Cambridge Assessment
International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

MATHEMATICS   **0580/21**

Paper 2 (Extended)   **October/November 2020**

                                                                          1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

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

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

This document has **12** pages. Blank pages are indicated.

[Turn over

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1 Simplify.
$$3a + 7b - 4a + b$$

.... [2]

2 A field, *ABC*, is in the shape of a triangle.
AC = 500 m and *BC* = 650 m.

Using a ruler and compasses only, complete the scale drawing of the field *ABC*.
Leave in your construction arcs.
Use a scale of 1 cm to represent 100 m.
The side *AB* has been drawn for you.
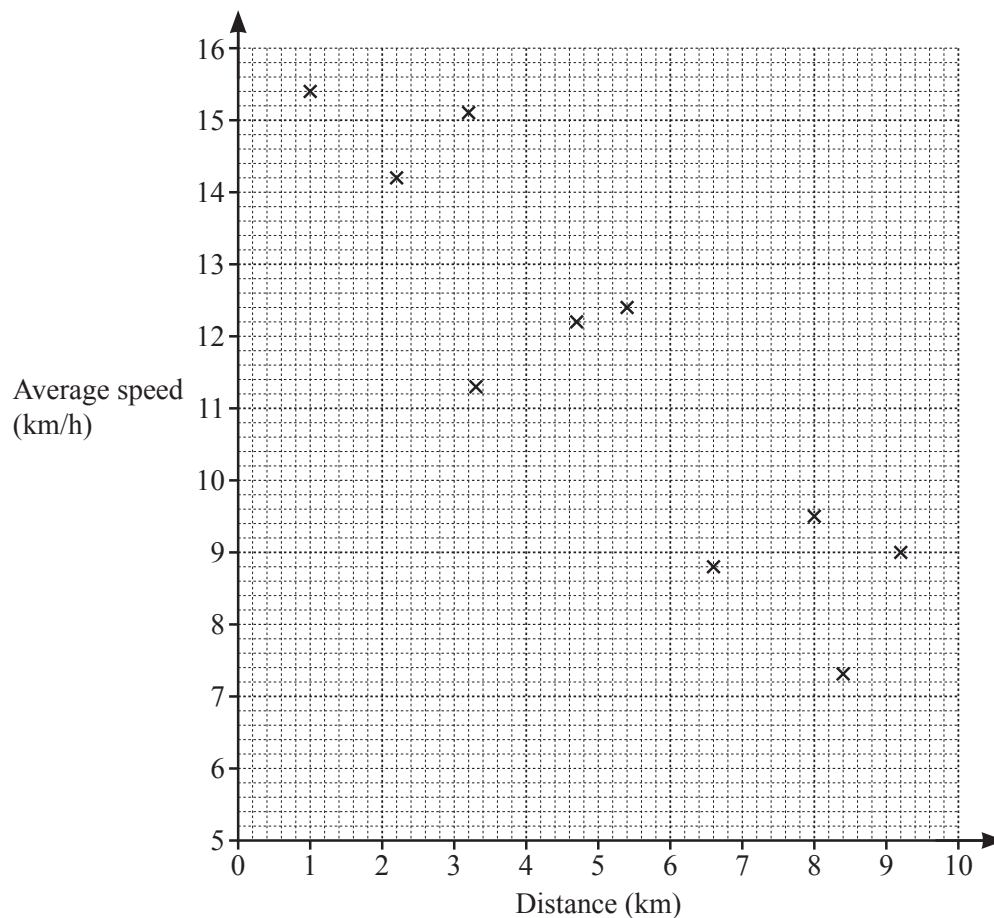
A ——————————————————— *B*

Scale: 1 cm to 100 m

[3]

3 Rangan buys 3.6 kg of potatoes and 2.8 kg of leeks.
The total cost is $13.72 .
Leeks cost $2.65 per kilogram.

Find the cost of 1 kg of potatoes.

$ .... [3]

4 Aisha records the distance she runs and her average speed.
The results are shown in the scatter diagram.

(a) The table shows the results of four more runs.

Distance (km)	4.2	5.7	7.1	8.8
Average speed (km/h)	13.4	11.8	9.8	8.3

On the scatter diagram, plot these points. [2]

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

.... [1]

(c) On the scatter diagram, draw a line of best fit. [1]

(d) Use your line of best fit to estimate her average speed when she runs a distance of 6 km.

.... km/h [1]

5 $$T = \frac{49.2 - 9.59}{4.085 \times 2.35}$$

By writing each number correct to 1 significant figure, work out an estimate for T.
You must show all your working.

.... [2]

6 **Without using a calculator**, work out $2\frac{2}{3} \times 2\frac{3}{4}$.

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

.... [3]

7 Make x the subject of this formula.
$$2y = 5x - 7$$

$x =$ .... [2]

8 **(a)** 1, 2, 3, 5 and 7 are all common factors of two numbers.

Write down the digit that the two numbers must end in.

.... [1]

(b) Write 84 as a product of its prime factors.

.... [2]

9 **(a)** Ahmed increases 40 by 300%.

From this list, put a ring around the correct calculation.

40×1.300 $\qquad$ 40×3 $\qquad$ 40×400 $\qquad$ 40×4 $\qquad$ 40×300

[1]

(b) Ahmed finds the magnitude of the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$.

From this list, put a ring around the correct calculation.

$\sqrt{2^2 + -3^2}$ $\qquad$ $2^2 - 3^2$ $\qquad$ $\sqrt{2^2 - 3^2}$ $\qquad$ $2^2 + (-3)^2$ $\qquad$ $\sqrt{2^2 + (-3)^2}$

[1]

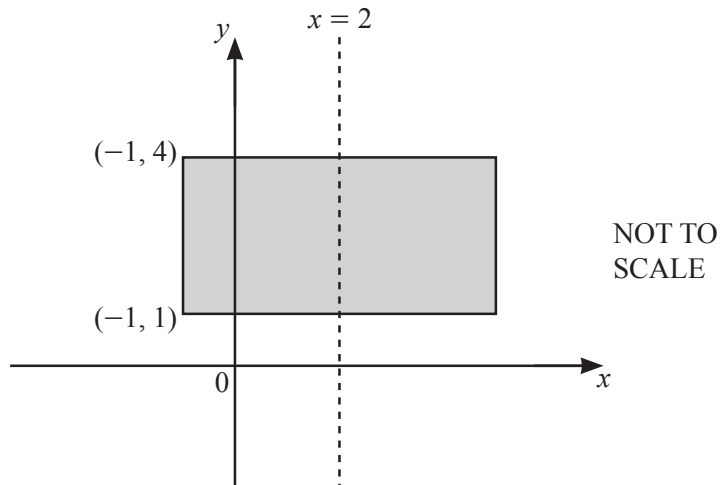**10** A town has a population of 45 000.
This population increases exponentially at a rate of 1.6% per year.

Find the population of the town at the end of 5 years.
Give your answer correct to the nearest hundred.

.... [3]

11

The diagram shows a rectangle with a line of symmetry at $x = 2$.
Two vertices of the rectangle are at $(-1, 1)$ and $(-1, 4)$.

The shaded region is defined by the inequalities $a \leqslant x \leqslant b$ and $c \leqslant y \leqslant d$.

Find the values of a, b, c and d.

$a = $ ....

$b = $ ....

$c = $ ....

$d = $ .... [2]

12 The interior angle of a regular polygon with n sides is 156°.

Work out the value of n.

$n = $ .... [2]

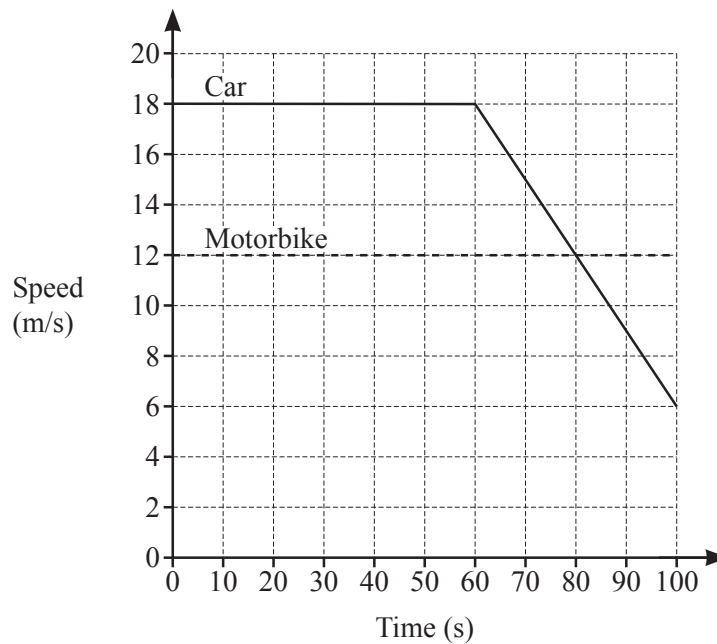**13** Write the recurring decimal $0.1\dot{7}$ as a fraction in its simplest form.
You must show all your working.

.... [3]

14 Find the gradient of a line that is perpendicular to $8y + 4x = 5$.

.... [2]

15

The diagram shows the speed–time graph for 100 seconds of the journey of a car and of a motorbike.

(a) Find the deceleration of the car between 60 and 100 seconds.

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

(b) Calculate how much further the car travelled than the motorbike during the 100 seconds.

.... m [3]

 [Turn over

16 Factorise $6x^2 + 7x - 20$.

.... [2]

17 (a) $f(x) = 3x^2 + a$ where a is an integer.
$f(-2) = 19$

Find the value of a.

$a =$ .... [2]

(b) $g(x) = 2x + 7$ $h(x) = 3x - 8$

(i) Find $gh(x)$ in its simplest form.

.... [2]

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

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

18

NOT TO
SCALE
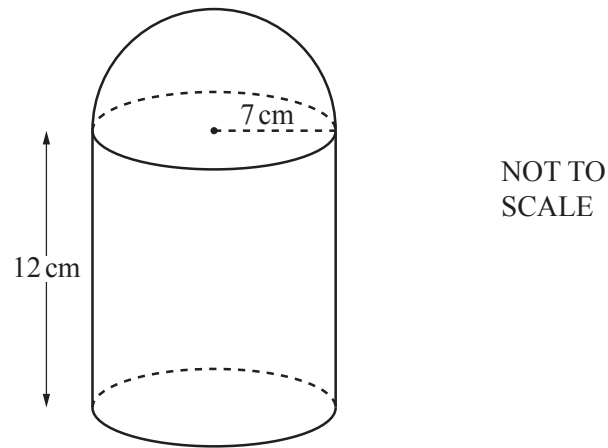
The diagram shows a solid made from a cylinder and a hemisphere, both of radius 7 cm.
The cylinder has length 12 cm.
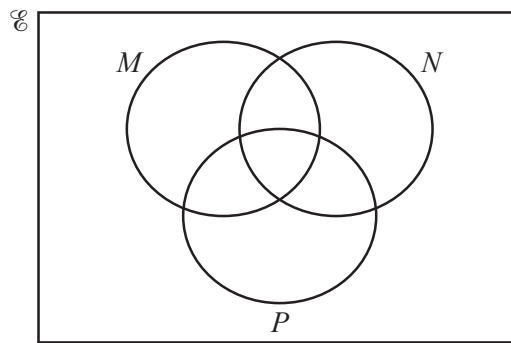
Work out the total surface area of the solid.
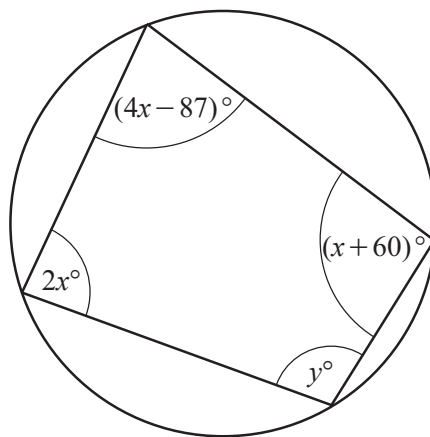[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

.... cm^2 [4]

19 In this Venn diagram, shade the region $M' \cup N \cup P$.

[1]

20

NOT TO SCALE

The diagram shows a cyclic quadrilateral.

Find the value of y.

$y = $ .... [4]

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21
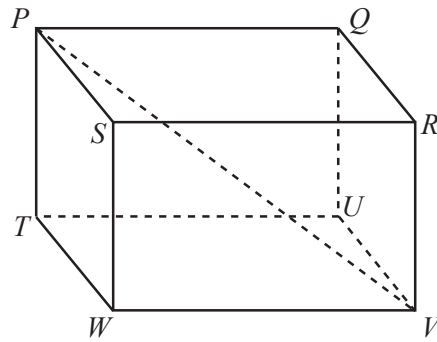
The diagram shows a cuboid *PQRSTUVW*.
PV = 17.2 cm
The angle between the line *PV* and the base *TUVW* of the cuboid is 43°.

Calculate *PT*.

PT = ... cm [3]

22 Simplify.

$$\frac{x^2 - 5x}{2x^2 - 50}$$

.... [4]

Question 23 is printed on the next page.

23 (a)
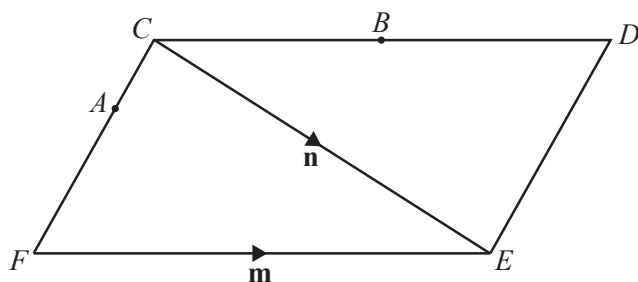
NOT TO
SCALE

The diagram shows a parallelogram *CDEF*.
$\overrightarrow{FE} = \mathbf{m}$ and $\overrightarrow{CE} = \mathbf{n}$.
B is the midpoint of *CD*.
FA = 2*AC*

Find an expression, in terms of **m** and **n**, for $\overrightarrow{AB}$.
Give your answer in its simplest form.

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

(b) $\overrightarrow{GH} = \frac{5}{6}(2\mathbf{p}+\mathbf{q})$ $\overrightarrow{JK} = \frac{5}{18}(2\mathbf{p}+\mathbf{q})$

Write down **two** facts about vectors $\overrightarrow{GH}$ and $\overrightarrow{JK}$.

....

.... [2]

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MATHEMATICS	**0580/21**
Paper 2 (Extended)	**October/November 2020**
MARK SCHEME	
Maximum Mark: 70	

Published

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

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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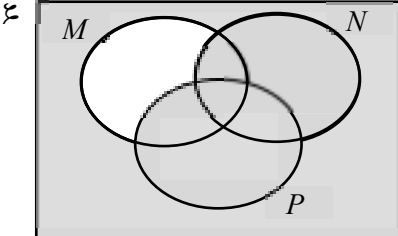

	Maths-Specific Marking Principles
1	Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.
2	Unless specified in the question, answers may be given as fractions,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

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

Question	Answer	Marks	Partial Marks
1	$-a + 8b$ final answer	**2**	**B1** for $-a$ or $[+]8b$ in final answer or for $-a + 8b$ spoilt
2	Correct triangle constructed with $AC = 5$ cm and $BC = 6.5$ cm and intersecting arcs	**3**	**B2** for correct triangle with no/incorrect arcs or **SC2** for accurate triangle with arcs but sides interchanged

or **B1** for 6.5 [cm] or 5 [cm] soi |
3	1.75	**3**	**M2** for $(13.72 - 2.8 \times 2.65) \div 3.6$ oe or **M1** for 2.8×2.65
4(a)	4 points correctly plotted	**2**	**B1** for 2 or 3 points correctly plotted
4(b)	Negative	**1**	
4(c)	Correct ruled line of best fit	**1**	
4(d)	10 to 12	**1**	**FT** *their* straight line of best fit
5	$\dfrac{50 - 10}{4 \times 2}$	**M1**	Allow **M1** for 3 out of 4 values correctly rounded or for all correct but with any trailing zeros
	5	**A1**	dep on $\dfrac{50 - 10}{4 \times 2}$
6	$\dfrac{8}{3}$ and $\dfrac{11}{4}$ oe improper fractions	**M1**	
	$\dfrac{88}{12}$ oe improper fraction	**A1**	
	$7\dfrac{1}{3}$ cao final answer	**A1**	dep on 1st A1

If M0 scored **SC1** for $\dfrac{8}{3}$ or $\dfrac{11}{4}$ oe improper fraction |
7	$[x =]\dfrac{2y+7}{5}$ oe or $[x =]\dfrac{2y}{5} + \dfrac{7}{5}$ oe final answer	**2**	**M1** for $2y + 7 = 5x$ oe or $\dfrac{2y}{5} = x - \dfrac{7}{5}$ oe
8(a)	0	**1**	
8(b)	$2^2 \times 3 \times 7$ or $2 \times 2 \times 3 \times 7$	**2**	**B1** for 2, 2, 3, 7
9(a)	40×4	**1**	
9(b)	$\sqrt{2^2 + (-3)^2}$	**1**	

Question	Answer	Marks	Partial Marks
10	48 700 cao	3	**M1** for $45\,000 \times \left(1 + \dfrac{1.6}{100}\right)^5$ oe **A1** for 48 710 to 48 720 If A0 scored **B1** for *their* more accurate value correctly rounded to the nearest 100
11	[a =] –1 [b =] 5 [c =] 1 [d =] 4	2	**B1** for two or three correct or **SC1** for [a =] $x \geqslant -1$ [b =] $x \leqslant 5$ [c =] $y \geqslant 1$ [d =] $y \leqslant 4$
12	15	2	**M1** for $\dfrac{360}{180 - 156}$ or $\dfrac{180(n-2)}{n} = 156$ oe
13	17.77… – 1.77… oe	M1	**M1** for correct working shown
	$\dfrac{8}{45}$ cao	A2	**B1** for $\dfrac{16}{90}$ oe seen
14	2	2	**M1** for $y = \dfrac{5 - 4x}{8}$ oe or better
15(a)	0.3	1	
15(b)	360	3	**M2** for correct complete area statement e.g. $18 \times 60 + \dfrac{1}{2} \times 40 \times (18 + 6) - 12 \times 100$ or $\dfrac{1}{2} \times 6 \times (60 + 80) - \dfrac{1}{2} \times 6 \times 20$ or for answer 420 or **M1** for one area calculation
16	$(3x - 4)(2x + 5)$ final answer	2	**B1** for $(ax + b)(cx + d)$ where $ac = 6$ and $ad + bc = 7$ or $bd = -20$
17(a)	[a =] 7	2	**M1** for $3(-2)^2 + a = 19$ or better
17(b)(i)	$6x - 9$ or $3(2x - 3)$ final answer	2	**M1** for $2(3x - 8) + 7$ or better
17(b)(ii)	$\dfrac{x - 7}{2}$ final answer	2	**M1** for a correct first step $x = 2y + 7$ or $y - 7 = 2x$ or $\dfrac{y}{2} = x + \dfrac{7}{2}$

0580/21   **Muhammad Shafiq ur Rehman (03247304567) Aitchison College**
Cambridge IGCSE – Mark Scheme   October/November 2020
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Question	Answer	Marks	Partial Marks
18	990 or 989.58 to 989.73	4	**M1** for $4 \times \pi \times 7^2 \, [\div 2]$ **M1** for $\pi \times 7^2$ **M1** for $\pi \times 7 \times 2 \times 12$
19		1	
20	107	4	**B2** for $x = 40$ or **M1** for $2x + x + 60 = 180$ oe **M1** for correctly substituting *their x* into $4x - 87 + y = 180$ oe or $4x - 87 + x + 60 + y + 2x = 360$ oe
21	11.7 or 11.73…	3	**M2** for $\sin 43 = \dfrac{PT}{17.2}$ oe or **M1** for identifying angle *PVT*
22	$\dfrac{x}{2(x+5)}$ or $\dfrac{x}{2x+10}$ final answer	4	**B1** for $x(x - 5)$ **B2** for $2(x - 5)(x + 5)$ or $(x - 5)(2x + 10)$ or $(2x - 10)(x + 5)$ or **B1** for $2(x^2 - 25)$ or $(x - 5)(x + 5)$
23(a)	$\dfrac{5}{6}\,\mathbf{m} - \dfrac{1}{3}\,\mathbf{n}$	3	**B2** for correct unsimplified answer in terms of **m** and **n** e.g. $\dfrac{1}{3}\,(\mathbf{m} - \mathbf{n}) + \dfrac{1}{2}\,\mathbf{m}$ or **M1** for a correct route or for $\overrightarrow{FC} = \mathbf{m} - \mathbf{n}$ or $\overrightarrow{CF} = \mathbf{n} - \mathbf{m}$ or better e.g. $\overrightarrow{AC} = \dfrac{1}{3}\,(\mathbf{m} - \mathbf{n})$
23(b)	$\overrightarrow{GH} = 3\,\overrightarrow{JK}$ oe or $\overrightarrow{GH}$ has a greater magnitude $\overrightarrow{GH}$ and $\overrightarrow{JK}$ are parallel	2	**B1** for each

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CANDIDATE NAME

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MATHEMATICS **0580/22**

Paper 2 (Extended) **October/November 2020**

1 hour 30 minutes

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This document has **12** pages. Blank pages are indicated.

[Turn over

1 Write two hundred thousand and seventeen in figures.

.... [1]

2 Insert one pair of brackets to make this calculation correct.

$$7 - 5 - 3 + 4 = 9$$ [1]

3 Solve the equation.
$$6 - 2x = 3x$$

$x =$ .... [2]

4
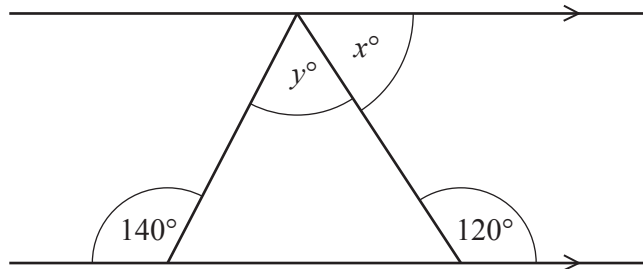
NOT TO SCALE

The diagram shows a triangle drawn between a pair of parallel lines.

Find the value of x and the value of y.

$x =$ ....

$y =$ .... [3]

5 Increase 42 by 16%.

.... [2]

6 Factorise completely.
$$4 - 8x$$

.... [1]

7
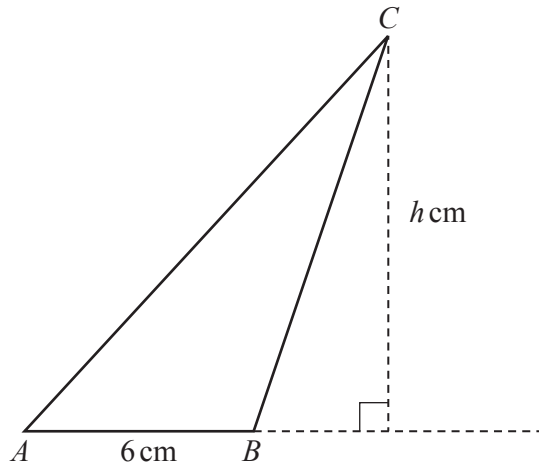
The area of triangle ABC is $27\,\text{cm}^2$ and $AB = 6\,\text{cm}$.

Calculate the value of h.

$h =$ .... [2]

8 Calculate the size of one interior angle of a regular polygon with 40 sides.

.... [2]

9 Solve the simultaneous equations.

$$2x + y = 7$$
$$3x - y = 8$$

$x =$ ....

$y =$ .... [2]

10 **Without using a calculator**, work out $\dfrac{5}{6} \div 1\dfrac{1}{3}$.
You must show all your working and give your answer as a fraction in its simplest form.

.... [3]

11 Simplify.
$$2x^2 \times 5x^5$$

.... [2]

12 Alex and Chris share sweets in the ratio   Alex : Chris = 7 : 3.
Alex receives 20 more sweets than Chris.

Work out the number of sweets Chris receives.

.... [2]

13 The length of one side of a rectangle is 12 cm.
The length of the diagonal of the rectangle is 13 cm.

Calculate the area of the rectangle.

.... cm^2 [3]

14 Work out $(3 \times 10^{199}) + (2 \times 10^{201})$.
Give your answer in standard form.

.... [2]

15

NOT TO
SCALE

7.5 cm
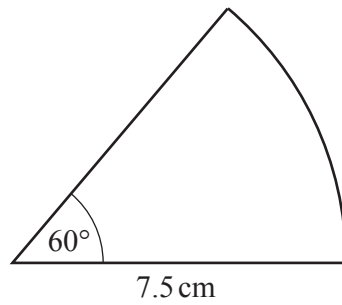
Calculate the area of this sector of a circle.

.... cm^2 [2]

16 The selling price of a shirt is \$26.50 .
This includes a tax of 6%.

Calculate the price of the shirt before the tax was added.

\$ .... [2]

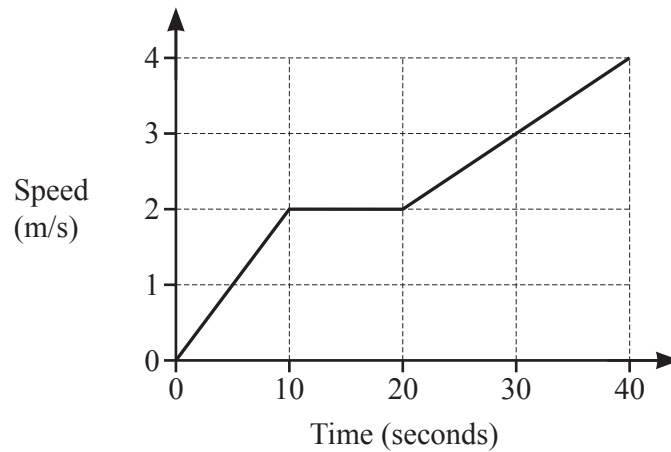**17**

The diagram shows the speed–time graph for the first 40 seconds of a cycle ride.

(a) Find the acceleration between 20 and 40 seconds.

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

(b) Find the total distance travelled.
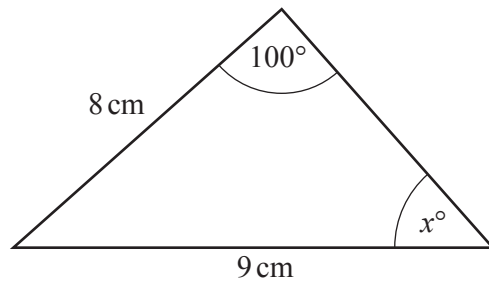
.... m [3]

18 The sides of an isosceles triangle are measured correct to the nearest millimetre.
One side has a length of 8.2 cm and another has a length of 9.4 cm.

Find the largest possible value of the perimeter of this triangle.

.... cm [3]

19

NOT TO
SCALE

(a) Calculate the value of x.

$x =$ .... [3]

(b) Calculate the area of the triangle.

.... cm^2 [3]

20 A model of a statue has a height of 4 cm.
The volume of the model is 12 cm^3.
The volume of the statue is 40 500 cm^3.

Calculate the height of the statue.

.... cm [3]

21 **(a)** Differentiate $6+4x-x^2$.

.... [2]

(b) Find the coordinates of the turning point of the graph of $y=6+4x-x^2$.

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

22
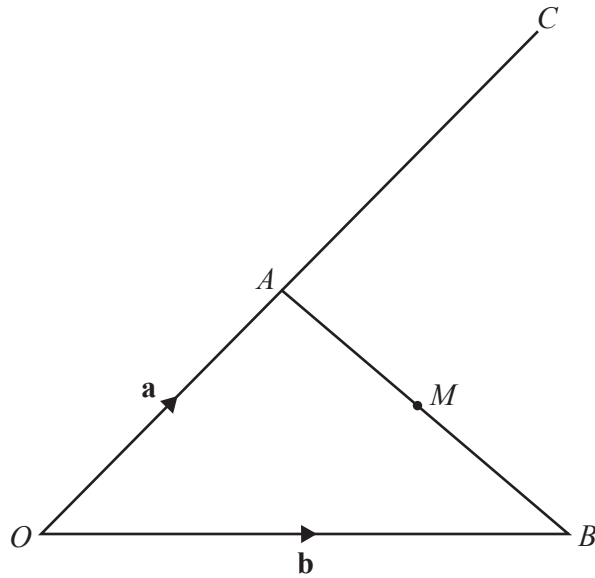
NOT TO
SCALE

The diagram shows a triangle OAB and a straight line OAC.
$OA : OC = 2 : 5$ and M is the midpoint of AB.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

(a) $\overrightarrow{AB}$,

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

(b) $\overrightarrow{MC}$.

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

23 Write as a single fraction in its simplest form.

$$2 - \frac{2x-1}{x+1}$$

.... [3]

24 A line from the point (2, 3) is perpendicular to the line $y = \frac{1}{3}x + 1$.
The two lines meet at the point P.

Find the coordinates of P.

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

Questions 25 and 26 are printed on the next page.

25 Solve the equation $\tan x = 2$ for $0° \leqslant x \leqslant 360°$.

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

26 Simplify.

$$\frac{ux - 2u - x + 2}{u^2 - 1}$$

.... [4]

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- 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

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Question	Answer	Marks	Partial Marks
1	200 017	**1**	
2	$7 - (5 - 3) + 4$	**1**	
3	1.2 or $1\frac{1}{5}$ or $\frac{6}{5}$	**2**	**M1** for $6 = 2x + 3x$ or better
4	$[x =]\ 60$ $[y =]\ 80$	**3**	**B1** for $[x =]\ 60$ **B2** for $[y =]\ 80$ or **B1** for 40 in a correct place on diagram If 0 scored **SC1** for *their x + their y* = 140
5	48.72	**2**	**M1** for $\dfrac{16}{100} \times 42$ oe or better
6	$4(1 - 2x)$	**1**	
7	9	**2**	**M1** for $\dfrac{1}{2} \times 6 \times h = 27$ oe
8	171	**2**	**M1** for $180 - (360 \div 40)$ oe or $\dfrac{(40 - 2) \times 180}{40}$ oe
9	$[x =]\ 3$ $[y =]\ 1$	**2**	**B1** for each
10	$\dfrac{5}{6} \times \dfrac{3}{4}$ or $\dfrac{5}{6} \div \dfrac{8}{6}$ oe	**M2**	**M1** for $\dfrac{4}{3}$ seen or for $\dfrac{5}{6} \times their\,\dfrac{3}{4}$ or for $\dfrac{5}{6} \div \dfrac{their\,8}{6}$
	$\dfrac{5}{8}$ cao	**A1**	dep on M2
11	$10x^7$ final answer	**2**	**B1** for kx^7 or $10x^k$ final answer or for correct answer then spoilt
12	15	**2**	**M1** for 4 [parts] = 20 soi or a correct equation e.g. $\dfrac{x + 20}{7} = \dfrac{x}{3}$ oe
13	60	**3**	**M2** for $12 \times \sqrt{13^2 - 12^2}$ or **M1** for $13^2 - 12^2$ or for $12 \times their\ 5$ from Pythagoras or trig
14	2.03×10^{201}	**2**	**B1** for figs 203 or $[0].03 \times 10^{201}$ or 200×10^{199}

Question	Answer	Marks	Partial Marks
15	29.5 or 29.45 to 29.46	2	**M1** for $\dfrac{60}{360}\times\pi\times7.5^2$ oe
16	25	2	**M1** for $x\times\left(1+\dfrac{6}{100}\right)=26.50$ oe or better
17(a)	0.1 or $\dfrac{1}{10}$	1	
17(b)	90	3	**M2** for $\dfrac{1}{2}\times10\times2+10\times2+\dfrac{1}{2}(2+4)\times20$ oe or **M1** for one area calculation or indicated on diagram
18	27.15 cao	3	**M2** for $(9.4 + 0.05) \times 2 + 8.2 + 0.05$ or better or **M1** for $8.2 + 0.05$ or $9.4 + 0.05$ or better seen **OR** **SC2** for answer 25.95 or **SC1** for answer 26.85
19(a)	61.1 or 61.08 to 61.09...	3	**M2** for $[\sin x =]$ $\dfrac{8\sin100}{9}$ oe or better or **M1** for $\dfrac{9}{\sin100}=\dfrac{8}{\sin x}$ oe
19(b)	11.7 or 11.66 to 11.67	3	**M2** for $\dfrac{1}{2}\times9\times8\times\sin(180-100-their\ \textbf{(a)})$ oe or **M1** for $180-100-their\ \textbf{(a)}$
20	60	3	**M2** for $4\times\sqrt[3]{\dfrac{40500}{12}}$ oe or **M1** for $\left(\dfrac{4}{l}\right)^3=\dfrac{12}{40500}$ oe or $\sqrt[3]{\dfrac{40500}{12}}$ oe or $\sqrt[3]{\dfrac{12}{40500}}$ oe
21(a)	$4-2x$	2	**B1** for 4 or $-2x$
21(b)	(2, 10)	2	**B1** for x-coordinate of 2 or **M1** for $their\ 4-2x=0$
22(a)	$-\mathbf{a}+\mathbf{b}$	1	

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Question	Answer	Marks	Partial Marks
22(b)	$2\mathbf{a} - \dfrac{1}{2}\mathbf{b}$	3	**B2** for answer $2\mathbf{a} + p\mathbf{b}$ or $q\mathbf{a} - \dfrac{1}{2}\mathbf{b}$ $q \neq \dfrac{1}{2}$ or correct unsimplified answer in terms of **a** and **b** or **M1** for $\overrightarrow{AC} = \dfrac{3}{2}\mathbf{a}$ or $\overrightarrow{OC} = \dfrac{5}{2}\mathbf{a}$ or correct route If 0 scored **SC1** for answer $\mathbf{a} + \dfrac{1}{2}\mathbf{b}$
23	$\dfrac{3}{x+1}$ final answer	3	**B1** for $2(x+1) - (2x-1)$ oe **B1** for common denominator $x + 1$
24	(2.4, 1.8) oe	5	**M1** for [gradient =] $-1 \div \dfrac{1}{3}$ oe **M1** for substituting (2, 3) into $y = (their\ m)x + c$ oe **M1** for $\dfrac{1}{3}x + 1 = their\left(mx + c\right)$ with $their\ m \neq \dfrac{1}{3}$ **M1** for substituting *their x*-coord into either equation to find *y* or for substituting *their y*-coord into either equation to find *x*
25	63.4 or 63.43... 243.4 or 243.4...	2	**B1** for each If 0 scored **SC1** for two answers with a difference of 180
26	$\dfrac{x-2}{u+1}$ oe final answer	4	**B2** for $(x-2)(u-1)$ or **B1** for $u(x-2) - (x-2)$ or $x(u-1) - 2(u-1)$ **B1** for $(u-1)(u+1)$

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS   **0580/23**

Paper 2 (Extended)   **October/November 2020**

                                                                    1 hour 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

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

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

This document has **12** pages. Blank pages are indicated.

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1   Write down the cube number that is greater than 50 but less than 100.

.... [1]

2   Calculate. $\dfrac{4}{\sqrt{0.0025}}$

.... [1]

3   In triangle *ABC*, *BC* = 7.6 cm and *AC* = 6.2 cm.

Using a ruler and compasses only, construct triangle *ABC*.
Leave in your construction arcs.
The side *AB* has been drawn for you.

A ————————————————————————————— *B*

[2]

4   Simplify. $a^2 \div a^6$

.... [1]

5 Thor changes 40 000 Icelandic Krona into dollars when the exchange rate is 1 krona = $0.0099 .

Work out how many dollars he receives.

$ .... [1]

6
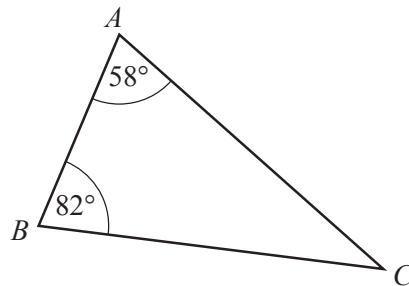
NOT TO
SCALE

The diagram shows triangle *ABC*.
The triangle is reflected in the line *BC* to give a quadrilateral *ABDC*.

(a) Write down the mathematical name of the quadrilateral *ABDC*.

.... [1]

(b) Find angle *ACD*.

Angle *ACD* = ... [2]

7 Change 457 000 cm^2 into m^2.

....m^2 [1]

8 The length, l cm, of a line is 18.3 cm, correct to the nearest millimetre.

Complete this statement about the value of l.

.... $\leqslant l <$ .... [2]

9 **Without using a calculator**, work out $1\frac{1}{7} \times 2\frac{1}{10}$.
You must show all your working and give your answer as a mixed number in its simplest form.

.... [3]

10 Solve the simultaneous equations.
You must show all your working.
$$3x - 8y = 22$$
$$x + 4y = 4$$

$x =$ ....

$y =$ .... [3]

11 A bag contains 7 red discs, 5 green discs and 2 pink discs.

(a) Helen takes one disc at random, records the colour and replaces it in the bag.
She does this 140 times.

Find how many times she expects to take a green disc.

.... [2]

(b) Helen adds 9 green discs and some pink discs to the discs already in the bag.
The probability of taking a green disc is now $\frac{2}{7}$.

Find the number of pink discs that Helen added to the bag.

.... [2]

12 A straight line, *l*, has equation $y = 5x + 12$.

(a) Write down the gradient of line *l*.

.... [1]

(b) Find the coordinates of the point where line *l* crosses the *x*-axis.

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

(c) A line perpendicular to line *l* has gradient *k*.

Find the value of *k*.

$k = $ .... [1]

13
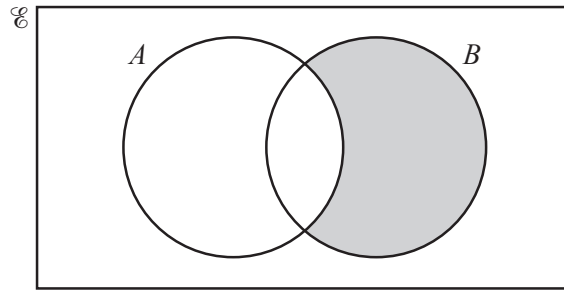
Use set notation to describe the shaded region.

.... [1]

14 $N = 2^4 \times 3 \times 7^5$

$PN = K$, where P is an integer and K is a square number.

Find the smallest value of P.

$P = $ .... [2]

15 $m = 2p + \sqrt{\dfrac{x}{y}}$

Make x the subject of this formula.

$x = $ .... [3]

16 A paperweight has height $4\,\text{cm}$ and volume $38.4\,\text{cm}^3$.
A mathematically similar paperweight has height $7\,\text{cm}$.

Calculate the volume of this paperweight.

.... cm^3 [3]

17 Adil and Brian are paid the same wage.
Adil is given a 7% pay decrease and his new wage is $427.80 .
Brian is given a 7% pay increase.

Work out Brian's new wage.

$ .... [3]

18 (a) Simplify.
$$\left(4xy^2\right)^3$$

.... [2]

(b) $25 = 125^k$

Find the value of k.

$k =$ .... [1]

19
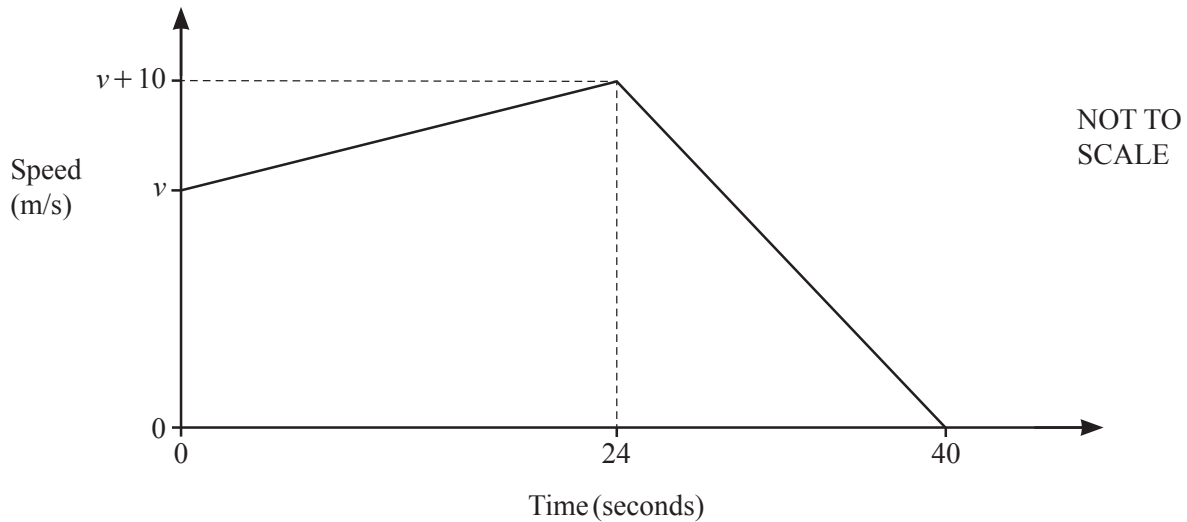
The diagram shows the speed–time graph for the final 40 seconds of a car journey.
At the start of the 40 seconds the speed is v m/s.

(a) Find the acceleration of the car during the first 24 seconds.

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

(b) The total distance travelled during the 40 seconds is 1.24 **kilometres**.

Find the value of v.

$v =$ .... [4]

20 Factorise.
$$3x + 8y - 6ax - 16ay$$

.... [2]

21
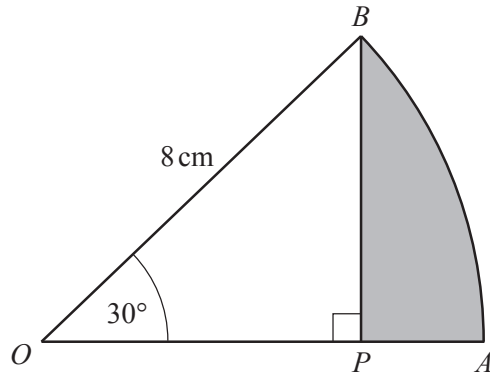
NOT TO
SCALE

OAB is the sector of a circle, centre *O*.
OB = 8 cm and angle *AOB* = 30°.
BP is perpendicular to *OA*.

(a) Calculate *AP*.

AP = ... cm [3]

(b) Work out the area of the shaded region *APB*.

.... cm² [3]

22 The table shows information about the times, t seconds, taken by each of 100 students to solve a puzzle.

Time (t seconds)	$0 < t \leqslant 10$	$10 < t \leqslant 15$	$15 < t \leqslant 20$	$20 < t \leqslant 40$	$40 < t \leqslant 75$
Frequency	9	18	22	30	21

(a) Calculate an estimate of the mean time.

.... s [4]

(b) Emmanuel draws a histogram to show this information.
The table shows the heights, in cm, of some of the bars for this histogram.

Complete the table.

Time (t seconds)	$0 < t \leqslant 10$	$10 < t \leqslant 15$	$15 < t \leqslant 20$	$20 < t \leqslant 40$	$40 < t \leqslant 75$
Height of bar (cm)	3.6	14.4	17.6		

[3]

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23 y is inversely proportional to the square root of x.
When $y = 7$, $x = 2.25$.

Write y in terms of x.

$y =$ .... [2]

24 Simplify.

$$\frac{x^2 - 25}{x^2 - 17x + 60}$$

.... [4]

Question 25 is printed on the next page.

25 Solve $3\tan x = -4$ for $0° \leqslant x \leqslant 360°$.

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

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MATHEMATICS	**0580/23**
Paper 2 (Extended)	**October/November 2020**
MARK SCHEME	
Maximum Mark: 70	

<div style="border:1px solid black; text-align:center;">

Published

</div>

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

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

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

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

Abbreviations

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

Question	Answer	Marks	Partial Marks
1	64	**1**	
2	80	**1**	
3	Accurate triangle with correct construction arcs	**2**	**B1** for accurate triangle with no/incorrect arcs or **SC1** for accurate triangle with arcs with sides interchanged
4	a^{-4} or $\dfrac{1}{a^4}$ final answer	**1**	
5	396	**1**	
6(a)	Kite	**1**	
6(b)	80	**2**	**M1** for (180 – 82 – 58) or better
7	45.7	**1**	
8	18.25, 18.35	**2**	**B1** for each or **SC1** for both values correct but reversed
9	$\dfrac{8}{7}$ and $\dfrac{21}{10}$ oe improper fractions	**M1**	
	$\dfrac{168}{70}$ oe improper fractions	**A1**	
	$2\dfrac{2}{5}$ cao final answer	**A1**	**Dep**. on first **A1** If M0 scored **SC1** for $\dfrac{8}{7}$ or $\dfrac{21}{10}$ oe improper fractions
10	Correctly eliminates one variable	**M1**	
	[x =] 6 [y =] –0.5 oe	**A2**	**A1** for either correct If M0 scored, **SC1** for 2 values satisfying one of the original equations
11(a)	50	**2**	**M1** for $\dfrac{5}{7+5+2}$ [× 140] or $\dfrac{140}{7+5+2}$ [× 5]
11(b)	26	**2**	**M1** for $\dfrac{5+9}{n}=\dfrac{2}{7}$ oe or $\dfrac{5+9}{p+7+5+2+9}=\dfrac{2}{7}$ oe

0580/23   **Muhammad Shafiq ur Rehman (03247304567) Aitchison College**
Cambridge IGCSE – Mark Scheme   October/November 2020
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Question	Answer	Marks	Partial Marks
12(a)	5	1	
12(b)	$(-\dfrac{12}{5}$ oe, 0)	2	**M1** for $5x + 12 = 0$
12(c)	$-\dfrac{1}{5}$ oe	1	**FT** $-\dfrac{1}{their\,(a)}$
13	$A' \cap B$	1	
14	21	2	**B1** for 3×7 soi or $2^4 \times 3^2 \times 7^6$ oe or answer of $21 \times k^2$
15	$[x =]\; y(m - 2p)^2$ nfww or $[x =]\; y(m^2 - 4mp + 4p^2)$ final answer	3	**M1** for subtract $2p$ or *their* term in p to isolate a term in x **M1** for squaring **M1** for multiplying by *their* term in y Maximum of 2 marks for an incorrect answer
16	205.8	3	**M2** for $38.4 \times \left(\dfrac{7}{4}\right)^3$ oe or **M1** for $\left(\dfrac{7}{4}\right)^3$ or $\left(\dfrac{4}{7}\right)^3$ oe or $\dfrac{7}{4} = \sqrt[3]{\dfrac{v}{38.4}}$ oe
17	492.2[0]	3	**B2** for 32.2[0] OR **M1** for $x \times \left(1 - \dfrac{7}{100}\right) = 427.8[0]$ oe or better **M1** for *their* $460 \times \left(1 + \dfrac{7}{100}\right)$ oe or *their* $460 \times \dfrac{7}{100}$ correctly evaluated

Question	Answer	Marks	Partial Marks
18(a)	$64x^3y^6$ final answer	2	**B1** for kx^3y^6 or $64x^ky^6$ or $64x^3y^k$ final answer or correct answer then spoilt
18(b)	$\dfrac{2}{3}$	1	
19(a)	$\dfrac{5}{12}$ or 0.417 or 0.4166 to 0.4167	1	
19(b)	32.5	4	**M3** for $\dfrac{1}{2}(v+v+10)\times 24 + \dfrac{1}{2}\times 16(v+10) = 1240$ oe OR **M2** for $\dfrac{1}{2}(v+v+10)\times 24$ oe and $\dfrac{1}{2}\times 16(v+10)$ oe or **M1** for one area expression **M1** for correctly solving *their* $(av + b = 1240)$ oe $(a \neq 0, b \neq 0)$
20	$(3x + 8y)(1 - 2a)$	2	**M1** for $3x(1 - 2a) + 8y(1 - 2a)$ or $3x + 8y - 2a(3x + 8y)$ or better
21(a)	1.07 or 1.071 to 1.072	3	**M2** for $[8 -]$ 8 cos 30 oe or **M1** for $\dfrac{OP}{8} = \cos 30$ oe
21(b)	2.9[0] or 2.895 to 2.901	3	**M1** for $\dfrac{30}{360}\times \pi \times 8^2$ oe **M1** for $\dfrac{1}{2}\times 8\times their\, 6.93\times \sin 30$ oe or $\dfrac{1}{2}\times 8\cos 30 \times 4$ oe

Question	Answer	Marks	Partial Marks
22(a)	27.625	4	**M1** for 5, 12.5, 17.5, 30, 57.5 **M1** for $\sum fx$ where x is in correct interval including boundaries **M1** dep on second **M1** for $\dfrac{\Sigma fx}{100}$
22(b)	6 and 2.4	3	**B2** for either correct or **M1** for [fd =] 1.5 or 0.6 oe or **B1** for [multiplier] 4
23	$y = \dfrac{10.5}{\sqrt{x}}$ oe final answer	2	**M1** for $y = \dfrac{k}{\sqrt{x}}$
24	$\dfrac{x+5}{x-12}$ nfww final answer	4	**B1** for $(x+5)(x-5)$ **B2** for $(x-12)(x-5)$ or **B1** for $x(x-5)-12(x-5)$ or $x(x-12)-5(x-12)$ or for $(x+a)(x+b)$ where $ab=-60$ or $a+b=-17$
25	126.9 or 126.86 to 126.87 and 306.9 or 306.86 to 306.87	3	**B2** for one correct or **M1** for $\tan x = -\dfrac{4}{3}$ if 0 scored then **SC1** for two answers with a difference of 180°

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS   **0580/41**

Paper 4 (Extended)   **October/November 2020**

                                                                                    2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

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

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

This document has **20** pages. Blank pages are indicated.

[Turn over

1

(a) Draw the image of shape A after a translation by the vector $\begin{pmatrix} 8 \\ -6 \end{pmatrix}$. [2]

(b) Draw the image of shape A after a reflection in the line $y = -1$. [2]

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

....

.... [3]

(d) Describe fully the **single** transformation that maps shape A onto shape C.

....

.... [3]

2 **(a)** A plane has 14 First Class seats, 70 Premium seats and 168 Economy seats.

Find the ratio   First Class seats : Premium seats : Economy seats.
Give your answer in its simplest form.

.... : .... : .... [2]

(b) (i) For a morning flight, the costs of tickets are in the ratio

First Class : Premium : Economy $= 14 : 6 : 5$.

The cost of a Premium ticket is $114.

Calculate the cost of a First Class ticket and the cost of an Economy ticket.

First Class $ ....

Economy $ .... [3]

(ii) For an afternoon flight, the cost of a Premium ticket is reduced from $114 to $96.90 .

Calculate the percentage reduction in the cost of a ticket.

.... % [2]

(c) When the local time in Athens is 09 00, the local time in Berlin is 08 00.
A plane leaves Athens at 13 15.
It arrives in Berlin at 15 05 local time.

(i) Find the flight time from Athens to Berlin.

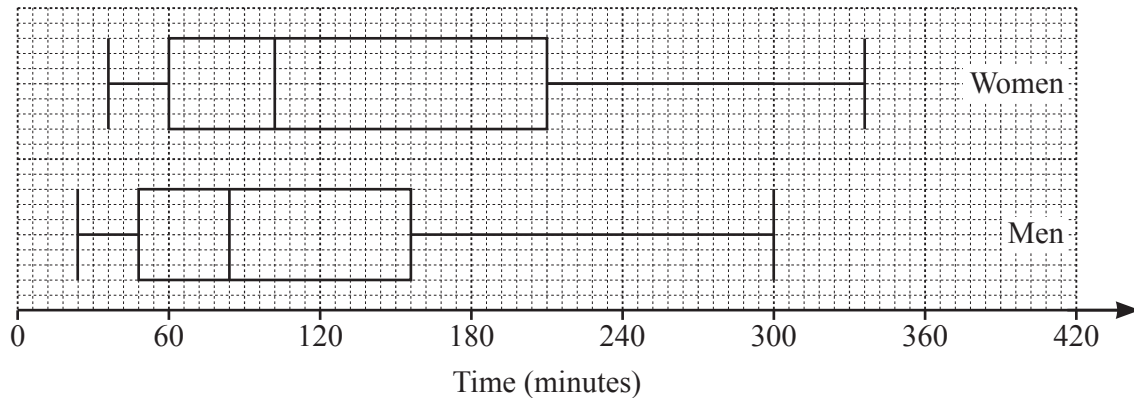......................... h .... min [1]

(ii) The distance the plane flies from Athens to Berlin is 1802 km.

Calculate the average speed of the plane.
Give your answer in kilometres per hour.

.... km/h [2]

3 **(a)**

Time (minutes)

The box-and-whisker plots show the times spent exercising in one week by a group of women and a group of men.

Below are two statements comparing these times.
For each one, write down whether you agree or disagree, giving a reason for your answer.

Statement	Agree or disagree	Reason
On average, the women spent less time exercising than the men.		
The times for the women show less variation than the times for the men.		

[2]

(b) The frequency table shows the times, *t* minutes, each of 100 children spent exercising in one week.

Time (*t* minutes)	$0 < t \leqslant 60$	$60 < t \leqslant 100$	$100 < t \leqslant 160$	$160 < t \leqslant 220$	$220 < t \leqslant 320$
Frequency	41	24	23	8	4

(i) Calculate an estimate of the mean time.

.... min [4]

(ii) The information in the frequency table is shown in this cumulative frequency diagram.
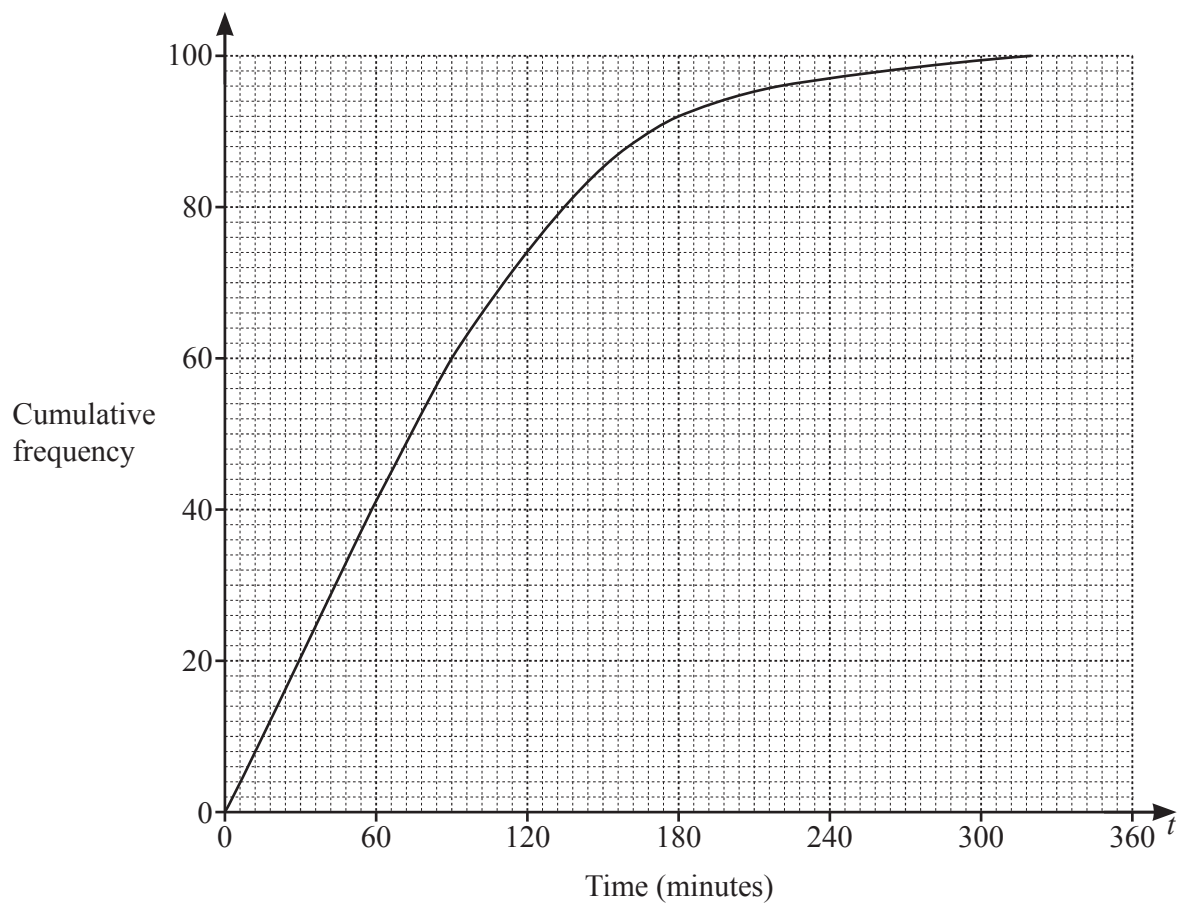
Use the cumulative frequency diagram to find an estimate of

(a) the 60th percentile,

.... min [1]

(b) the number of children who spent more than 3 hours exercising.

.... [2]

(iii) A histogram is drawn to show the information in the frequency table.
The height of the bar for the interval $60 < t \leqslant 100$ is 10.8 cm.

Calculate the height of the bar for the interval $160 < t \leqslant 220$.

.... cm [2]

4 **(a)** A rectangle measures 8.5 cm by 10.7 cm, both correct to 1 decimal place.

Calculate the upper bound of the perimeter of the rectangle.

.... cm [3]

(b)
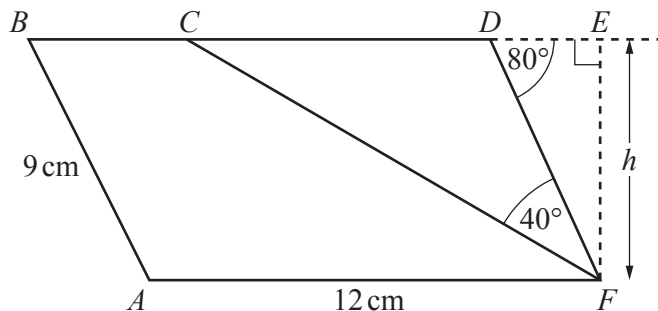
ABDF is a parallelogram and *BCDE* is a straight line.
AF = 12 cm, *AB* = 9 cm, angle *CFD* = 40° and angle *FDE* = 80°.

(i) Calculate the height, *h*, of the parallelogram.

h = ... cm [2]

(ii) Explain why triangle *CDF* is isosceles.

....

.... [2]

(iii) Calculate the area of the **trapezium** *ABCF*.

.... cm^2 [3]

(c)
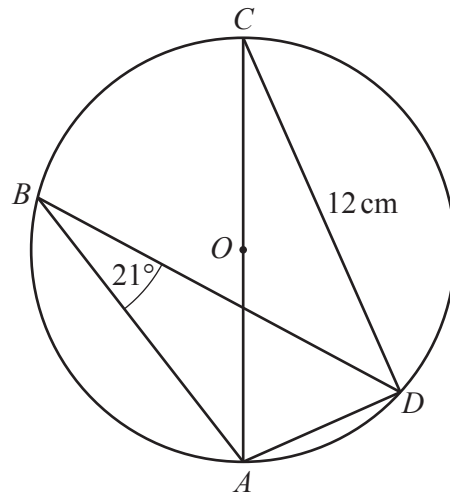
NOT TO
SCALE

A, *B*, *C* and *D* are points on the circle, centre *O*.
Angle *ABD* = 21° and *CD* = 12 cm.

Calculate the area of the circle.

.... cm² [5]

(d)

8 cm   9.5 cm   NOT TO
SCALE
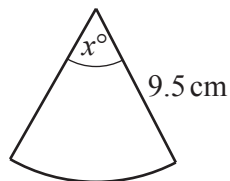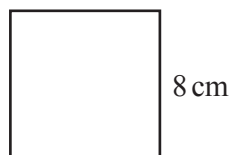
The diagram shows a square with side length 8 cm and a sector of a circle with radius 9.5 cm
and sector angle *x*°.
The perimeter of the square is equal to the perimeter of the sector.

Calculate the value of *x*.

x = ... [3]

5 **(a)** The diagram shows the graph of $y = f(x)$ for $-3 \leqslant x \leqslant 3$.
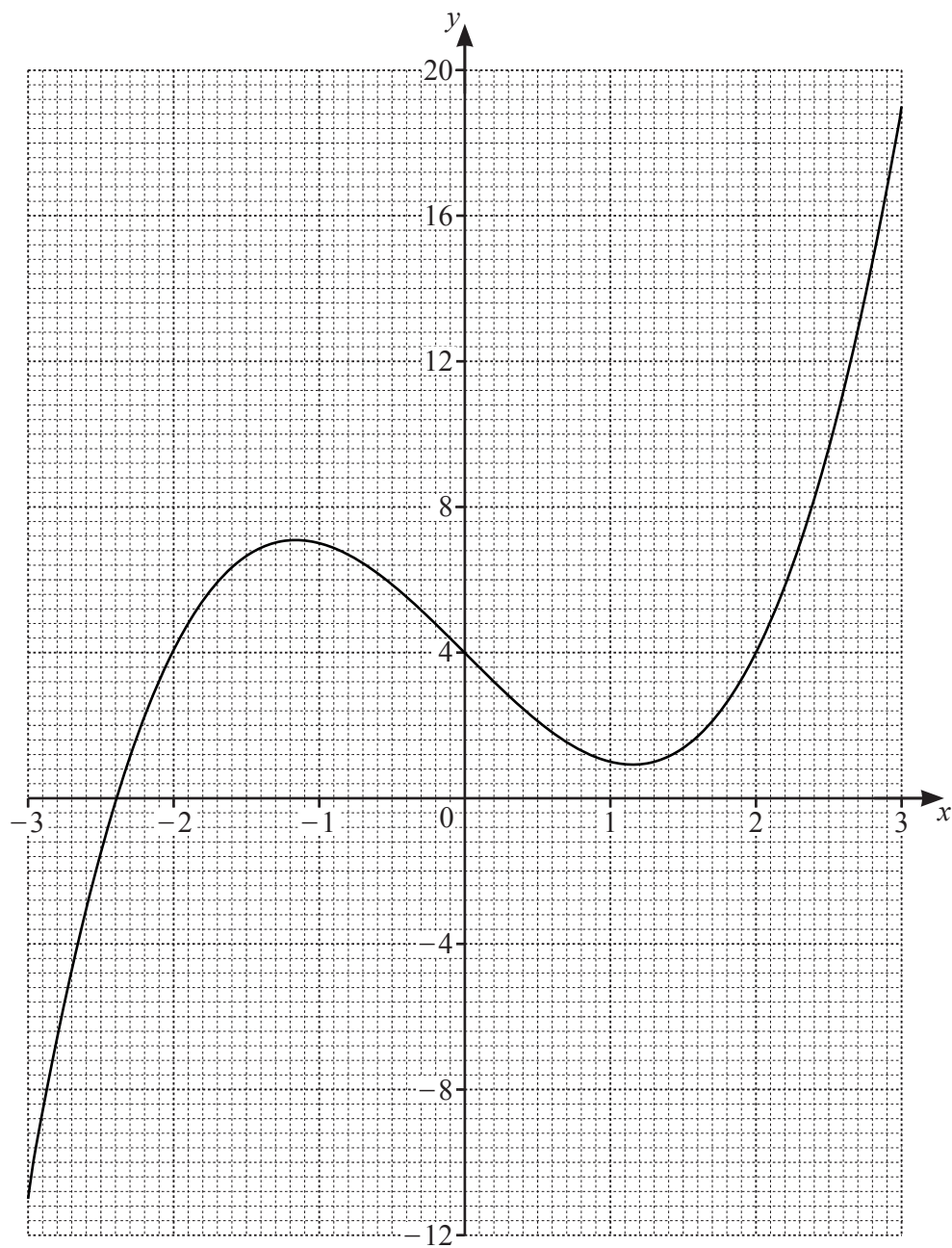
(i) Solve $f(x) = 14$.

$x = $ .... [1]

(ii) By drawing a suitable tangent, find an estimate of the gradient of the graph at the point $(-2, 4)$.

.... [3]

(iii) By drawing a suitable straight line on the grid, solve $f(x) = 2x - 2$ for $-3 \leqslant x \leqslant 3$.

.

$x =$ .... [3]

(b)
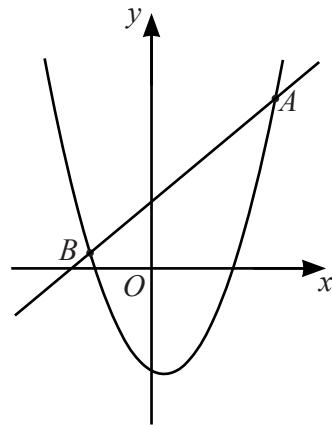
NOT TO
SCALE

The diagram shows a curve with equation $y = 2x^2 - 2x - 7$.
The straight line with equation $y = 3x + 5$ intersects the curve at the points A and B.

Find the coordinates of the points A and B.

A (.................... , ...)

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

6
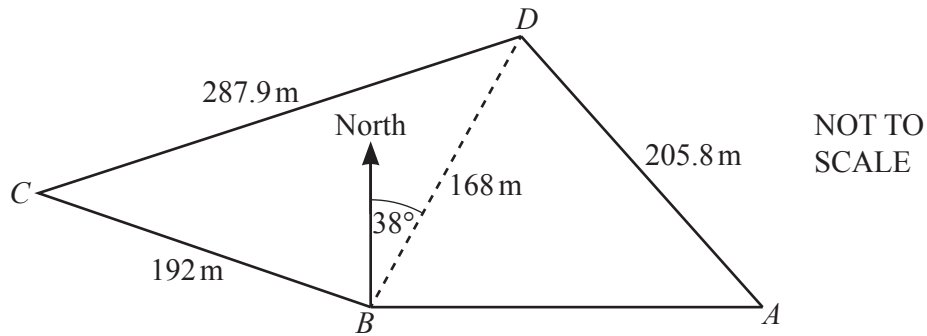
The diagram shows a field, *ABCD*, on horizontal ground.
BC = 192 m, *CD* = 287.9 m, *BD* = 168 m and *AD* = 205.8 m.

(a) (i) Calculate angle *CBD* and show that it rounds to 106.0°, correct to 1 decimal place.

[4]

(ii) The bearing of *D* from *B* is 038°.

Find the bearing of *C* from *B*.

.... [1]

(iii) *A* is **due east** of *B*.

Calculate the bearing of *D* from *A*.

.... [5]

(b) (i) Calculate the area of triangle *BCD*.

.... m^2 [2]

(ii) Tomas buys the triangular part of the field, *BCD*.
The cost is $35 750 per hectare.

Calculate the amount he pays.
Give your answer correct to the nearest $100.
[1 hectare = 10 000 m^2]

$ .... [2]

7

| Diagram 1 | Diagram 2 | Diagram 3 | Diagram 4 |
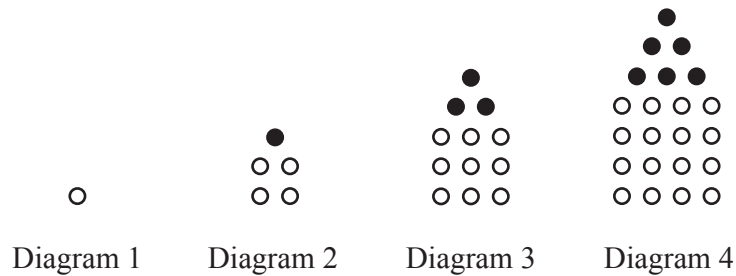
These are the first four diagrams of a sequence.
The diagrams are made from white dots and black dots.

(a) Complete the table for Diagram 5 and Diagram 6.

Diagram	1	2	3	4	5	6
Number of white dots	1	4	9	16		
Number of black dots	0	1	3	6		
Total number of dots	1	5	12	22		

[2]

(b) Write an expression, in terms of n, for the number of white dots in Diagram n.

.... [1]

(c) The expression for the total number of dots in Diagram n is $\frac{1}{2}(3n^2 - n)$.

(i) Find the total number of dots in Diagram 8.

.... [1]

(ii) Find an expression for the number of black dots in Diagram n.
Give your answer in its simplest form.

.... [2]

(d) *T* is the total number of dots used to make **all** of the first *n* diagrams.

$$T = an^3 + bn^2$$

Find the value of *a* and the value of *b*.
You must show all your working.

a = ...

b = ... [5]

8 **(a)** Factorise completely.

$$3a^2b - ab^2$$

.... [2]

(b) Solve the inequality.

$$3x + 12 < 5x - 3$$

.... [2]

(c) Simplify.

$$\left(3x^2y^4\right)^3$$

.... [2]

(d) Solve.

$$\frac{2}{x} = \frac{6}{2-x}$$

$x =$ .... [3]

(e) Expand and simplify.

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

.... [3]

(f) Alan invests \$200 at a rate of r% per year compound interest.
After 2 years the value of his investment is \$206.46 .

(i) Show that $r^2 + 200r - 323 = 0$.

[3]

(ii) Solve the equation $r^2 + 200r - 323 = 0$ to find the rate of interest.
Show all your working and give your answer correct to 2 decimal places.

$r =$ .... [3]

9 **(a)** There are 32 students in a class.

        5 do not study any languages.
        15 study German (G).
        18 study Spanish (S).
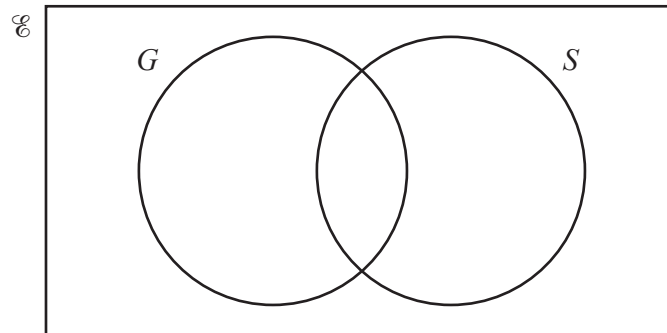
    (i) Complete the Venn diagram to show this information. [2]

   (ii) A student is chosen at random.

       Find the probability that the student studies Spanish but not German.

                                       .... [1]

  (iii) A student who studies German is chosen at random.

       Find the probability that this student also studies Spanish.

                                         .... [1]

(b) A bag contains 54 red marbles and some blue marbles.
36% of the marbles in the bag are red.

Find the number of blue marbles in the bag.

.... [2]

(c) Another bag contains 15 red beads and 10 yellow beads.
Ariana picks a bead at random, records its colour and replaces it in the bag.
She then picks another bead at random.

(i) Find the probability that she picks two red beads.

.... [2]

(ii) Find the probability that she does not pick two red beads.

.... [1]

(d) A box contains 15 red pencils, 8 yellow pencils and 2 green pencils.
Two pencils are picked at random without replacement.

Find the probability that at least one pencil is red.

.... [3]

10 (a)
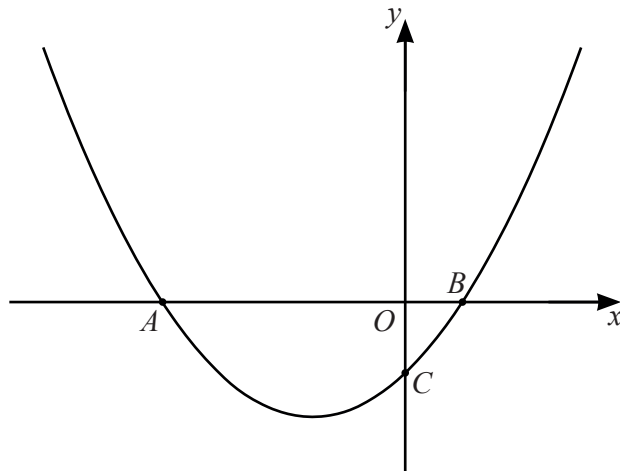
NOT TO
SCALE

The diagram shows a sketch of the curve $y = x^2 + 3x - 4$.

(i) Find the coordinates of the points A, B and C.

A (.............. , ...)

B (.............. , ...)

C (.............. , ...) **[4]**

(ii) Differentiate $x^2 + 3x - 4$.

.... **[2]**

(iii) Find the equation of the tangent to the curve at the point $(2, 6)$.

.... **[3]**

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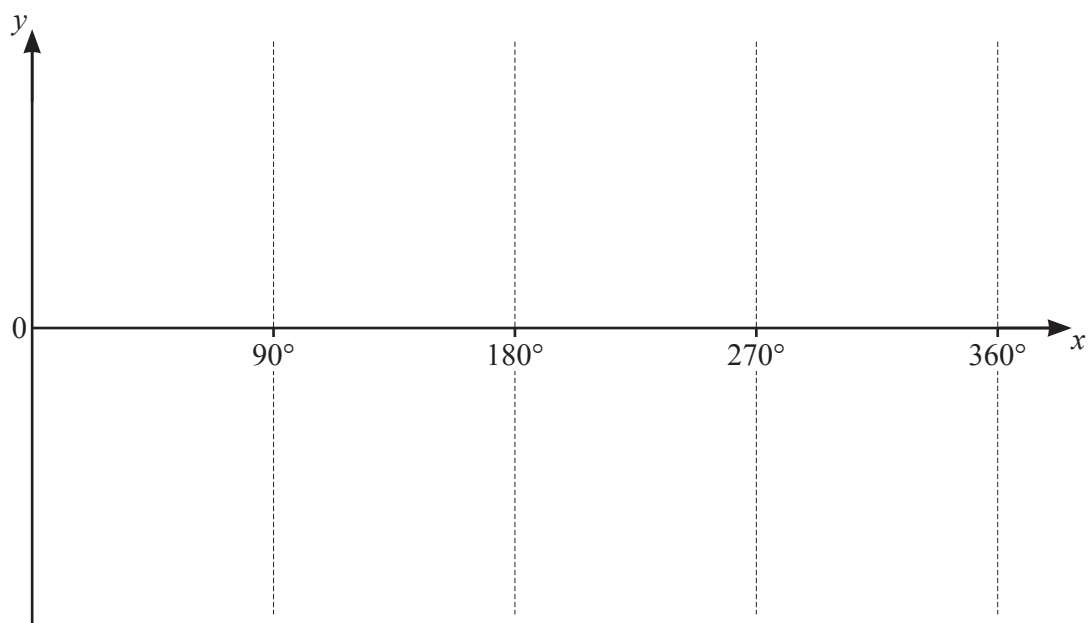
(i) On the diagram, sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$. [2]

(ii) Solve the equation $5 \tan x = -7$ for $0° \leqslant x \leqslant 360°$.

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

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Cambridge Assessment
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MATHEMATICS	**0580/41**
Paper 4 (Extended)	**October/November 2020**
MARK SCHEME	
Maximum Mark: 130	

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Published

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

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

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

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

[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)	Image at (4, –1) (4, –4) (5, –4)	2	**B1** for translation by $\begin{pmatrix} 8 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -6 \end{pmatrix}$ or for correct vertices not joined
1(b)	Image at (–4, –4) (–4, –7) (–3, –4)	2	**B1** for reflection in $x = -1$ or $y = k$ or for correct vertices not joined
1(c)	Enlargement 3 (–5, 5)	3	**B1** for each
1(d)	Rotation 90º clockwise oe (1, 1)	3	**B1** for each
2(a)	1 : 5 : 12	2	**M1** for 2 : 10 : 24 or 7 : 35 : 84 or $\frac{1}{18} : \frac{5}{18} : \frac{12}{18}$
2(b)(i)	266 and 95	3	**B2** for 266 or 95 or 266 and 95 reversed or **M1** for $\frac{114}{6}$
2(b)(ii)	15	2	**M1** for $\frac{114 - 96.9}{114}$ [× 100] oe or $\frac{96.9}{114} \times 100$
2(c)(i)	2h 50min	1	
2(c)(ii)	636	2	**M1** for 1802 ÷ *their* 2h 50min
3(a)	Disagree: the median for the women is greater (than the median for the men) oe Disagree: the men have a smaller [interquartile] range of times oe	2	**B1** for each correct statement oe
3(b)(i)	87.4 nfww	4	**M1** for mid-points **soi** (30, 80, 130, 190, 270) **M1** for use of Σ*fm* with *m* in correct interval including both boundaries **M1** (dep on 2nd M1) for Σ*fm* ÷ (41 + 24 + 23 + 8 + 4)
3(b)(ii)(a)	90	1	
3(b)(ii)(b)	8	2	**B1** for 92 seen
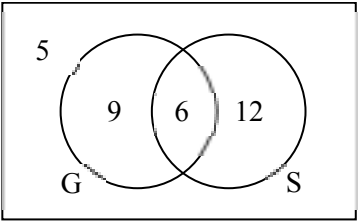
Question	Answer	Marks	Partial Marks
3(b)(iii)	2.4	**2**	**M1** for $\dfrac{24}{40}$ or $\dfrac{8}{60}$ Or **B1** for [multiplier] 18 or $\dfrac{1}{18}$
4(a)	38.6	**3**	**M2** for [2 ×] (8.5 + 0.05 + 10.7 + 0.05) or **M1** for 8.5 + 0.05 or 10.7 + 0.05
4(b)(i)	8.86 or 8.863…	**2**	**M1** for $\dfrac{h}{9}$ = sin 80 or better oe
4(b)(ii)	∠CDF = 100 leading to ∠DCF = 40 Or ∠EDF = 80 leading to ∠DCF = 40	**M1**	Implied by 180-(100 + 40) = 40 or 80 – 40
	'two equal angles'	**A1**	With no incorrect work seen
4(b)(iii)	66.5 or 66.45 to 66.47…	**3**	**M2** for 0.5(3 + 12) × *their* **(b)(i)** or 12 × *their* **(b)(i)** – 0.5 × 9 × 9 × sin 100 oe or **B1** for *DC* = 9 or *BC* = 3
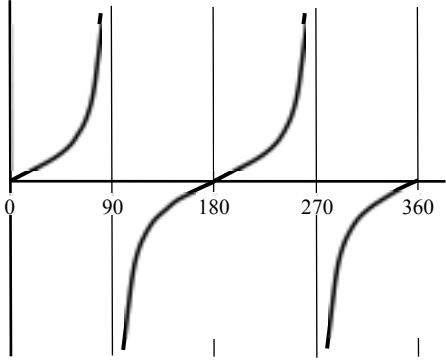
Question	Answer	Marks	Partial Marks
4(c)	130 nfww or 129.6 to 129.8	5	**B1** for $\angle ACD = 21°$ or $\angle CAD = 69°$ **Method 1** **M2** for $\cos 21 = \dfrac{12}{AC}$ oe or **M1** for $\angle ADC = 90$ soi **M1** for $\pi(their\ AC/2)^2$ OR **Method 2** **M2** for $\dfrac{12}{sin138} = \dfrac{r}{sin21}$ oe or **M1** for $\angle COD = 138$ soi **M1** for $\pi(their\ r)^2$ OR **Method 3** **M2** for $\cos 21 = \dfrac{6}{OC}$ oe or **M1** for $\angle CXO = 90$ soi where X is the point where the perpendicular from O meets the chord CD **M1** for $\pi(their\ OC)^2$
4(d)	78.4 or 78.37 to 78.41	3	**M2** for $\dfrac{x}{360} \times 2 \times \pi \times 9.5 + 2 \times 9.5 = 4 \times 8$ oe or **M1** for $\dfrac{x}{360} \times 2 \times \pi \times 9.5$ After **M0, SC1** for $9.5x + 19 = 32$ oe
5(a)(i)	2.7 to 2.8	1	

Question	Answer	Marks	Partial Marks
5(a)(ii)	tangent ruled at $x = -2$	**B1**	
	6 to 10	**2**	**dep on B1** or a close attempt at tangent at $x = -2$ or **M1** for rise/run for *their* tangent, or close attempt, at any point Must see correct or implied calculation from a drawn tangent After **M0, SC1** for gradient of tangent (or close attempt) in range embedded in $y = mx + c$
5(a)(iii)	$y = 2x - 2$ ruled and $x = -2.9$ to -2.8 cao	**3**	**B2** for correct ruled line or **B1** for short line or for freehand line or broken line or ruled line with gradient 2 or with y-intercept at -2 (but not $y = -2$)
5(b)	A (4, 17) B (−1.5, 0.5)	**5**	**B4** for (−1.5, 0.5) and (4, 17), or for $x = 4$ and $x = -1.5$ **OR** **B3** for A(4, 17) or B(−1.5, 0.5) **OR** **M1** for $2x^2 - 2x - 7 = 3x + 5$ oe AND either **M2** for $(2x + 3)(x - 4)$ or **M1** for $2x(x - 4) + 3(x - 4)$ or $x(2x + 3) - 4(2x + 3)$ or $(2x + c)(x + d)$ where $cd = -12$ or $c + 2d = -5$ [c and d are integers] OR **M2** for $$\dfrac{-their\,b \pm \sqrt{(their\,b)^2 - 4(their\,a)(their\,c)}}{2(their\,a)}$$ or **M1** for $\sqrt{(their\,b)^2 - 4(their\,a)(their\,c)}$ or for $p = -their\,b$, $r = 2(their\,a)$ if in the form $\dfrac{p + \sqrt{q}}{r}$ or $\dfrac{p - \sqrt{q}}{r}$

Question	Answer	Marks	Partial Marks
6(a)(i)	106.01 to 106.02	4	**M2** for $[\cos[\angle CBD]=]\dfrac{192^2+168^2-287.9^2}{2\times192\times168}$ oe or **M1** for the implicit form **A1** for -0.276 to -0.275
6(a)(ii)	292.0 or 291.98 to 291.99	1	
6(a)(iii)	310.0 or 310.03 to 310.04	5	**M2** for $[\sin A=]\dfrac{168\times\sin(90-38)}{205.8}$ or **M1** for $\dfrac{\sin A}{168}=\dfrac{\sin(90-38)}{205.8}$ **A1** for $[A=]$ 40.0 or 40.03 to 40.04 **M1 dep** for $270+$ *their* angle DAB oe
6(b)(i)	15 500 or 15 501 to 15 503. …	2	**M1** for $0.5\times192\times168\times\sin(106)$ oe
6(b)(ii)	55 400	2	**FT** $3.575\times$ *their* **(b)(i)** oe rounded to nearest 100 **M1** for figs 35 75 $\times$ figs *their* **(b)(i)** or figs 554 or figs 5541 to figs 5543
7(a)	25 36 10 15 35 51	2	**B1** for 3, 4 or 5 correct
7(b)	n^2	1	
7(c)(i)	92	1	
7(c)(ii)	$\dfrac{1}{2}(n^2-n)$ oe	2	**M1** for $\dfrac{1}{2}(3n^2-n)-n^2$ oe or for final quadratic answer with $\dfrac{1}{2}n^2$ oe or $-\dfrac{1}{2}n^2$ oe but not both

Question	Answer	Marks	Partial Marks
7(d)	$a = \dfrac{1}{2}$, $b = \dfrac{1}{2}$	5	**B2** for 2 correct equations eg $a + b = 1$, $8a + 4b = 6$ or **B1** for 1 correct equation **B2** for one correct value or **M1** (dep on at least B1) for correctly eliminating one variable from two linear equations in a and b OR **B2** for $a = \dfrac{1}{2}$ or **B1** for $6a = 3$ or for 3rd difference = 3 **B2** for $b = \dfrac{1}{2}$ or **M1** for substituting *their* a into a correct equation of first differences
8(a)	$ab(3a - b)$ final answer	2	**B1** for $a(3ab - b^2)$ or $b(3a^2 - ab)$ or $ab(3a - b)$ seen
8(b)	$x > 7.5$ final answer	2	**B1** for $12+3 < 5x - 3x$ oe
8(c)	$27x^6y^{12}$	2	**B1** for two of 27, x^6 and y^{12} correct
8(d)	0.5 or $\dfrac{1}{2}$	3	**M2** for $4 = 6x + 2x$ or better or **M1** for $2(2 - x) = 6x$ oe
8(e)	$2x^3 + 5x^2 - 23x + 10$ final answer	3	**B2** for correct expansion of three brackets unsimplified **B1** for correct expansion of two brackets with at least 3 terms correct
8(f)(i)	$200\left(1+\dfrac{r}{100}\right)^2 = 206.46$ oe	M1	
	$1 + \dfrac{2r}{100} + \dfrac{r^2}{100^2}$ oe	M1	
	$r^2 + 200r - 323 = 0$	A1	Correct solution reached with no errors or omissions seen If 0 scored, **SC1** for $200\left(n\right)^2 = 206.46$

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Question	Answer	Marks	Partial Marks
8(f)(ii)	$\dfrac{-200+\sqrt{200^2-4(1)(-323)}}{2\times1}$	**B2**	**B1** for $\sqrt{200^2-4(1)(-323)}$ or $(r+100)^2$ **B1** for $\dfrac{-200+\sqrt{q}}{2\times1}$ or $r=\sqrt{323+100^2}-100$ OR **B2** for $100\left(\sqrt{\dfrac{206.46}{200}}-1\right)$ or **B1** for $\sqrt{\dfrac{206.46}{200}}$
	1.60 cao final answer	**B1**	
9(a)(i)		2	**B1** for two correct values Or **B1** 5 outside and total in G = 15 and total in S = 18
9(a)(ii)	$\dfrac{3}{8}$ oe	1	**FT** $\dfrac{their\ 12}{32}$
9(a)(iii)	$\dfrac{2}{5}$ oe	1	**FT** $\dfrac{their\ 6}{15}$
9(b)	96	2	**M1** for $\dfrac{36}{64}=\dfrac{54}{x}$ oe or $36=\dfrac{54}{(54+b)}\times100$ oe If 0 scored **SC**1 for answer 150
9(c)(i)	$\dfrac{9}{25}$ oe	2	**M1** for $\dfrac{15}{25}\times\dfrac{15}{25}$ oe
9(c)(ii)	$\dfrac{16}{25}$ oe	1	**FT** 1 – *their* **(c)(i)**
9(d)	$\dfrac{17}{20}$ oe	3	**M2** for $1-\dfrac{10}{25}\times\dfrac{9}{24}$ oe or for $\dfrac{15}{25}\times\dfrac{14}{24}+\dfrac{15}{25}\times\dfrac{8}{24}+\dfrac{15}{25}\times\dfrac{2}{24}+\dfrac{8}{25}\times\dfrac{15}{24}$ $+\dfrac{2}{25}\times\dfrac{15}{24}$ oe or **M1** for one correct relevant product

Question	Answer	Marks	Partial Marks
10(a)(i)	$A(-4, 0)$ $B(1, 0)$ $C(0, -4)$	4	**B3** for A and B correct Or **B2** for B $(-4, 0)$ and A $(1, 0)$ Or **B1** for $(x + 4)(x - 1)$ or for $\dfrac{-3 \pm \sqrt{3^2 - 4 \times 1 \times -4}}{2}$ oe and **B1** for A or B correct **B1** for C$(0, -4)$ OR **SC2** for -4, 1 and -4 in correct positions on the graph
10(a)(ii)	$2x + 3$ [± 0] final answer	2	**B1** for answer $2x + c$ or for $ax + 3$, $a \neq 0$ or for correct answer seen
10(a)(iii)	$y = 7x - 8$ oe	3	**B2** for answer $7x - 8$ OR **M1** for [gradient =] $2(2) + 3$ FT *their* part **(a)(ii)** of the form $ax + b$ **M1dep** for substitution of $(2, 6)$ into $y = their\ mx + c$ oe
10(b)(i)	Correct sketch 	2	**B1** for one correct section out of 4 OR **B1** for two properties correct from • Crosses x-axis at $(0, 0)$ $(180, 0)$ and $(360, 0)$ only • Correct curvature in each section of 90° • Asymptotes at $x = 90$ and $x = 270$
10(b)(ii)	125.5 or 125.53 to 125.54 and 305.5 or 305.53 to 305.54	3	**B2** for one correct angle or **B1** for -54.5 or $-54.46\ldots$ or for 2 angles with a difference of 180.

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

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

This document has **20** pages. Blank pages are indicated.

DC (LK/SG) 189256/2
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[Turn over

1   Karel travelled from London to Johannesburg and then from Johannesburg to Windhoek.

   (a) The flight from London to Johannesburg took 11 hours 10 minutes.
        The average speed was 813 km/h.

        Calculate the distance travelled from London to Johannesburg.
        Give your answer correct to the nearest 10 km.

.... km [3]

   (b) The total time for Karel's journey from London to Windhoek was 15 hours 42 minutes.
        The total distance travelled from London to Windhoek was 10 260 km.

      (i) Calculate the average speed for this journey.

.... km/h [2]

(ii) The cost of Karel's journey from London to Windhoek was $470.

(a) Calculate the distance travelled per dollar.

.... km per dollar [1]

(b) Calculate the cost per 100 km of this journey.
Give your answer correct to the nearest cent.

$ .... per 100 km [2]

(c) Karel changed $300 into 3891 Namibian dollars.

Complete the statement.

$1 = ... Namibian dollars [1]

2
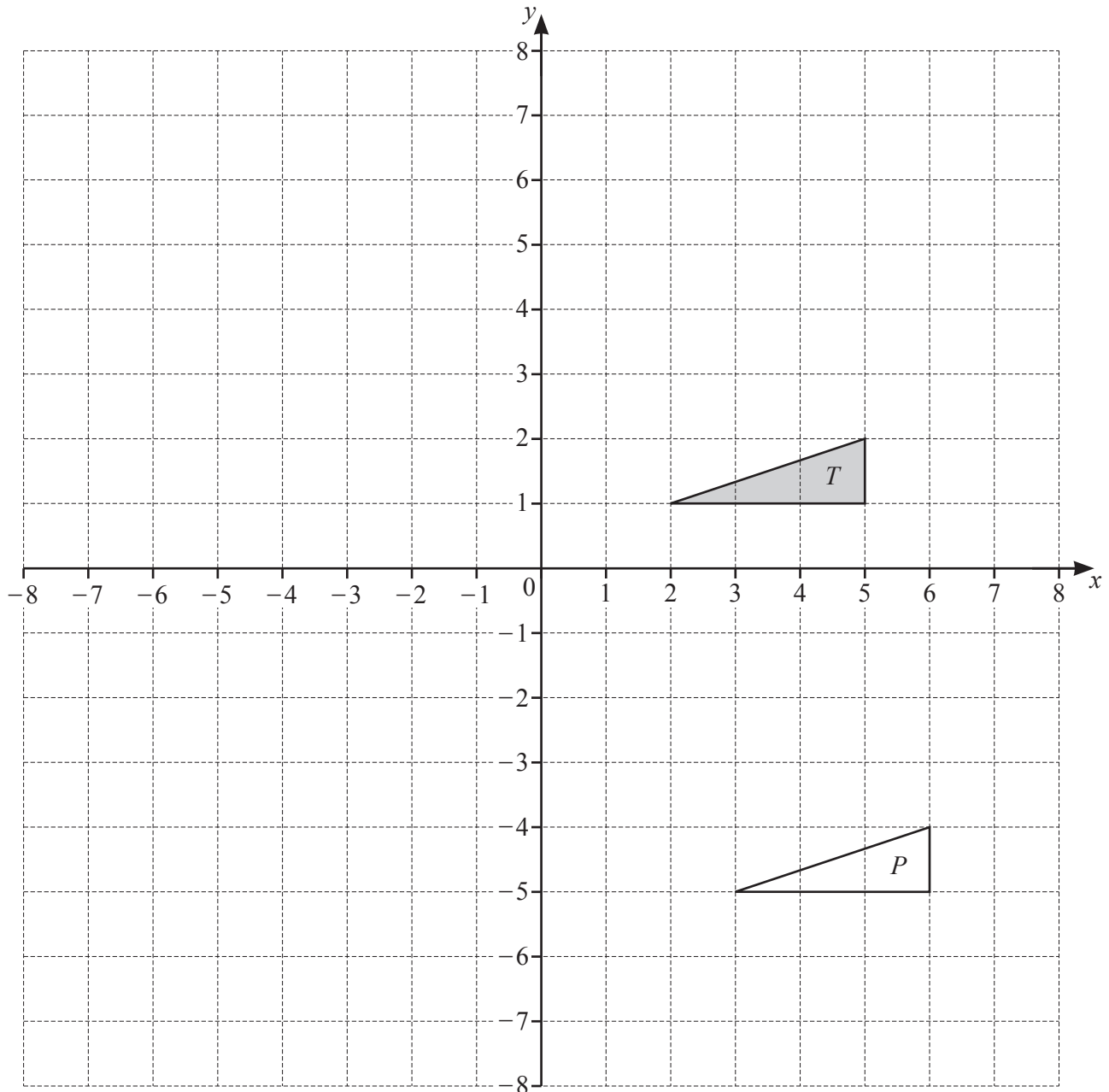
(a) Describe fully the **single** transformation that maps triangle *T* onto triangle *P*.

....

.... [2]

(b) (i) Reflect triangle *T* in the line $x = 1$. [2]

(ii) Rotate triangle *T* through 90° anticlockwise about (6, 0). [2]

(iii) Enlarge triangle *T* by a scale factor of −2, centre (1, 0). [2]

3 **(a)** Beth invests $2000 at a rate of 2% per year compound interest.

    (i) Calculate the value of this investment at the end of 5 years.

$ .... [2]

    (ii) Calculate the overall percentage increase in the value of Beth's investment at the end of 5 years.

.... % [2]

    (iii) Calculate the minimum number of complete years it takes for the value of Beth's investment to increase from $2000 to more than $2500.

.... [3]

(b) The population of a village decreases exponentially at a rate of 4% each year.
The population is now 255.

Calculate the population 16 years ago.

.... [3]

4 The height, h cm, of each of 120 plants is measured.
   The cumulative frequency diagram shows this information.
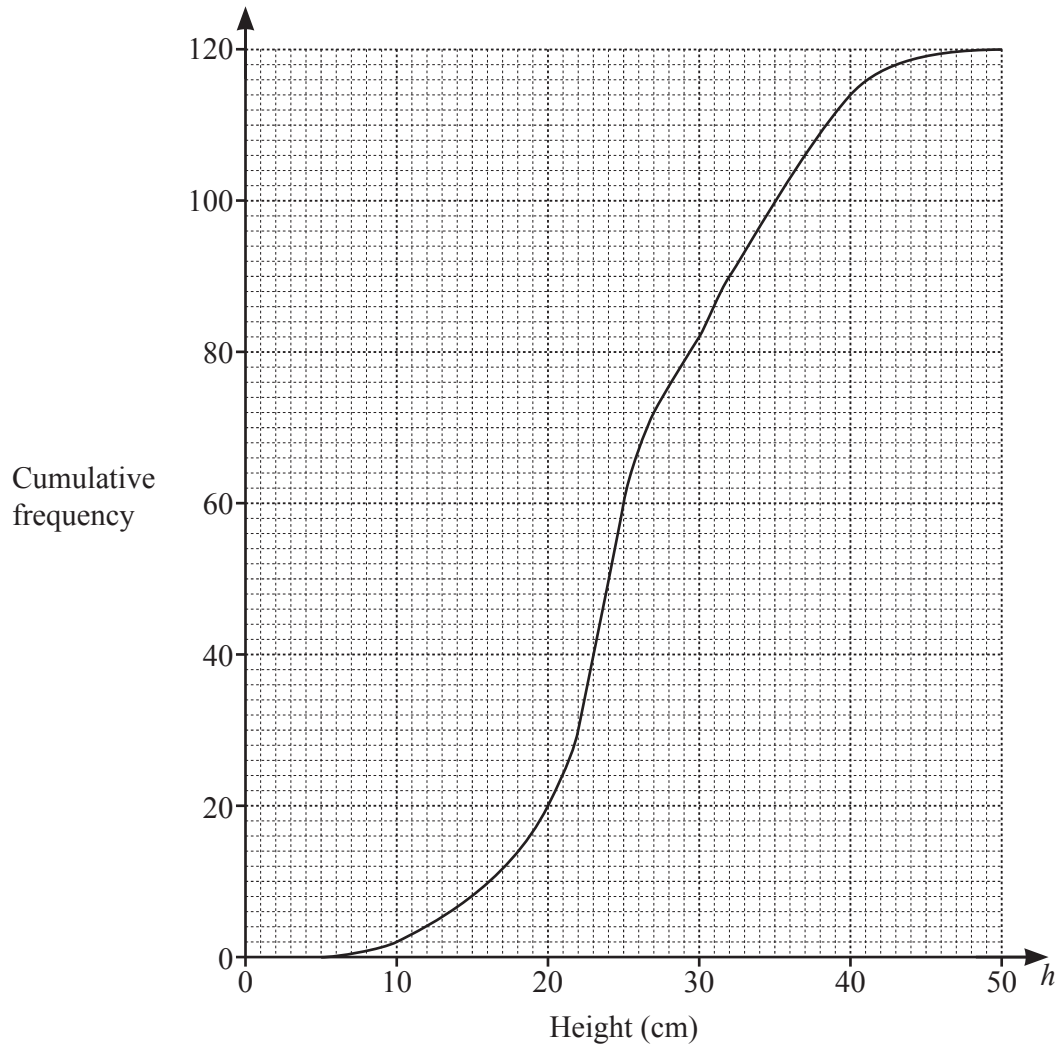
Height (cm)

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

   (i) the median,

   .... cm [1]

   (ii) the interquartile range,

   .... cm [2]

   (iii) the 60th percentile,

   .... cm [1]

   (iv) the number of plants with a height greater than 40 cm.

   .... [2]

(b) The information in the cumulative frequency diagram is shown in this frequency table.

Height, h cm	$0 < h \leqslant 10$	$10 < h \leqslant 20$	$20 < h \leqslant 30$	$30 < h \leqslant 50$
Frequency	2	18	62	38

    (i) Calculate an estimate of the mean height.

.... cm [4]

    (ii) A histogram is drawn to show the information in the frequency table.
The height of the bar representing the interval $10 < h \leqslant 20$ is 7.2 cm.

Calculate the height of the bar representing the interval $30 < h \leqslant 50$.

.... cm [2]

5 Ahmed sells different types of cake in his shop.
The cost of each cake depends on its type and its size.

Every small cake costs \$$x$ and every large cake costs \$$(2x + 1)$.

(a) The total cost of 3 small lemon cakes and 2 large lemon cakes is \$12.36 .

Find the cost of a small lemon cake.

\$ .... [3]

(b) The cost of 18 small chocolate cakes is the same as the cost of 7 large chocolate cakes.

Find the cost of a small chocolate cake.

\$ .... [3]

(c) The number of small cherry cakes that can be bought for \$4 is the same as the number of large cherry cakes that can be bought for \$13.

Find the cost of a small cherry cake.

\$ .... [3]

(d) Petra spends $20 on small coffee cakes and $10 on large coffee cakes.
The total number of cakes is 45.

Write an equation in terms of x.
Solve this equation to find the cost of a small coffee cake.
Show all your working.

$ .... [7]

6

| 4 | 6 | 3 | 4 | 2 | 3 |
| Red | Yellow | Blue | Blue | Yellow | Blue |
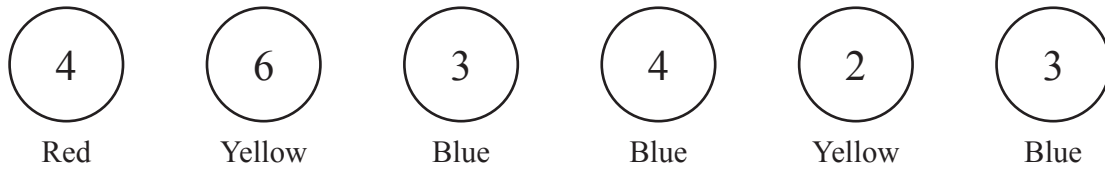
The diagram shows six discs.
Each disc has a colour and a number.

(a) One disc is picked at random.

Write down the probability that

(i) the disc has the number 4,

.... [1]

(ii) the disc is red and has the number 3,

.... [1]

(iii) the disc is blue and has the number 4.

.... [1]

(b) Two of the six discs are picked at random **without** replacement.

Find the probability that

(i) both discs have the number 3,

.... [2]

(ii) both discs have the same colour.

.... [3]

(c) Two of the six discs are picked at random **with** replacement.

Find the probability that both discs have the same colour.

.... [3]

7    $y = x^2 + \dfrac{1}{x}, \; x \neq 0$

(a) Complete the table.

x	0.2	0.3	0.5	1	1.5	2	2.5
y	5.0	3.4	2.3		2.9		6.7

[2]

(b) On the grid, draw the graph of $y = x^2 + \dfrac{1}{x}$ for $0.2 \leqslant x \leqslant 2.5$.

The graph of $y = x^2 + \dfrac{1}{x}$ for $-2.5 \leqslant x \leqslant -0.2$ has been drawn for you.
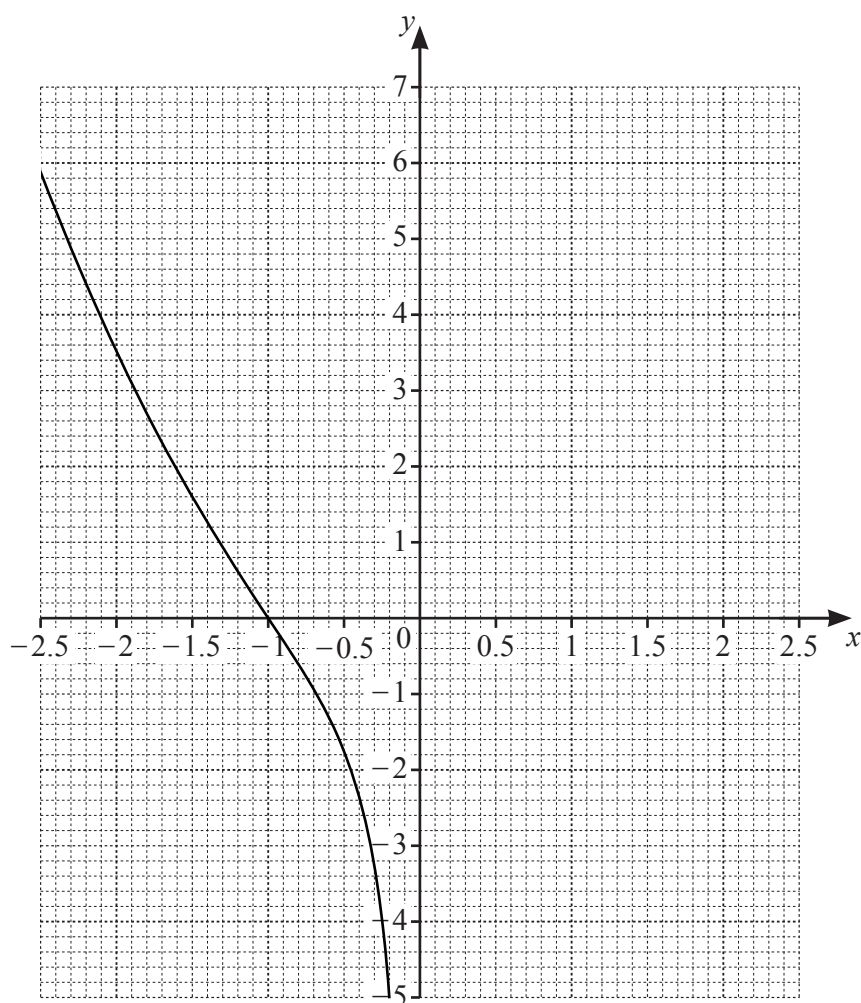
[4]

(c) By drawing suitable straight lines on the grid, solve the following equations.

(i) $x^2 + \dfrac{1}{x} = -2$

$x = $ .... [1]

(ii) $x^2 + \dfrac{1}{x} + x - 1 = 0$

$x = $ .... [2]

(d) k is an integer and the equation $x^2 + \dfrac{1}{x} = k$ has three solutions.

Write down a possible value of k.

$k = $ .... [1]

8 (a)
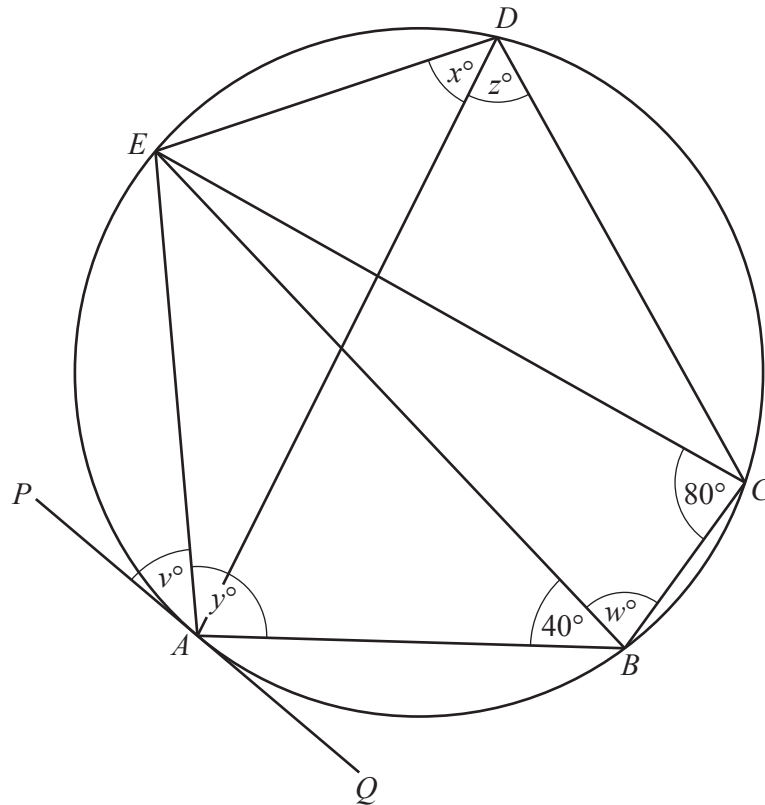
NOT TO SCALE

The points *A*, *B*, *C*, *D* and *E* lie on the circle.
PAQ is a tangent to the circle at *A* and *EC* = *EB*.
Angle *ECB* = 80° and angle *ABE* = 40°.

Find the values of *v*, *w*, *x*, *y* and *z*.

v = ... *w* = ... *x* = ... *y* = ... *z* = ... [5]

(b)
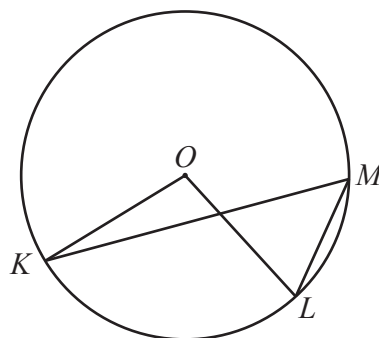
NOT TO SCALE

In the diagram, *K*, *L* and *M* lie on the circle, centre *O*.
Angle *KML* = 2*x*° and reflex angle *KOL* = 11*x*°.

Find the value of *x*.

x = ... [3]

(c)
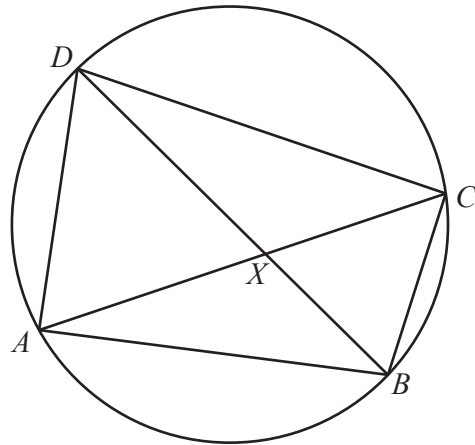
NOT TO
SCALE

The diagonals of the cyclic quadrilateral *ABCD* intersect at *X*.

(i) Explain why triangle *ADX* is similar to triangle *BCX*.
Give a reason for each statement you make.

....

....

....

.... [3]

(ii) *AD* = 10 cm, *BC* = 8 cm, *BX* = 5 cm and *CX* = 7 cm.

(a) Calculate *DX*.

DX = ... cm [2]

(b) Calculate angle *BXC*.

Angle *BXC* = ... [4]

16

9
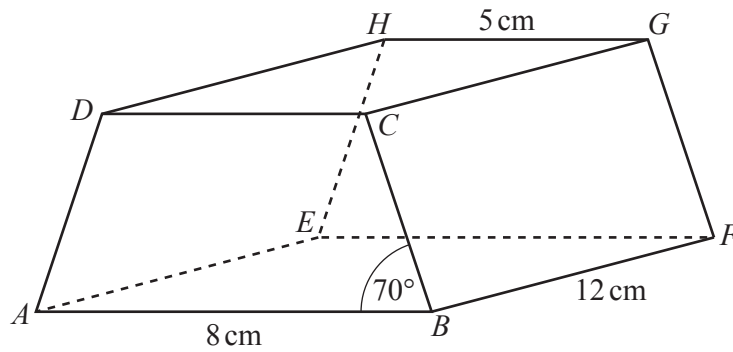
NOT TO SCALE

The diagram shows a prism with a rectangular base, *ABFE*.
The cross-section, *ABCD*, is a trapezium with *AD* = *BC*.
AB = 8 cm, *GH* = 5 cm, *BF* = 12 cm and angle *ABC* = 70°.

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

.... cm² [6]

(b) The perpendicular from *G* onto *EF* meets *EF* at *X*.

    (i) Show that *EX* = 6.5 cm.

<div align="right">[1]</div>

    (ii) Calculate *AX*.

<div align="right">*AX* = ... cm [2]</div>

    (iii) Calculate the angle between the diagonal *AG* and the base *ABFE*.

<div align="right">.. [2]</div>

10 $\quad f(x) = x^2 + 1 \qquad g(x) = 1 - 2x \qquad h(x) = \dfrac{1}{x}, \ x \neq 0 \qquad j(x) = 5^x$

(a) Find the value of

(i) f(3),

.... [1]

(ii) gf(3).

.... [1]

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

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

(c) Find x when $h(x) = 2$.

$x = $ .... [1]

(d) Find $g(x)g(x) - gg(x)$, giving your answer in the form $ax^2 + bx + c$.

.... [4]

(e) Find hh(x), giving your answer in its simplest form.

.... [1]

(f) Find j(5).

.... [1]

(g) Find x when $\text{j}^{-1}(x) = 2$.

$x =$ .... [1]

(h) $\text{j}(x) = \text{hg}(-12)$

Find the value of x.

$x =$ .... [2]

Question 11 is printed on the next page.

11

Sequence	1st term	2nd term	3rd term	4th term	5th term		nth term
A	13	9	5	1			
B	0	7	26	63			
C	$\dfrac{7}{8}$	$\dfrac{8}{16}$	$\dfrac{9}{32}$	$\dfrac{10}{64}$			

(a) Complete the table for the three sequences.

[10]

(b) One term in Sequence C is $\dfrac{p}{q}$.

Write down the next term in Sequence C in terms of p and q.

.... [2]

Cambridge IGCSE™

MATHEMATICS	**0580/42**
Paper 4 (Extended)	**October/November 2020**
MARK SCHEME	
Maximum Mark: 130	

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

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

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

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: •   the specific content of the mark scheme or the generic level descriptors for the question •   the specific skills defined in the mark scheme or in the generic level descriptors for the question •   the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: •   marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate •   marks are awarded when candidates clearly demonstrate what they know and can do •   marks are not deducted for errors •   marks are not deducted for omissions •   answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.
GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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

Abbreviations

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

Question	Answer	Marks	Partial Marks
1(a)	9080 cao	3	**B2** for 9078 to 9081… or **M1** for $813 \times$ *their* 11h 10min
1(b)(i)	654 or 653.5…	2	**M1** for $10260 \div 15$ h 42 min oe
1(b)(ii)(a)	21.8 or 21.82 to 21.83	1	
1(b)(ii)(b)	4.58 or 4.59 cao	2	**M1** for $470 \div (10260 \div 100)$ oe or $100 \div$ *their* **(b)(ii)(a)**
1(c)	12.97	1	
2(a)	Translation $\begin{pmatrix} 1 \\ -6 \end{pmatrix}$	2	**B1** for each
2(b)(i)	Image at (0, 1), (–3, 1), (–3, 2)	2	**B1** for reflection in $x = k$ or $y = 1$
2(b)(ii)	Image at (5, –4), (5, –1), (4, –1)	2	**B1** for rotation 90° anticlockwise with other centre or for rotation 90° clockwise about (6, 0)
2(b)(iii)	Image at (–1, –2), (–7, –2), (–7, –4)	2	**B1** for enlargement, factor –2 with other centre
3(a)(i)	2210 or 2208 or 2208.2, or 2208.16…	2	**M1** for $2000 \times \left(1 + \dfrac{2}{100}\right)^5$ oe
3(a)(ii)	10.4 or 10.5 or 10.40 to 10.41	2	**M1** for $\dfrac{their\,(a)(i) - 2000}{2000}$ [$\times 100$] or $\dfrac{their\,(a)(i)}{2000} \times 100$ or $\left(1 + \dfrac{2}{100}\right)^5 - 1$ or $\left(1 + \dfrac{2}{100}\right)^5 \times 100$ oe
3(a)(iii)	12	3	**B2** for 11.3 or 11.26 to 11.27 **OR** **M2** for $[2000 \times] \left(1 + \dfrac{2}{100}\right)^{11}$ oe or $[2000 \times] \left(1 + \dfrac{2}{100}\right)^{12}$ oe seen or **M1** for $[2000 \times] \left(1 + \dfrac{2}{100}\right)^n$ oe, $n > 5$ oe or for $2000 \times \left(1 + \dfrac{2}{100}\right)^n =$ or $>$ or $\geqslant 2500$ oe

Question	Answer	Marks	Partial Marks
3(b)	490 cao	3	**M2** for $p \times \left(1 - \dfrac{4}{100}\right)^{16} = 255$ oe soi by 490.0... or **M1** for $p \times \left(1 - \dfrac{4}{100}\right)^{n} = 255$ oe, $n > 1$ oe
4(a)(i)	25	1	
4(a)(ii)	10 nfww	2	**B1** for [lq =] 22 or [uq =] 32
4(a)(iii)	27	1	
4(a)(iv)	6	2	**B1** for 114 written
4(b)(i)	27.9 or 27.91 to 27.92 nfww	4	**M1** for mid-values **M1** for $\sum fx$ where x lies within or on boundary of correct interval **M1 dep** $\sum fx \div 120$ dep on second M1
4(b)(ii)	7.6	2	**M1** for $\dfrac{18}{10}$ oe or $\dfrac{38}{20}$ oe or **B1** for [multiplier] 4 or ¼
5(a)	1.48	3	**B2** for $7x + 2 = 12.36$ or better or **M1** for $3x + 2(2x + 1)$ [= 12.36] or better
5(b)	1.75 or $1\dfrac{3}{4}$	3	**B2** for $18x - 14x = 7$ or better or **M1** for $18x = 7(2x + 1)$
5(c)	[0].8 oe	3	**B2** for $4(2x + 1) = 13x$ or **M1** for $\dfrac{4}{x} = \dfrac{13}{2x+1}$ oe or correct equation to find number of cakes

Question	Answer	Marks	Partial Marks
5(d)	$\dfrac{20}{x}+\dfrac{10}{2x+1}=45$ oe	M2	**B1** for $\dfrac{20}{x}$ seen or $\dfrac{10}{2x+1}$ seen
	$90x^2 - 5x - 20\;[= 0]$ oe	B2	**B1** for $\dfrac{20(2x+1)+10x}{x(2x+1)} = 45$ or better
	$(9x + 4)(2x - 1)\;[= 0]$ or for $\dfrac{--1\pm\sqrt{(-1)^2-4(18)(-4)}}{2(18)}$ oe	M2	**FT** *their* 3-term quadratic **M1** for factors that give two correct terms when expanded or for correct discriminant or correct $\dfrac{-b}{2a}$ provided quadratic formula is in correct form
	$[0].5$ or $\dfrac{1}{2}$ final answer	B1	
6(a)(i)	$\dfrac{1}{3}$ oe	1	
6(a)(ii)	0	1	
6(a)(iii)	$\dfrac{1}{6}$ oe	1	
6(b)(i)	$\dfrac{1}{15}$ oe	2	**M1** for $\dfrac{2}{6}\times\dfrac{1}{5}$ or equivalent method
6(b)(ii)	$\dfrac{4}{15}$ oe	3	**M2** for $\dfrac{2}{6}\times\dfrac{1}{5} + \dfrac{3}{6}\times\dfrac{2}{5}$ or equivalent method or **M1** for $\dfrac{2}{6}\times\dfrac{1}{5}$ oe seen or $\dfrac{3}{6}\times\dfrac{2}{5}$ oe seen
6(c)	$\dfrac{7}{18}$ oe	3	**M2** for $\left(\dfrac{1}{6}\right)^2+\left(\dfrac{2}{6}\right)^2+\left(\dfrac{3}{6}\right)^2$ oe or **M1** for one correct product seen or sample space with 14 correct pairs identified
7(a)	2, 4.5	2	**B1** for each
7(b)	Correct graph	4	**B3 FT** for 6 or 7 correct points FT *their* table or **B2 FT** for 4 or 5 correct points FT *their* table or **B1 FT** for 2 or 3 correct points FT *their* table

Question	Answer	Marks	Partial Marks
7(c)(i)	–0.5 to –0.4	**1**	
7(c)(ii)	$y = 1 - x$ ruled **and** –1.9 to –1.75	**2**	**M1** for $[y =] \ 1 - x$ or $\left[x^2 + \dfrac{1}{x} = \right] 1 - x$ soi or **B1** for –1.9 to –1.75
7(d)	Any integer ≥ 2	**1**	
8(a)	$[v =]\ 40$ $[w =]\ 80$ $[x =]\ 40$ $[y =]\ 100$ $[z =]\ 60$	**5**	**B1** for each **FT** angle z as $140 -$ *their w*
8(b)	24	**3**	**M2** for $360 - 11x = 2 \times 2x$ oe or **M1** for $360 - 11x$ seen or obtuse angle $KOL = 2 \times 2x$ oe
8(c)(i)	angle $ADX =$ angle BCX oe same segment oe angle $DAX =$ angle CBX oe same segment oe angle $AXD = BXC$ oe [vertically] opposite oe	**M2**	Accept in any order **M1** for one correct pair with reason If 0 scored, **SC1** for two correct pairs of equal angles identified with incorrect/no reasons
	corresponding angles are equal oe	**A1**	
8(c)(ii)(a)	8.75 or 8¾	**2**	**M1** for $\dfrac{8}{10} = \dfrac{7}{DX}$ oe
8(c)(ii)(b)	81.8 or 81.78 to 81.79	**4**	**M2** for $[\cos[BXC] =] \dfrac{5^2 + 7^2 - 8^2}{2 \times 5 \times 7}$ oe or **M1** for $8^2 = 5^2 + 7^2 - 2 \times 5 \times 7 \times \cos(...)$ oe **A1** for $\dfrac{10}{70}$ oe

0580/42   **Muhammad Shafiq ur Rehman (03247304567) Aitchison College**
Cambridge IGCSE – Mark Scheme   October/November 2020
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Question	Answer	Marks	Partial Marks
9(a)	315 or 314.5 to 315.0	6	**M1** for $\tan 70 = \dfrac{\text{height}}{\frac{1}{2}(8-5)}$ oe or better seen **M1dep** for $\frac{1}{2}(8+5) \times their$ height or better seen **dep** on trig attempt for height **M2** for $12 \times \dfrac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen or **M1** for $\dfrac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen **M1** for 8×12 oe isw and 5×12 oe isw
9(b)(i)	$8 - \frac{1}{2}(8-5)$ or $5 + \frac{1}{2}(8-5)$	**M1**	
9(b)(ii)	13.6 or 13.64 to 13.65	2	**M1** for $12^2 + (6.5)^2$ oe
9(b)(iii)	16.8 or 16.9 or 16.79 to 16.91… nfww	2	**M1** for identifying angle *GAX* from a diagram or from working or better
10(a)(i)	10	1	
10(a)(ii)	–19	1	FT 1 – 2 *their* **(a)(i)**
10(b)	$\dfrac{1-x}{2}$ oe final answer	2	**M1** for $x = 1 - 2y$ or $y + 2x = 1$ or $\dfrac{y}{2} = \dfrac{1}{2} - x$ or $y - 1 = -2x$ or better
10(c)	$\dfrac{1}{2}$ oe	1	
10(d)	$4x^2 - 8x + 2$ final answer	4	**M1** for $(1 - 2x)(1 - 2x) - (1 - 2(1 - 2x))$ or better **B1** for $1 - 2x - 2x + 4x^2$ **B1** for $-(1 - 2 + 4x)$ or better or [+] $1 - 4x$ or for correct answer seen then spoiled
10(e)	*x* final answer	1	
10(f)	3125	1	
10(g)	25	1	
10(h)	–2	2	**B1** for $\dfrac{1}{25}$ or 0.04
11(a)	A : –3 $17 - 4n$ oe	3	**B1** for –3 **B2** for $17 - 4n$ oe or **B1** for $k - 4n$ oe or $17 - pn$ oe, $p \neq 0$

Question	Answer	Marks	Partial Marks
	B : 124 $\qquad n^3 - 1$ oe	3	**B1** for 124 **B2** for $n^3 - 1$ oe or **B1** for any cubic
	C : $\dfrac{11}{128} \qquad \dfrac{n+6}{2^{n+2}}$ oe	4	**B1** for $\dfrac{11}{128}$ **B3** for $\dfrac{n+6}{2^{n+2}}$ oe or **B2** for 2^{n+2} oe seen or **B1** for 2^k oe or $n + 6$ seen
11(b)	$\dfrac{p+1}{2q}$ oe	2	**B1** for $p + 1$ or $2q$ oe

Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2020**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

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

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

This document has **20** pages. Blank pages are indicated.

2

1 (a) The Earth has a surface area of approximately $510\,100\,000\,\text{km}^2$.

(i) Write this surface area in standard form.

.... km^2 [1]

(ii) Water covers 70.8% of the Earth's surface.

Work out the area of the Earth's surface covered by water.

.... km^2 [2]

(b) The table shows the surface area of some countries and their estimated population in 2017.

Country	Surface area (km^2)	Estimated population in 2017
Brunei	5.77×10^3	433 100
China	9.60×10^6	1 388 000 000
France	6.41×10^5	67 000 000
Maldives	3.00×10^2	374 600

(i) Find the total surface area of Brunei and the Maldives.

.... km^2 [1]

(ii) The ratio   surface area of the Maldives : surface area of China
can be written in the form $1 : n$.

Find the value of n.

$n = $ .... [2]

(iii) Find the surface area of France as a percentage of the surface area of China.

.... % [2]

3

(iv) Find the population density of the Maldives.
[Population density = population ÷ surface area]

.... people/km^2 [2]

(c) The population of the Earth in 2017 was estimated to be 7.53×10^9.

The population of the Earth in 2000 was estimated to be 6.02×10^9.

(i) Work out the percentage increase in the Earth's estimated population from 2000 to 2017.

.... % [2]

(ii) Assume that the population of the Earth increased exponentially by y% each year for these 17 years.

Find the value of y.

$y =$ .... [3]

2
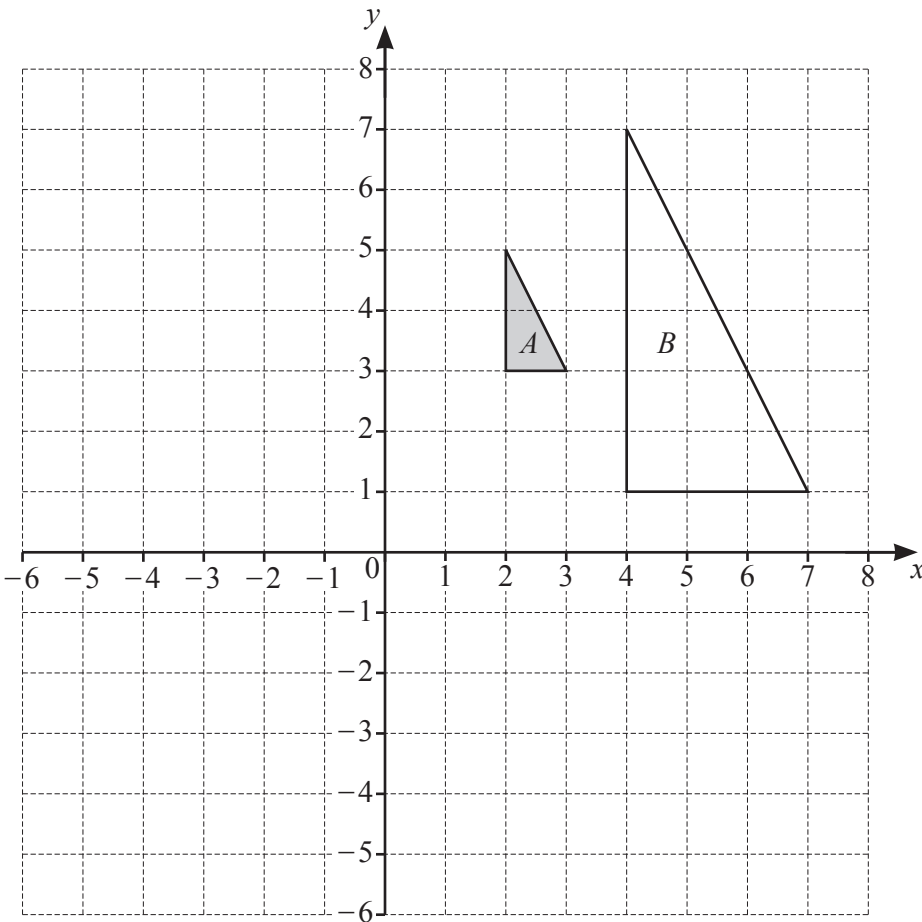
(a) On the grid, draw the image of

    (i) triangle *A* after a rotation of 90° anticlockwise about (0, 0),   [2]

    (ii) triangle *A* after a translation by the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$.   [2]

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

....

.... [3]

3 **(a)** The average speeds, in km/h, of cars travelling along a road are recorded.
The box-and-whisker plot shows this information.
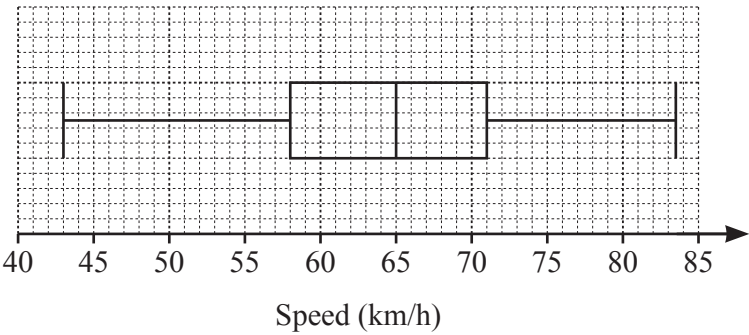
Speed (km/h)

Find

(i) the lowest speed recorded,

.... km/h [1]

(ii) the median,

.... km/h [1]

(iii) the interquartile range.

.... km/h [1]

(b) Another car takes 18 seconds to travel 400 m along this road.

Calculate the average speed of this car in km/h.

.... km/h [3]

4

| P | O | S | S | I | B | I | L | I | T | Y |

Morgan picks two of these letters, at random, **without** replacement.

(a) Find the probability that he picks

(i) the letter Y first,

.... [1]

(ii) the letter B then the letter Y,

.... [2]

(iii) two letters that are the same.

.... [3]

(b) Morgan now picks a third letter at random.

Find the probability that

(i) all three letters are the same,

.... [2]

(ii) exactly two of the three letters are the same,

.... [5]

(iii) all three letters are different.

.... [2]

5 **(a)**

NOT TO
SCALE
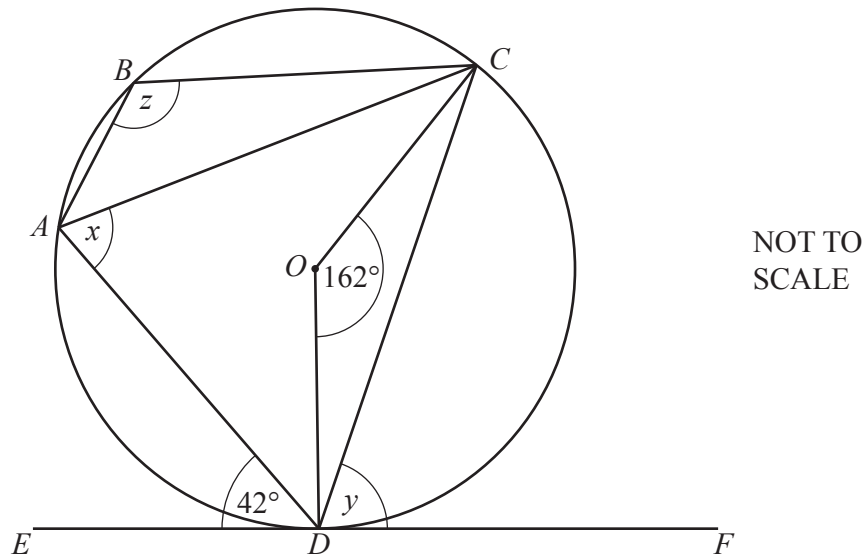
A, *B*, *C* and *D* are points on the circle, centre *O*.
EF is a tangent to the circle at *D*.
Angle *ADE* = 42° and angle *COD* = 162°.

Find the following angles, giving reasons for each of your answers.

(i) Angle *x*

x = ... because ....

.... [2]

(ii) Angle *y*

y = ... because ....

.... [2]

(iii) Angle *z*

z = ... because ....

....

.... [3]

(b)

NOT TO SCALE
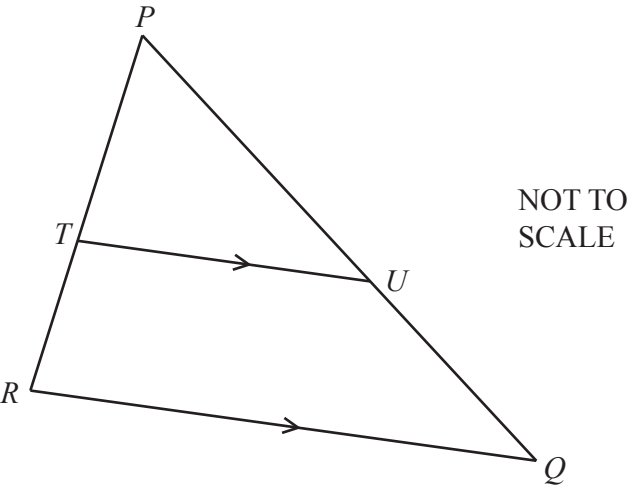
PQR is a triangle.
T is a point on *PR* and *U* is a point on *PQ*.
RQ is parallel to *TU*.

(i) Explain why triangle *PQR* is similar to triangle *PUT*.
Give a reason for each statement you make.

....

....

....

.... [3]

(ii) $PT : TR = 4 : 3$

(a) Find the ratio *PU* : *PQ*.

.... : .... [1]

(b) The area of triangle *PUT* is 20 cm^2.

Find the area of the quadrilateral *QRTU*.

.... cm^2 [3]

6
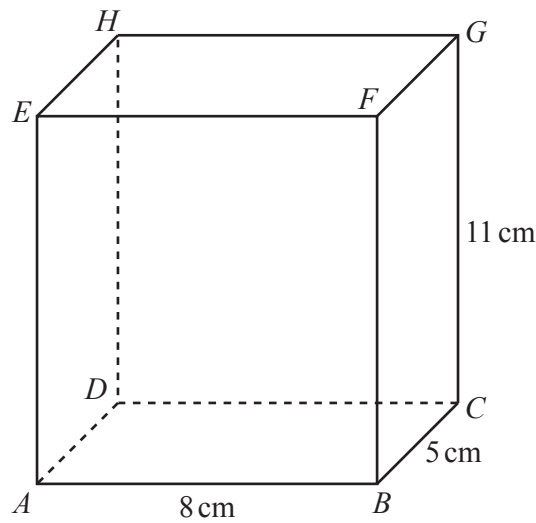
NOT TO
SCALE

ABCDEFGH is a cuboid.
AB = 8 cm, *BC* = 5 cm and *CG* = 11 cm.

(a) Work out the volume of the cuboid.

.... cm^3 [2]

(b) Ivana has a pencil of length 13 cm.

Does this pencil fit completely inside the cuboid?
Show how you decide.

[4]

(c) **(i)** Calculate angle *CAB*.
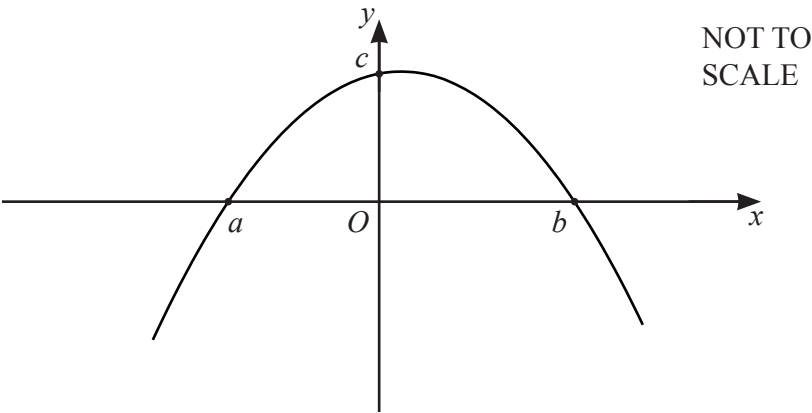
Angle *CAB* = ... [2]

(ii) Calculate angle *GAC*.

Angle *GAC* = ... [2]

7 **(a) (i)** Factorise $24 + 5x - x^2$.

.... [2]

(ii) The diagram shows a sketch of $y = 24 + 5x - x^2$.

NOT TO SCALE

Work out the values of a, b and c.

$a = $ ....

$b = $ ....

$c = $ .... [3]

(iii) Calculate the gradient of $y = 24 + 5x - x^2$ at $x = -1.5$.

.... [3]

(b) (i) On the diagram, sketch the graph of $y = (x+1)(x-3)^2$.
Label the values where the graph meets the x-axis and the y-axis.

$$\begin{array}{c} y \\ \uparrow \end{array}$$
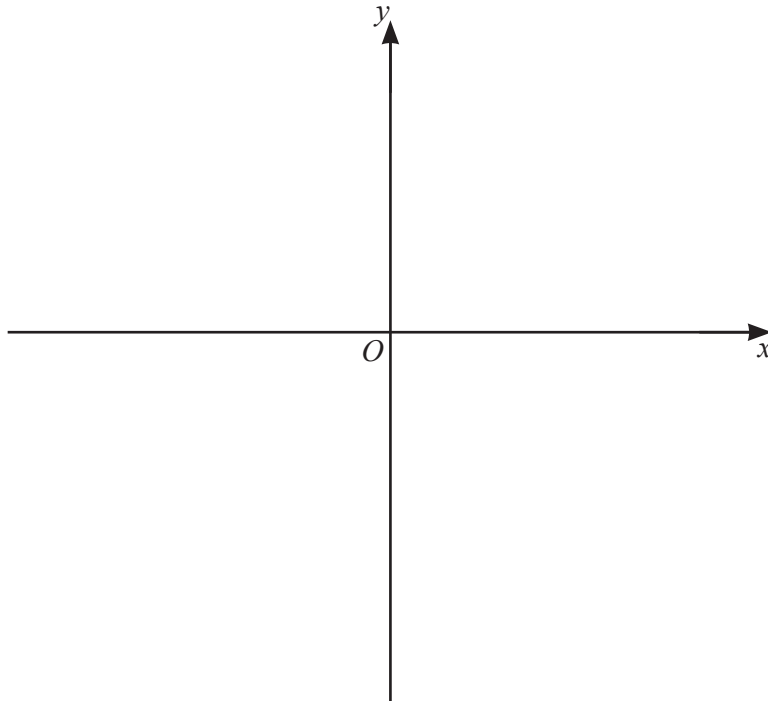
[4]

(ii) Write $(x+1)(x-3)^2$ in the form $ax^3 + bx^2 + cx + d$.

.... [3]

8 **(a)** $\overrightarrow{AB} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\overrightarrow{DC} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Find

(i) $\overrightarrow{AC}$,

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

(ii) $\overrightarrow{BD}$,

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

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

.... [2]

(b)

NOT TO
SCALE
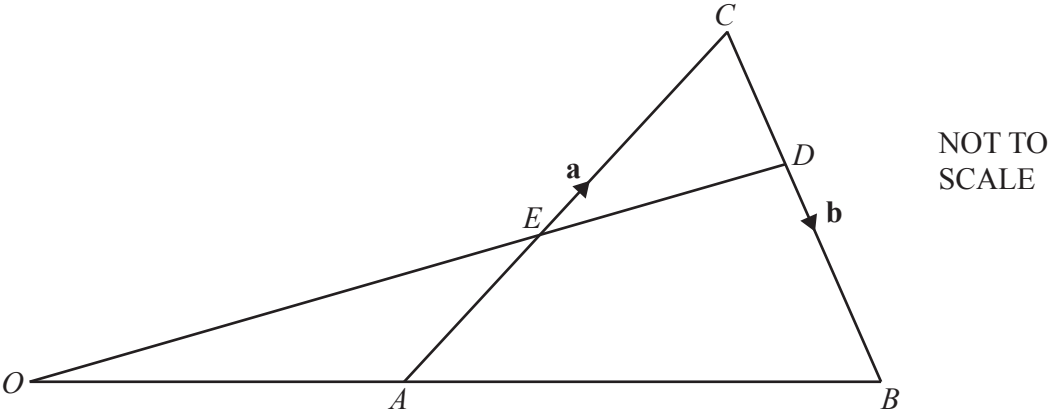
In the diagram, OAB and OED are straight lines.
O is the origin, A is the midpoint of OB and E is the midpoint of AC.
$\overrightarrow{AC} = \mathbf{a}$ and $\overrightarrow{CB} = \mathbf{b}$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form

(i) $\overrightarrow{AB}$,

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

(ii) $\overrightarrow{OE}$,

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

(iii) the position vector of D.

.... [3]

16

9 **(a)** Find the integer values that satisfy the inequality $2 < 2x \leqslant 10$.

.... [2]

(b) Factorise completely.

(i) $6y^2 - 15xy$

.... [2]

(ii) $y^2 - 9x^2$

.... [2]

(c) Simplify.

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

.... [3]

17

(d) The straight line $y = 3x + 2$ intersects the curve $y = 2x^2 + 7x - 11$ at two points.

Find the coordinates of these two points.
Give your answers correct to 2 decimal places.

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

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

18

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

(a) Find   fh(2).

.... [2]

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

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

(c) Simplify.

(i) $f(1 - 2x)$

.... [2]

(ii) $gf(x) - 9g(x)$

.... [4]

(d) $\dfrac{1}{h(x)} = 9^{kx}$

Find the value of k.

$k = $ .... [2]

11 The table shows the first four terms in sequences *A*, *B*, and *C*.

Sequence	1st term	2nd term	3rd term	4th term	5th term		*n*th term
A	4	9	14	19			
B	3	10	29	66			
C	1	4	16	64			

Complete the table.

[9]

20

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MATHEMATICS **0580/43**

Paper 4 (Extended) **October/November 2020**

MARK SCHEME

Maximum Mark: 130

Published

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

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

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

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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

Generic Marking Principles

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

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

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

GENERIC MARKING PRINCIPLE 2:

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

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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

GENERIC MARKING PRINCIPLE 4:

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

GENERIC MARKING PRINCIPLE 5:

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

GENERIC MARKING PRINCIPLE 6:

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

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

Abbreviations

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

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Question	Answer	Marks	Partial Marks
1(a)(i)	$5.101[00\ldots] \times 10^8$ final answer	1	
1(a)(ii)	361 150 800 oe	2	**FT** *their* **(a)(i)** **M1** for $\dfrac{70.8}{100} \times 510\,100\,000$ or for $\dfrac{70.8}{100} \times$ *their* **a(i)**
1(b)(i)	6070 oe	1	
1(b)(ii)	32 000 oe	2	**B1** for figs 32
1(b)(iii)	6.68 or 6.677 …	2	**M1** for $\dfrac{6.41 \times 10^5}{9.6[0] \times 10^6}$ $[\times\,100]$ oe
1(b)(iv)	1250 or 1248 to 1249 oe	2	**B1** for figs 125 or figs1248 to figs 1249
1(c)(i)	25.1 or 25.08…	2	**M1** for $\dfrac{7.53\left[\times 10^9\right] - 6.02\left[\times 10^9\right]}{6.02\left[\times 10^9\right]}$ oe or $\dfrac{7.53\left[\times 10^9\right]}{6.02\left[\times 10^9\right]} \times 100$
1(c)(ii)	1.33 or 1.325…	3	**M2** for $\sqrt[17]{\dfrac{7.53[\times 10^9]}{6.02[\times 10^9]}}$ or $\sqrt[17]{1 + \dfrac{\textit{their}\ \textbf{(c)(i)}}{100}}$ or **M1** for $6.02[\times 10^9] \times p^{17} = 7.53[\times 10^9]$ or $p^{17} = 1 + \dfrac{\textit{their}\ \textbf{(c)(i)}}{100}$
2(a)(i)	Triangle at (–3, 2) (–3, 3) (–5, 2)	2	**B1** for correct rotation about incorrect point or for rotation 90 clockwise around (0, 0)
2(a)(ii)	Triangle at (5, –2) (6, –2) (5, 0)	2	**B1** for translation by $\begin{pmatrix} 3 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ -5 \end{pmatrix}$
2(b)	Enlargement [SF] 3 [Centre] (1, 4)	3	**B1** for each
3(a)(i)	43	1	
3(a)(ii)	65	1	
3(a)(iii)	13	1	

Question	Answer	Marks	Partial Marks
3(b)	80	3	**M2** for $\dfrac{400}{18} \times \dfrac{60 \times 60}{1000}$ oe Or **M1** for $\dfrac{400}{18}$ or for *their* speed in m/s $\times \dfrac{60 \times 60}{1000}$ or for $\dfrac{400}{1000}$ and $\dfrac{18}{60 \times 60}$ soi
4(a)(i)	$\dfrac{1}{11}$ oe	1	
4(a)(ii)	$\dfrac{1}{110}$ oe	2	**M1** for $\dfrac{1}{11} \times \dfrac{1}{10}$ oe
4(a)(iii)	$\dfrac{4}{55}$ oe	3	**M2** for $\left(\dfrac{2}{11} \times \dfrac{1}{10}\right) + \left(\dfrac{3}{11} \times \dfrac{2}{10}\right)$ oe **or M1** for $\left(\dfrac{2}{11} \times \dfrac{1}{10}\right)$ or $\left(\dfrac{3}{11} \times \dfrac{2}{10}\right)$ seen oe
4(b)(i)	$\dfrac{1}{165}$ oe	2	**M1** for $\dfrac{3}{11} \times \dfrac{2}{10} \times \dfrac{1}{9}$ oe
4(b)(ii)	$\dfrac{1}{5}$ oe	5	**M4** for $3\left(\dfrac{2}{11} \times \dfrac{1}{10} \times \left[\dfrac{9}{9}\right]\right) + 3\left(\dfrac{3}{11} \times \dfrac{2}{10} \times \dfrac{8}{9}\right)$ oe or **M3** for $3\left(\dfrac{3}{11} \times \dfrac{2}{10} \times \dfrac{8}{9}\right)$ or **M2** for $3\left(\dfrac{2}{11} \times \dfrac{1}{10} \times \left[\dfrac{9}{9}\right]\right)$ or $\dfrac{3}{11} \times \dfrac{2}{10} \times \dfrac{8}{9}$ oe or **M1** for $\dfrac{2}{11} \times \dfrac{1}{10} \times \left[\dfrac{k}{9}\right]$ where k is 3, 6 or 9
4(b)(iii)	$\dfrac{131}{165}$ oe	2	**M1** for $1 - ($*their* **(b)(i)** + *their* **(b)(ii)**$)$ oe
5(a)(i)	81° <u>Angle</u> at <u>centre</u> is <u>twice</u> angle at <u>circumference</u> oe	2	**B1** for 81°
5(a)(ii)	81° Alternate segment [theorem] oe	2	**FT** *their* **(a)(i)** **B1FT** for 81°

Question	Answer	Marks	Partial Marks
5(a)(iii)	123° Angles on a straight line [= 180] Opposite angles in a cyclic quadrilateral are supplementary oe	3	**FT** *their* acute **(a)(ii)** + 42 **B1** for each element
5(b)(i)	Angle *PTU* = angle *PRQ* corresponding Angle *PUT* = angle *PQR* corresponding Angle *RPQ* is common oe	M2	Accept in any order **M1** for one correct pair with reason If 0 scored, **SC1** for two correct pairs of equal angles identified with incorrect/no reasons
	Corresponding angles are equal oe	A1	
5(b)(ii)(a)	4 : 7 oe	1	
5(b)(ii)(b)	41.25 oe	3	**M2** for $20 \times \left(\dfrac{7}{4}\right)^2$ oe or $20 \times \dfrac{7^2 - 4^2}{4^2}$ oe or **M1** for $\left(\dfrac{7}{4}\right)^2$ or $\left(\dfrac{4}{7}\right)^2$ or $\dfrac{7^2 - 4^2}{4^2}$ or $\dfrac{4^2}{7^2 - 4^2}$
6(a)	440	2	**M1** for $8 \times 5 \times 11$
6(b)	$\sqrt{8^2 + 5^2 + 11^2}$ oe or $8^2 + 5^2 + 11^2$ and 13^2 ALTERNATIVE $\sqrt{8^2 + 11^2}$ or $8^2 + 11^2$ and 13^2	M3	**M2** for $8^2 + 5^2 + 11^2$ or $8^2 + 11^2$ oe or **M1** for $8^2 + 5^2$ or $5^2 + 11^2$ oe
	Yes and 14.5 or 14.4 or 14.49… or Yes and 13.6[0…]	A1	Accept equivalent conclusion
6(c)(i)	32.0[…]	2	**M1** for $\tan[..] = \dfrac{5}{8}$ oe
6(c)(ii)	49.4 or 49.38 to 49.39	2	**M1** for $\sin[..] = \dfrac{11}{their\ AG}$ oe
7(a)(i)	$(8 - x)(3 + x)$	2	**M1** for $8(3 + x) - x(3 + x)$ or $3(8 - x) + x(8 - x)$ or $(a - x)(b + x)$ where $ab = 24$ or $a - b = 5$

Question	Answer	Marks	Partial Marks
7(a)(ii)	$[a =]$ –3 $[b =]$ 8 $[c =]$ 24	3	**FT** *their* **(a)(i)** for a and b **B1FT** for each of a and b or both correct but reversed **B1** for $[c =]$ 24
7(a)(iii)	8	3	**M2** for $5 - 2x$ or **M1** for $-2x$ or $5 - kx$, $k \neq 0$
7(b)(i)	Correct sketch: positive cubic shape and max on the y-axis or to the right of y-axis with one root at (–1, 0) and turning point at (3, 0) and y-intercept at (0, 9) all labelled	4	**B1** for positive cubic shape with max on the y-axis or to the right of y-axis **B1** for root at (–1, 0) **B1** for turning point at (3, 0) **B1** for y-intercept (0, 9) If 0 score **SC1** for all three intercepts on axes identified
7(b)(ii)	$x^3 - 5x^2 + 3x + 9$ final answer	3	**B2** for correct expansion of three brackets unsimplified **B1** for correct expansion of two brackets with at least 3 terms correct
8(a)(i)	$\begin{pmatrix} 4 \\ 4 \end{pmatrix}$	2	**B1** for $\begin{pmatrix} 4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 4 \end{pmatrix}$
8(a)(ii)	$\begin{pmatrix} -4 \\ 8 \end{pmatrix}$	2	**B1** for $\begin{pmatrix} -4 \\ k \end{pmatrix}$ or $\begin{pmatrix} k \\ 8 \end{pmatrix}$
8(a)(iii)	5.39 or 5.385..	2	**M1** for $(-2)^2 + 5^2$ oe
8(b)(i)	$\mathbf{a} + \mathbf{b}$	1	
8(b)(ii)	$\dfrac{3}{2}\mathbf{a} + \mathbf{b}$	2	**M1** for a correct route, e.g. $\overrightarrow{OA} + \overrightarrow{AE}$
8(b)(iii)	$2\mathbf{a} + \dfrac{4}{3}\mathbf{b}$	3	**M2** for unsimplified $\overrightarrow{OD}$ or for $\dfrac{4}{3}\mathbf{b}$ or **M1** for $\overrightarrow{OD}$ attempted in terms of $\mathbf{a}$ and $\mathbf{b}$ or for $\overrightarrow{CD} = \dfrac{1}{3}\mathbf{b}$ or $\overrightarrow{DB} = \dfrac{2}{3}\mathbf{b}$ seen
9(a)	2, 3, 4, 5	2	**B1** for 3 correct and no extra or 4 correct and one extra or **M1** for $1 < x \leqslant 5$
9(b)(i)	$3y(2y - 5x)$	2	**B1** for $3(2y^2 - 5xy)$ or $y(6y - 15x)$ or for the correct answer seen and then spoiled

Question	Answer	Marks	Partial Marks
9(b)(ii)	$(y - 3x)(y + 3x)$	**2**	**B1** for $(y + 3)(y - 3)$
9(c)	$\dfrac{4x+5}{(x-1)(2x+1)}$ or $\dfrac{4x+5}{2x^2-x-1}$ final answer	**3**	**M1** for $3(2x + 1) - 2(x - 1)$ oe isw **M1** for $(x - 1)(2x + 1)$ oe isw
9(d)	$(1.74, 7.21 \text{ to } 7.24)$ and $(-3.74, -9.20 \text{ to } -9.22)$ cao	**6**	For the y values accept any value rounded to 2 decimal places in the given range **B5** for $(1.74, 7.21 \text{ to } 7.24)$ or $(-3.74, -9.20 \text{ to } -9.22)$ or $x = 1.74$ and $x = -3.74$ OR **M2** for $2x^2 + 4x - 13 = 0$ or $2y^2 + 4y - 133 = 0$ or **M1** for $2x^2 + 7x - 11 = 3x + 2$ or $y = 2\left(\dfrac{y-2}{3}\right)^2 + 7\left(\dfrac{y-2}{3}\right) - 11$ AND **FT** *their* quadratic expression (not $2x^2 + 7x - 11$) **M2FT** for $\dfrac{-4 \pm \sqrt{4^2 - 4 \times 2 \times -13}}{2 \times 2}$ or $-1 \pm \sqrt{\dfrac{15}{2}}$ oe or **M1FT** for $\sqrt{4^2 - 4 \times 2 \times -13}$ oe or for $\dfrac{-4 + \sqrt{k}}{2 \times 2}$ or $\dfrac{-4 - \sqrt{k}}{2 \times 2}$ or $(x + 1)^2\,[-13/2 - 1 = 0]$
10(a)	-23	**2**	**M1** for $4 - 3(3^x)$ oe soi
10(b)	$\dfrac{4-x}{3}$ oe final answer	**2**	**M1** for $x = 4 - 3y$ or $y + 3x = 4$ or $x + 3y = 4$ or $\dfrac{y}{-3} = \dfrac{4}{-3} + x$ oe or $\dfrac{x}{-3} = \dfrac{4}{-3} + y$ oe
10(c)(i)	$1 + 6x$ final answer	**2**	**M1** for $4 - 3(1 - 2x)$

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Question	Answer	Marks	Partial Marks
10(c)(ii)	$20 - 36x$ or $4(5 - 9x)$ final answer	**4**	**B3** for $20 - 36x$ seen in working then spoiled OR **M1** for $(4 - 3x)^2 + 4 - 3x - 9(x^2 + x)$ or better **B1** for $[(4 - 3x)^2 =] \ 16 - 12x - 12x + 9x^2$ or better **B1** for answer $20 - kx$ or $k - 36x$ oe or answer $20 - 36x + kx^2$ $\quad k \neq 0$
10(d)	$-\dfrac{1}{2}$ oe	**2**	**M1** for $(3^2)^{kx}$ or $9^{kx} = 9^{-\frac{1}{2}x}$ oe
11A	24	**B1**	
	$5n - 1$ oe	**B2**	**B1** for $5n - k$ or $jn - 1$ oe $j \neq 0$
11B	127	**B1**	
	$n^3 + 2$ oe	**B2**	**B1** for n^3 oe
11C	256	**B1**	
	$4^{(n-1)}$ oe	**B2**	**B1** for 4^k oe