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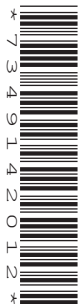
H

GCSE (9–1) Mathematics

J560/06 Paper 6 (Higher Tier)

Tuesday 13 June 2017 – Morning

Time allowed: 1 hour 30 minutes



You may use:

- A scientific or graphical calculator
- Geometrical instruments
- Tracing paper



First name										
Last name										
Centre number						Candidate number				

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Read each question carefully before you start to write your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the barcodes.

INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [].
- Use the π button on your calculator or take π to be 3.142 unless the question says otherwise.
- This document consists of **20** pages.

2

Answer **all** the questions.

- 1** This table shows the populations of the four countries of the UK in 2012.
All values are given correct to 3 significant figures.

Country	Population
England	5.35×10^7
Wales	3.07×10^6
Scotland	5.31×10^6
Northern Ireland	1.82×10^6

- (a)** Write the population of England as an ordinary number.

(a) [1]

- (b)** Work out the total population of Wales, Scotland and Northern Ireland.
Give your answer in standard form.

(b) [2]

- (c)** The total population of the UK is predicted to reach 73.3 million in 2037.

Calculate the predicted percentage increase in the UK population from 2012 to 2037.
Give your answer correct to 2 significant figures.

(c) % [4]

2 (a) The scale of a map is 1 cm represents 25 m.

(i) The length of a path is 240 m.

Work out the length, in centimetres, of the path on the map.

(a)(i)cm [1]

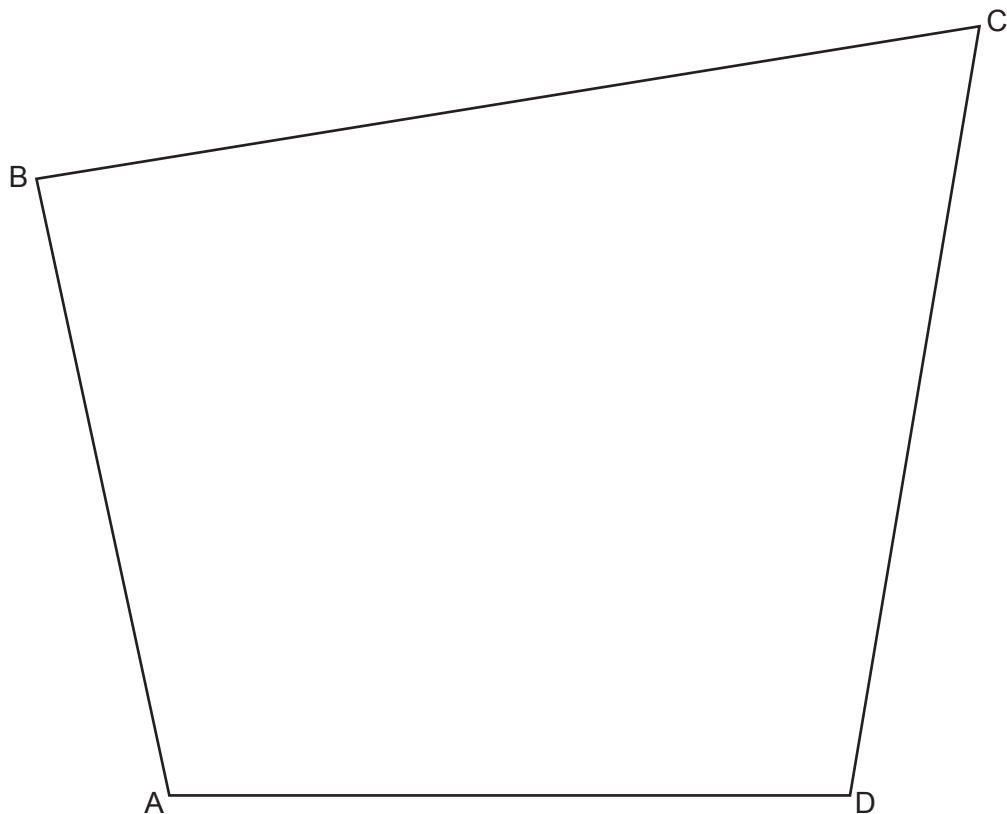
(ii) The scale 1 cm represents 25 m can be written in the form $1:k$.

Find the value of k .

(ii) $k =$ [1]

(b) The scale drawing represents a park.

Scale: 1 cm represents 25 m



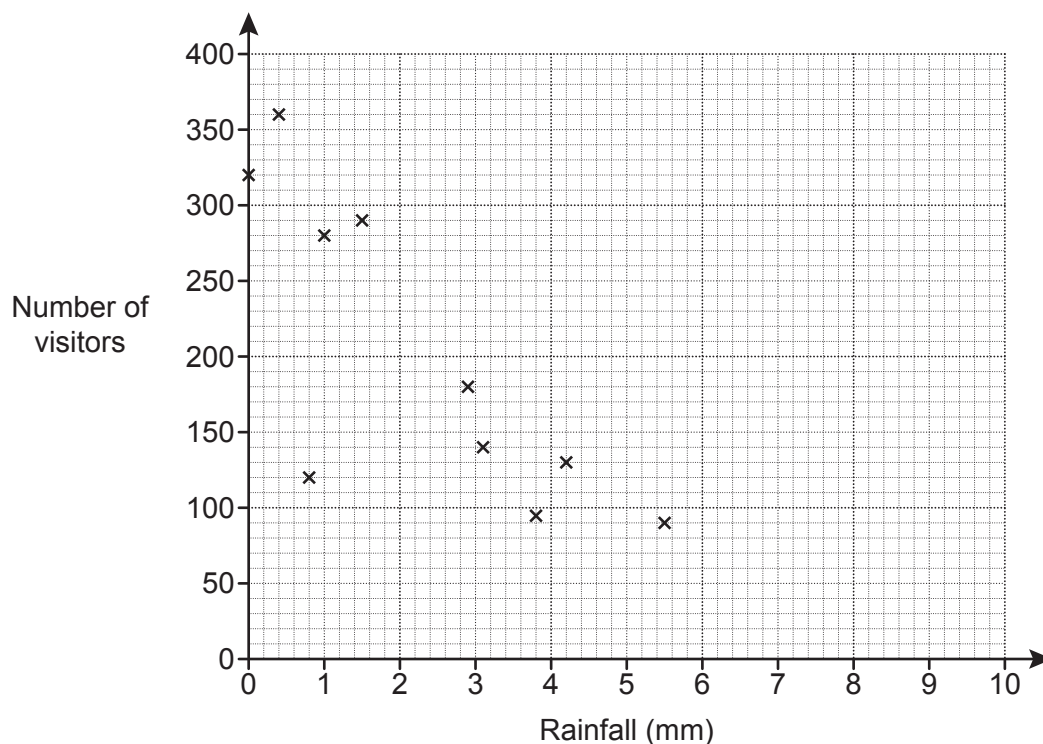
A new play area must be

- no more than 150 m from B
- closer to AD than to CD.

Construct and shade the region where the play area can be positioned.
Show all your construction lines.

[5]

- 3 (a) The owner of a tourist attraction records the amount of rainfall, in millimetres, and the number of visitors each day.
The results for 10 days are shown in the scatter diagram.



- (i) Circle the outlier on the scatter diagram. [1]
- (ii) The owner claims that he would expect around 320 visitors on a day with 2 mm of rainfall.

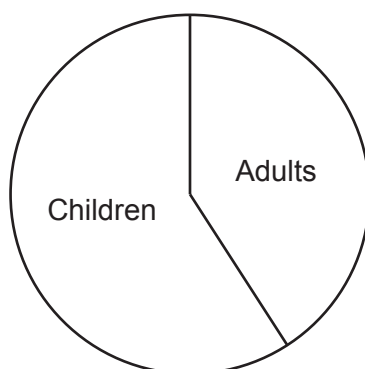
Does the scatter diagram support his statement?
Explain how you made your decision.

..... [2]

- (iii) Explain why the scatter diagram should not be used to estimate the number of visitors on a day with 9 mm of rainfall.

..... [1]

- (b) The pie chart summarises information about the visitors to the tourist attraction on a different day.



Explain why the pie chart cannot be used to work out how many adults visited on that day.

.....
 [1]

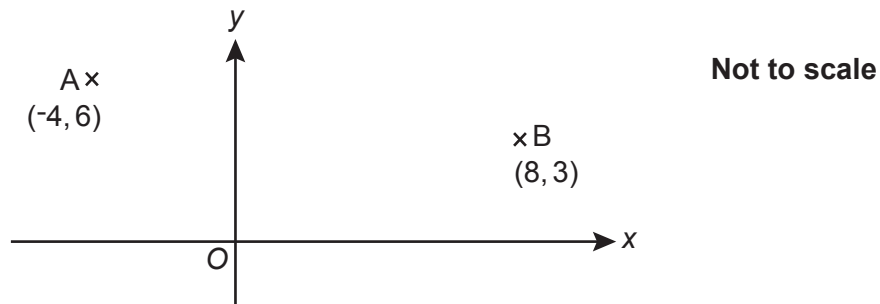
- 4 In a school, $\frac{2}{3}$ of the students study a language.

Of those students who study a language, $\frac{2}{5}$ study Spanish.

Find the ratio of students who study Spanish to students who do not study Spanish.

..... : [3]

- 5 Point A has coordinates $(-4, 6)$ and point B has coordinates $(8, 3)$.



- (a) (i) Find the gradient of line AB.

(a)(i) [2]

- (ii) Find the equation of line AB.

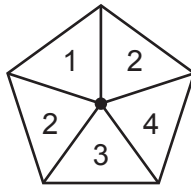
(ii) [2]

- (b) Point P has coordinates $(0, -2)$.

Write down the equation of the line parallel to line AB that passes through P.

(b) [2]

- 6 (a) This is a fair 5-sided spinner.



Ciara spins the spinner twice and records the product of the two scores.

- (i) Complete the table.

		First spin				
Second spin	x	1	2	2	3	4
	1	1				
	2			4		
	2					
	3					
	4				12	

[2]

- (ii) Find the probability that the product is a multiple of 3.

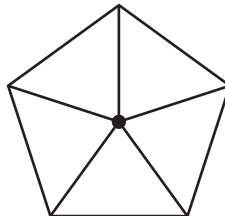
(a)(ii) [2]

- (b) Ciara makes a different fair 5-sided spinner.
She spins the spinner twice and records the product of the two scores.

Ciara says

The probability that the product is negative is 0.48.

Write numbers on the spinner below so that Ciara's statement is correct.



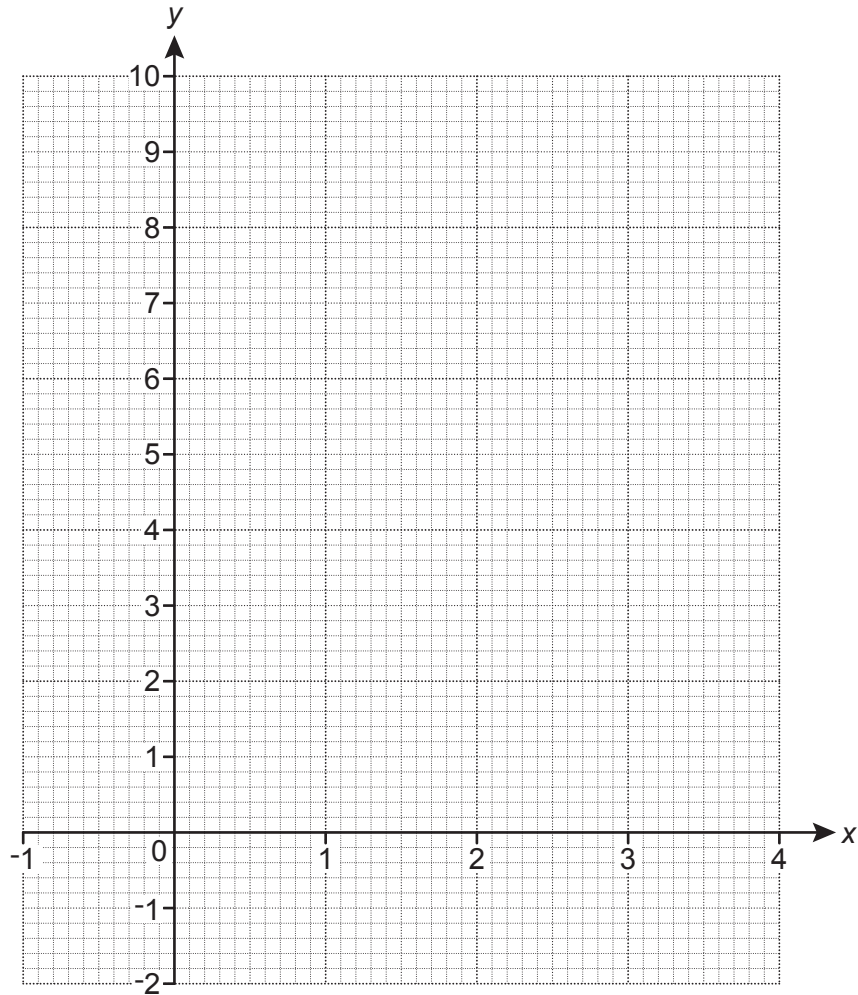
[3]

- 7 (a) Complete the table for $y = x^2 - 2x$.

x	-1	0	1	2	3	4
y	3	0	-1	0	3	

[1]

- (b) Draw the graph of $y = x^2 - 2x$ for $-1 \leq x \leq 4$.

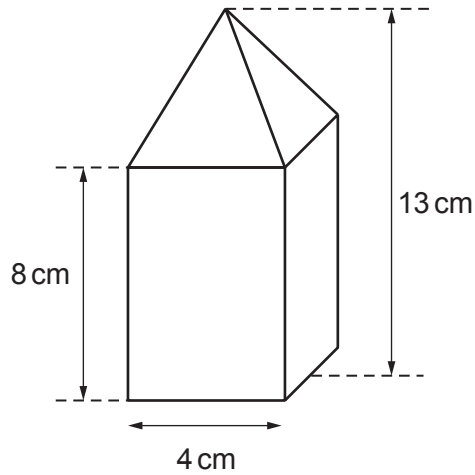


[2]

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

(c) [2]

- 8 The object below is made from a square-based pyramid joined to a cuboid.



The base of the cuboid and the base of the pyramid are both squares of side 4 cm.
 The height of the cuboid is 8 cm and the total height of the object is 13 cm.
 The total mass of the object is 158 g.

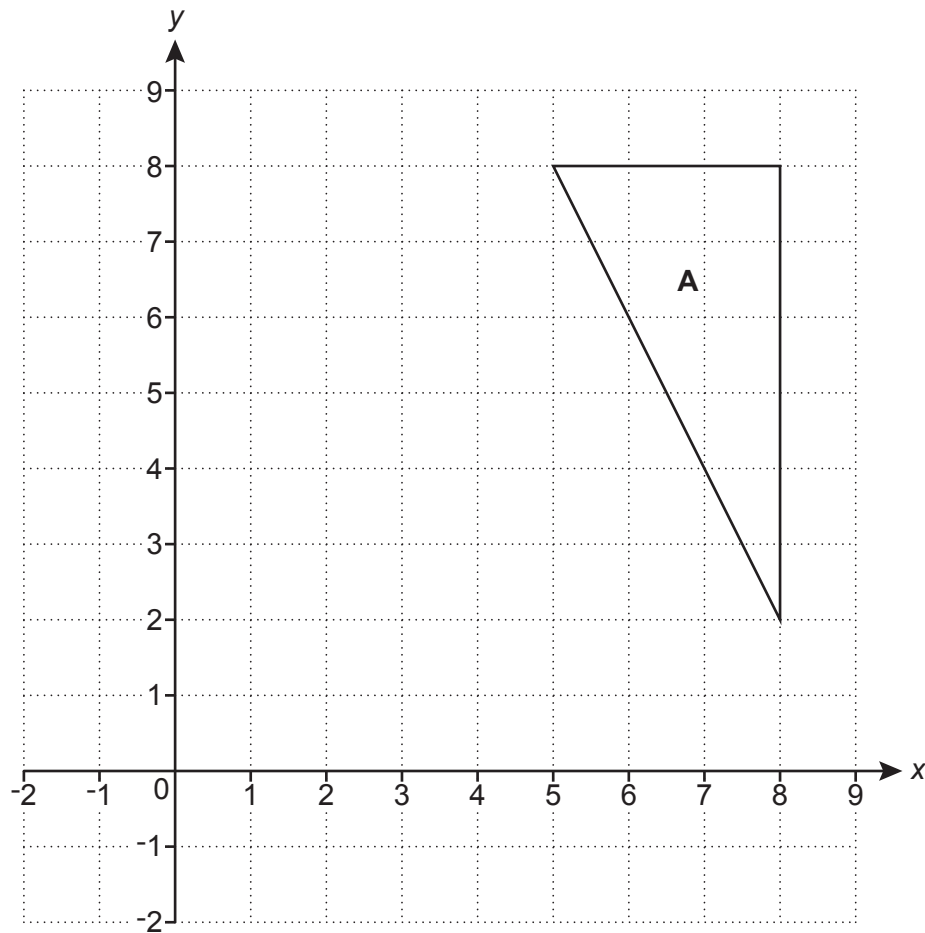
The cuboid is made from wood with density 0.67 g/cm^3 .
 The pyramid is made from granite.

Calculate the density of the granite.

[The volume of a pyramid is $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$.]

..... g/cm^3 [5]

- 9 (a) Triangle **A** is drawn on the grid.



Enlarge triangle **A** with scale factor $\frac{1}{3}$ and centre of enlargement $(-1, 5)$.

[3]

(b) Prism P and prism Q are similar.

The ratio of the surface area of prism P to the surface area of prism Q is 1 : 3.

(i) Jay says

The height of prism P is one third of the height of prism Q.

Explain why he is wrong.

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

(ii) The volume of prism Q is 86 cm^3 .

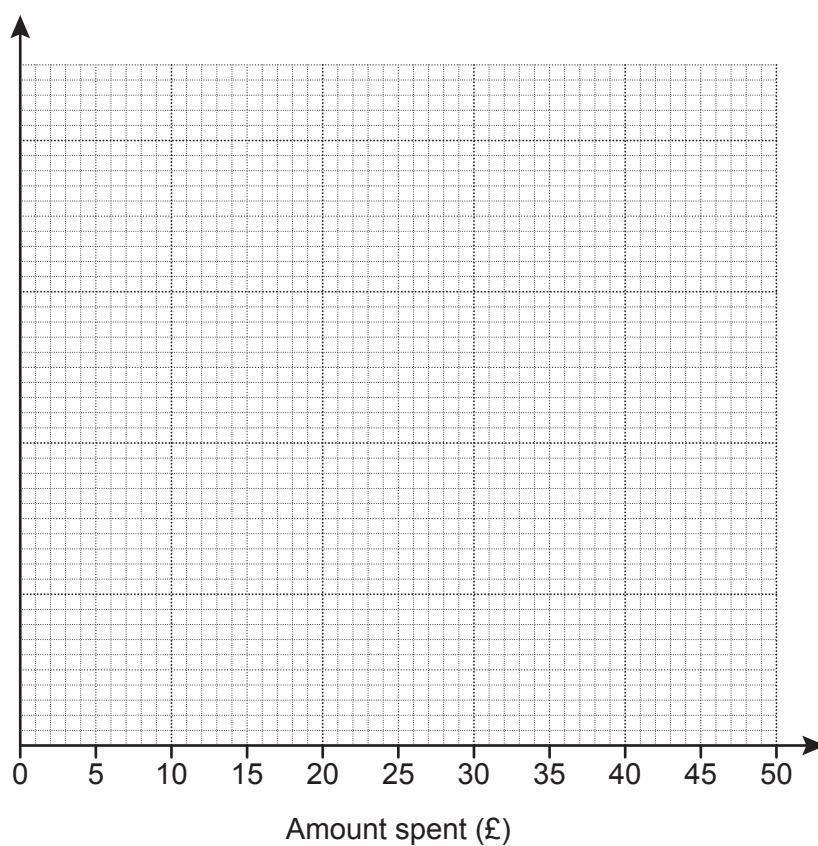
Calculate the volume of prism P.

(b)(ii) cm^3 [3]

- 10 Ana records the amount of money spent by 140 customers in her shop on one day.

Amount spent (£a)	Frequency
$0 < a \leq 5$	35
$5 < a \leq 10$	42
$10 < a \leq 15$	20
$15 < a \leq 20$	18
$20 < a \leq 30$	14
$30 < a \leq 50$	11

- (a) Draw a histogram to represent this information.



[4]

- (b) Ana wants to offer a discount to the customers who spend the most money in her shop.

Voucher Save 10% when you spend more than £...
--

She wants to give the discount to approximately 25% of her customers.

Suggest a suitable amount of money for Ana to use on her voucher.
Justify your decision.

..... [4]

- 11** Sunil makes 7.5 litres of soup, correct to the nearest 0.5 litre.
He serves the soup in 300 ml portions, correct to the nearest 10 ml.
24 people order this soup.

Does Sunil definitely have enough soup to serve the 24 people?
Show how you decide.

..... [4]

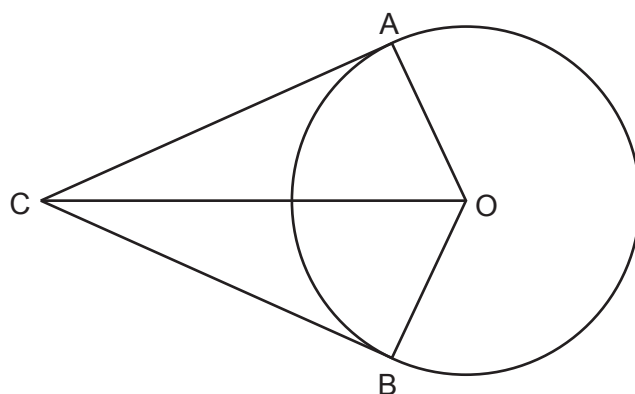
- 12** y is inversely proportional to the square of x .

Complete the table.

x	10	6	
y	9		4

[4]

- 13 A and B are points on the circumference of a circle, centre O. CA and CB are tangents to the circle.



Not to scale

Prove that triangle OAC is congruent to triangle OBC.

.....

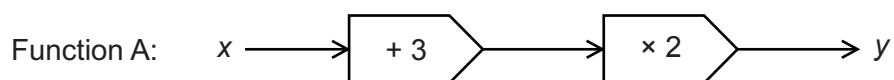
.....

.....

.....

..... [4]

14 Here is a function.

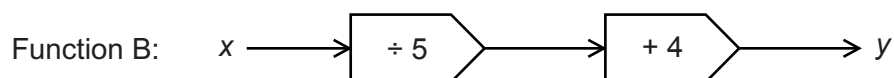


(a) Complete the table of values for **function A**.

x	y
-5	
	11

[2]

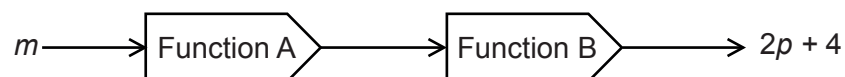
Here is another function.



(b) Find the inverse function of **function B**.

[2]

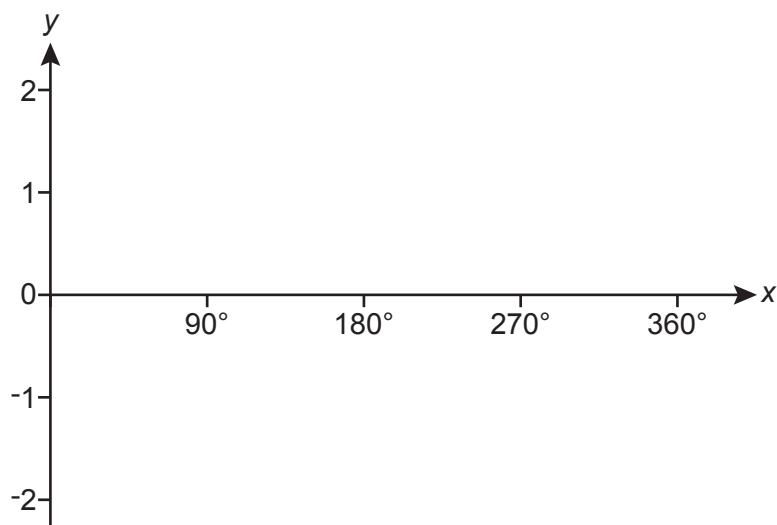
(c) Here is a composite function.



Find an expression for m in terms of p .
Give your answer in its simplest form.

(c) $m = \dots\dots\dots$ [4]

- 15 (a) Sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.



[2]

- (b) Solve the equation $5 \sin x = -3$.
Give all of the solutions in the range $0^\circ \leq x \leq 360^\circ$.

(b) $x = \dots\dots\dots^\circ$ or $x = \dots\dots\dots^\circ$ [4]

16 (a) Simplify.

$$\frac{3y^3}{y^{-4}}$$

(a) [1]

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

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

(b) [3]

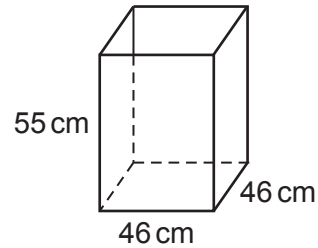
17 Show that $\frac{\sqrt[3]{81}}{3}$ can be written as $3^{\frac{1}{3}}$.

[3]

- 18** Alvin has a crate in the shape of a cuboid.

The crate is open at the top.

The internal dimensions of the crate are 46 cm long by 46 cm wide by 55 cm high.



Alvin has a stick of length 95 cm.

Alvin places the stick in the crate so that the shortest possible length extends out above the top of the crate.

- (a)** Calculate the length of the stick that extends out of the crate.

(a) cm **[4]**

- (b)** Calculate the angle the stick makes with the base of the crate.

(b) ° **[3]**

END OF QUESTION PAPER

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GCSE

Mathematics (9-1)

Unit **J560/06**: Paper 6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.















All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations used in the detailed Mark Scheme.

Annotation	Meaning
	Correct
	Incorrect
	Benefit of doubt
	Follow through
	Ignore subsequent working (after correct answer obtained), provided method has been completed
	Method mark awarded 0
	Method mark awarded 1
	Method mark awarded 2
	Accuracy mark awarded 1
	Independent mark awarded 1
	Independent mark awarded 2
	Misread
	Special case
	Omission sign

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for special cases that are worthy of some credit.

2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.

3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT $180 \times (\text{their '37' + 16})$, or FT $300 - \sqrt{(\text{their '5^2 + 7^2'})}$. Answers to part questions which are being followed through are indicated by eg FT $3 \times \text{their (a)}$.

For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

- **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
- **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
- **nfww** means **not from wrong working**.
- **oe** means **or equivalent**.
- **rot** means **rounded or truncated**.
- **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
- **soi** means **seen or implied**.

6. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.
7. In questions with a final answer line following working space,
 - (i) if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.
 - (ii) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✕ next to the wrong answer.
8. In questions with a final answer line:
 - (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
 - (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.
10. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

11. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.
12. Ranges of answers given in the mark scheme are always inclusive.
13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.
14. Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.

MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	a		53 500 000	1 1 AO1.2		
	b		1.02×10^7	2 2 AO1.3b	B1 for answer figs102	
	c		15 nfwv	4 3 AO1.3b 1 AO3.1d	B3 for 15.07 to 15.1 nfwv OR B1 for figs 637 and M1 for $\frac{73.3 \times 10^6 - \text{their} 63.7 \times 10^6}{\text{their} 63.7 \times 10^6}$ oe or $\frac{73.3 \times 10^6}{\text{their} 63.7 \times 10^6}$ oe and M1dep interpretation of answer to division as a percentage increase soi by answer	<i>their</i> 63.7×10^6 can be an error from their sum, <i>their</i> (b) or one of the country populations Allow M1M1 for (England answer) 37 (Wales answer) 2300 (Scotland answer) 1300 (NI answer) 3900 ((b) answer) 620
2	a	i	9.6	1 1 AO1.3a		
		ii	2500	1 1 AO1.2		Condone 1 : 2500

Question			Answer	Marks	Part marks and guidance	
	b		Arc centre B radius 6 cm meeting AB and CB or AB and bisector of ADC	2	B1 for any arc centre B meeting AB and BC or short arc (at least 1cm) radius 6 cm centre B	Accept dashed or dotted for all marks Freehand, all within template, max B1 Allow beyond AB and BC for 1 or 2 marks Tolerance 5.8 to 6.2 cm
			Ruled bisector of angle ADC to reach BC with construction arcs or Bisector with construction arcs from BC to <i>their</i> arc centre B	2	B1 for correct ruled bisector at least 2cm long by eye with no construction arcs or correct construction arcs with no bisector drawn	Tolerance $\pm 2^\circ$ Construction arcs on AD and on DC and two intersecting arcs from these
			Correct region shaded	1 1 AO2.3a 2 AO2.3b 1 AO3.1d 1 AO3.3	Dep on B1 and B1 If 0 scored SC1 for 6 [cm] [= 150] [m] seen	
3	a	i	Point (0.8, 120) indicated	1 1 AO2.1b		
		ii	No oe and Correct supporting value(s) and justification	2 1 AO2.1b 1 AO3.4b	B1 for 200 to 260 visitors expected or about 0 to 1mm and 320 or line of best fit within overlay or negative trend/correlation or marking(s) in relevant region above 2mm or 2 or more values within overlay and surrounding 2mm	Justification includes Reference to line of best fit (drawn or not) or trend or negative correlation or marking(s) in relevant region above 2mm or surrounding values See Appendix

Question			Answer	Marks	Part marks and guidance	
		iii	Outside range of data [collected]	1 1 AO3.4a		<p>Accept “The data (or diagram) only goes to 5.5 (or 6)” oe</p> <p>Do not accept “by 6 to 7 it would give no visitors” oe or There is no data around 9 mm oe The line of best fit does not reach 9 mm oe</p> <p>Condone “[Because] there would be a negative number of people”</p> <p>See Appendix</p>
	b		Total number or number of children is not known oe or The chart only shows proportions/percentages oe	1 1 AO2.5b	Mark the best bit so long as no contradiction	See Appendix

Question			Answer	Marks	Part marks and guidance	
4			4 : 11 or exact equivalent	3 2 AO1.3b 1 AO3.1d	<p>B2 for $\frac{4}{15}$ nfwv oe soi by 0.26[6...] to 0.27 or answer 11 : 4 or answer 4 : 15</p> <p>OR</p> <p>M1 for $\frac{2}{3} \times \frac{2}{5}$</p> <p>OR</p> <p>B1 for $\frac{2n}{3}$ evaluated where n is their total number of students</p> <p>Alternative method: [Spanish : Other : None] B2 4 : 6 : 5 soi OR Spanish : Other [: None] M1 2 : 3 [: 2.5]</p>	<p>Implied by eg $\frac{4n}{15}$ evaluated where n is their total number of students NB 0.26 : 0.73 scores 3 marks but 0.26 : 0.74 only scores B2 NB $\frac{4}{15}$ from $\frac{2}{3} - \frac{2}{5}$ scores 0</p> <p>0 for just 2 : 3 without labelling</p>
5	a	i	$-\frac{1}{4}$ oe	2 2 AO1.3a	<p>M1 for $\frac{\pm(3-6)}{\pm(8-4)}$</p> <p>or answer $\frac{1}{4}$ oe or answer $-\frac{1}{4}x$</p>	
		ii	$y = -\frac{1}{4}x + 5$ oe	2 2 AO1.3b	<p>M1 for substitution of (-4, 6) or (8, 3) into $y = \text{their (a)(i)} x + c$ or into $y - y_1 = \text{their (a)(i)}(x - x_1)$ or intercept clearly identified as 5 (may be on diagram or in equation)</p>	<p>eg final answer for 2 marks $y - 3 = -\frac{1}{4}(x - 8)$ oe or $y - 6 = -\frac{1}{4}(x - -4)$ oe</p> <p>Missing “y =” scores M1 max.</p>

Question			Answer	Marks	Part marks and guidance																																					
	b		$y = -\frac{1}{4}x - 2$ oe or FT	2FT 2 AO2.1a	B1FT for $y = \textit{their mx}$ [+ a] where m is FT B1 for $y = bx - 2$, $b \neq 0$	FT is for <i>their</i> gradient in (a)(ii) (if no answer in (a)(ii) then use (a)(i)) Condone missing “y =” if already penalised in (a)(ii), otherwise missing “y =” is B1 max																																				
6	a	i	<table><tr><td>×</td><td>1</td><td>2</td><td>2</td><td>3</td><td>4</td></tr><tr><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td><td>4</td></tr><tr><td>2</td><td>2</td><td>4</td><td>4</td><td>6</td><td>8</td></tr><tr><td>2</td><td>2</td><td>4</td><td>4</td><td>6</td><td>8</td></tr><tr><td>3</td><td>3</td><td>6</td><td>6</td><td>9</td><td>12</td></tr><tr><td>4</td><td>4</td><td>8</td><td>8</td><td>12</td><td>16</td></tr></table>	×	1	2	2	3	4	1	1	2	2	3	4	2	2	4	4	6	8	2	2	4	4	6	8	3	3	6	6	9	12	4	4	8	8	12	16	2 2 AO1.3a	B1 for table completed with no more than 5 errors or omissions	Ignore negative signs
×	1	2	2	3	4																																					
1	1	2	2	3	4																																					
2	2	4	4	6	8																																					
2	2	4	4	6	8																																					
3	3	6	6	9	12																																					
4	4	8	8	12	16																																					
		ii	$\frac{9}{25}$ oe	2 1 AO2.1a 1 AO2.3a	B1FT for <i>their</i> correct numerator B1 for fraction with denominator 25	Ignore attempts to convert form or simplify Accept [0].36 or 36% but not ratio or in words																																				
	b		Spinner completed with 3 negative numbers and 2 positives or 2 negatives and 3 positives	3 2 AO3.1a 1 AO3.2	M1 for $\frac{12}{25}$ soi eg by 12 [out of 25] M1 for spinner with 5 numbers inserted, at least one negative	Do not accept 0 for 3 marks Not just 12 as a number on the spinner Condone 0 (as positive) for M1																																				
7	a		8	1 1 AO1.3a																																						

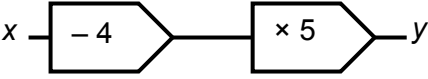
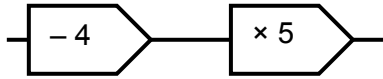
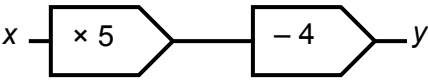
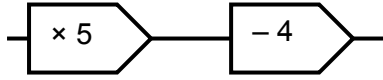
Question			Answer	Marks	Part marks and guidance	
	b		Correct curve	2 2 AO2.3b	B1FT for 4, 5 or 6 points plotted correctly	$\frac{1}{2}$ square tolerance B1 max if line ruled (between any points)
	c		-0.9 to -0.6 2.6 to 2.9	2 2 AO2.1a	B1 for each If 0 scored SC1 for (-0.9 to -0.6, 2) and (2.6 to 2.9, 2)	If more than two answers mark the worst two Condone for 2 marks when both answers in body but only one given on answer line
8			2.7 nfw	5 2 AO1.3b 1 AO3.1d 1 AO3.2 1 AO3.3	Allow 2.70 to 2.71 M2 for $4 \times 4 \times 8 \times 0.67$ or M1 for $4 \times 4 \times 8$ AND M1 for $\frac{1}{3} \times 4 \times 4 \times (13 - 8)$ AND M1 for <i>their</i> $85.76 + \text{their } 26.7x = 158$ oe	Condone for full marks minor inaccuracies from rounding if final answer given as 2.7 = 85.76 (mass of cuboid) = 128 (vol of cuboid) = 26.6 to 26.7 (vol of pyramid) eg $(x =) \frac{158 - \text{their } 85.76}{\text{their } 26.7}$

Question			Answer	Marks	Part marks and guidance	
9	a		Triangle with vertices at (1, 6), (2, 6), (2, 4)	3 3 AO2.3b	<p>B2 for triangle correct size and orientation in wrong position</p> <p>OR</p> <p>B1 for enlargement centre (-1, 5) incorrect scale factor < 1 or for triangle with two vertices correct or for three rays from (-1, 5) to vertices of triangle A or for triangle correct size but wrong orientation</p>	
	b	i	Height factor is square root of area factor oe in words or figures	1 1 AO2.5a	Mark the best bit so long as no contradiction	Must include correct reference to square or square root
		ii	16.5 to 16.6	3 2 AO1.3b 1 AO3.1b	<p>B2 for $(\sqrt{3})^3$ oe or $\frac{1}{(\sqrt{3})^3}$ oe soi by 5.19 to 5.20 or 0.192 to 0.193</p> <p>OR</p> <p>B1 for $\sqrt{3}$ or $\frac{1}{\sqrt{3}}$ oe soi by 1.73[...] or 0.577[...]</p>	<p>Accept $\frac{86\sqrt{3}}{9}$ oe</p> <p>Note that $(\sqrt{3})^3 = 3\sqrt{3}$ and</p> $\frac{1}{(\sqrt{3})^3} = \frac{\sqrt{3}}{9}$

Question		Answer	Marks	Part marks and guidance	
10	a	Fds 7, 8.4, 4, 3.6, 1.4, 0.55	1	At least 3 correct; may be implied by height of 3 bars including one of the last two	
		Bars all of correct height	1	Tolerance 1 mm unless on gridlines	FT <i>their</i> scale. Heights may be indicated by a plotted point, stick etc
		Bars all of correct width	1		Ignore polygon lines
		Vertical axis with consistent linear scale starting from 0 soi and labelled 'Frequency density' oe	1 1 AO1.3a 3 AO2.3b	B0 for scale 0 to 42 etc for frequency graph even if labelled frequency density	Condone missing vertical lines if tops correct width Accept abbreviations or an area key eg $1 \text{ cm}^2 = 5$
	b	Answer £17 to £18 inclusive with valid working and justification	4 1 AO1.3b 1 AO3.1d 1 AO3.2 1 AO3.3	M1 for 25% of 140 = 35 or 75% of 140 = 105 M1dep for identification of 15 to 20 soi A1 for answer £17 to £18 inclusive B1dep on M1M1A1 for justification If 0 scored, then SC1 for an answer £15 to £20	eg implied by frequencies 25 and 43 or 97 and 115 or by answer in range 15 to 20 Justification can be based on a calculation eg $\frac{10}{18}$ of 15 to 20 bar or reasoning eg 18% spent £20 and 30/31% spent £15, so 25% is just over/about halfway.

Question			Answer	Marks	Part marks and guidance									
11			No, with correct calculation leading to 23.77 to 23.8 identified or with 7.32 compared with 7.25 oe or 302 compared with 305 oe	4 1 AO1.3b 2 AO3.1d 1 AO3.3	B1 for 7250 or 7.25 seen B1 for 305 or 0.305 seen M1 for <i>their</i> $7.25 \div \text{their } 0.305$ with consistent units and at least one attempted bound or for <i>their</i> 0.305×24 oe or <i>their</i> $7250 \div 24$ oe	Ignore upper bound Ignore lower bound <i>Their</i> 7.25 in range 7 to 8, <i>their</i> 0.305 in range 0.29 to 0.31 or equivs. Ignore other divisions or products M0 for $7500 \div 300$ or $7.5 \div 0.3$								
12			<table><tr><td>x</td><td>10</td><td>6</td><td>[±] 15</td></tr><tr><td>y</td><td>9</td><td>25</td><td>4</td></tr></table>	x	10	6	[±] 15	y	9	25	4	4 1 AO1.1 3 AO1.3a	B3 for one value correct OR M2 for $9 \times 10^2 = y \times 6^2$ oe or $9 \times 10^2 = 4 \times x^2$ oe OR M1 for 9×10^2 or $y = \frac{k}{x^2}$ soi	Do not follow through mis-reads.
x	10	6	[±] 15											
y	9	25	4											

Question			Answer	Marks	Part marks and guidance							
13			<p>Three of these</p> <ul style="list-style-type: none">• OC is common or shared• OA = OB (equal) radii• $\angle OAC = \angle OBC$ tangent perpendicular to radius• CA = CB tangents from a point [to a circle] <p>RHS, SSS or SAS as appropriate</p>	<p>M3</p> <p>A1 4 AO2.4b</p>	<p>M1 for each</p> <p>After M0, B2 three pairs of these equal sides/angles with insufficient or no reasons or B1 for two pairs of these equal sides/angles identified with insufficient or no reasons</p> <p>OR</p> <p>After M1, B1 for two further pairs of these equal sides/angles identified with insufficient or no reasons</p>	<p>Ignore extra facts and reasons</p> <p>For B marks accept if indicated on diagram</p>						
14	a		<table border="1"><tr><td>x</td><td>y</td></tr><tr><td>-5</td><td>-4</td></tr><tr><td>2.5</td><td>11</td></tr></table>	x	y	-5	-4	2.5	11	<p>2 2 AO1.3a</p>	<p>B1 for one correct</p>	
x	y											
-5	-4											
2.5	11											

Question	Answer	Marks	Part marks and guidance	
b	$y = 5(x - 4)$ oe or 	2 1 AO1.1 1 AO1.3a	<p>M1 for correct operations in correct order but poor notation eg $y = x - 4 \times 5$ or $5(x - 4)$ oe</p>  <p>(as minimum allow $- 4$, $\times 5$ if intent clear)</p> <p>or for correct operations in reverse order eg implied by $y = 5x - 4$</p> 	<p>For 2 marks and M1 condone x and y transposed in algebraic expression or transposed in flow diagram.</p> <p>M0 for wrong order and poor notation</p>  <p>Mark right-to-left flow diagrams in a similar way</p> <p>Condone correct flow diagram followed by incorrect algebra or vice-versa</p>

Question		Answer	Marks	Part marks and guidance	
	c	$5p - 3$ as final answer	4 1 AO1.3b 3 AO3.1b	<p>M1 for $2p + 4 - 4$ soi M1 for <i>their</i> $2p \times 5$ soi M1 for <i>their</i> $10p \div 2$ M1 for <i>their</i> $5p - 3$ Maximum 3 marks if answer incorrect</p> <p>Alternative method: M1 for $2(m + 3)$ soi M1 for $\frac{\text{their } 2(m+3)}{5} + 4$ soi M1 for <i>their</i> $\frac{2(m+3)}{5} + 4 = 2p + 4$ or better M1FT for rearranging <i>their</i> equation to isolate m Maximum 3 marks if answer incorrect</p>	<p>Output of function A is $10p$ implies first M1M1</p> <p>Use of function A</p> <p>Use of function B with output of A</p> <p>Equating their output of B with $2p + 4$</p> <p><i>Their</i> equation must be of form $\frac{am + b}{5} + 4 = 2p + 4$ oe where $a \neq 0$ and $b \neq 0$, leading to $(m =) \frac{10p - b}{a}$ and then simplified if possible</p> <p>Accept another letter used consistently for m or p but not m and p interchanged</p>
15	a	Correct sketch with max at (90, 1) and min at (270, -1) and crossing x-axis at 0, 180 and 360	2 2 AO2.3b	M1 for correct shape starting at (0, 0) but inaccurate at roots and max/min. Needs at least one cycle, but may have more than one.	

Question		Answer	Marks	Part marks and guidance	
	b	217° and 323°	4 1 AO1.3b 1 AO3.1b 1 AO3.2 1 AO3.3	B3 for one correct even if from trials OR M2 for $[x =] -37$ to -36.86 OR M1 for $\sin x = -0.6$ oe If 0 scored SC1 answers summing to 540 to 3sf	Accept answers to greater accuracy 216.8[6...] and 323.1[3...] B3 for grads: $[x =] (-41), 221, 319$ OR B2 for grads: $[x =]$ one of 221, 319 OR M1 implied for grads $[x =] -41$ or rads: $[x =] -0.64[...]$
16	a	$3y^7$	1 1 AO1.3a		
	b	$\frac{7x+2}{(x-1)(x+2)}$ or $\frac{7x+2}{x^2+x-2}$ as final answer	3 3 AO1.3b	B1 for $(x-1)(x+2)$ or x^2+x-2 seen as a denominator M1 for $3(x+2) + 4(x-1)$ or $3x+6+4x-4$ soi	Condone missing final bracket. Accept not in fraction or seen in separate fractions
17		$\frac{\sqrt[3]{81}}{3} = \frac{\sqrt[3]{3^4}}{3}$ or $\frac{\sqrt[3]{81}}{3} = \frac{\sqrt[3]{3^4}}{3}$ $= \frac{3^{\frac{4}{3}}}{3}$ or $\frac{\sqrt[3]{3^3 \times 3}}{3} = \frac{3 \sqrt[3]{3}}{3}$ $\left[= 3^{\frac{4}{3}-1} \right] = 3^{\frac{1}{3}}$ or $\sqrt[3]{3} = 3^{\frac{1}{3}}$	M1 M1dep A1 3 AO2.2	$\frac{\sqrt[3]{81}}{3} = \frac{\sqrt[3]{81}}{\sqrt[3]{3^3}}$ $= \sqrt[3]{\frac{81}{27}}$ $= \sqrt[3]{3} = 3^{\frac{1}{3}}$	In left-hand methods, M1M1 can be awarded if the denominator 3 is consistently omitted There may be other surd methods. M1 first productive step $\sqrt[3]{81} = 81^{\frac{1}{3}}$ is not sufficiently productive as a first step M1dep second productive step from a correct first step Conversion to decimals scores 0

Question			Answer	Marks	Part marks and guidance	
18	a		9.8[1...] nfw	4 1 AO1.3b 2 AO3.1d 1 AO3.3	<p>M3 for $\sqrt{46^2 + 46^2 + 55^2}$ or 85.18 to 85.2 or $\sqrt{7257}$</p> <p>OR</p> <p>M2 for $46^2 + 46^2 + 55^2$ or 7257 or $\sqrt{46^2 + 46^2}$ or $\sqrt{4232}$ or 65.05 to 65.1 or $\sqrt{46^2 + 55^2}$ or $\sqrt{5141}$ or 71.7[...]</p> <p>OR</p> <p>M1 for $46^2 + 46^2$ or 4232 or $46^2 + 55^2$ or 5141</p>	<p>Accept answers rounding to 9.8 if correct working seen</p> <p>Condone for full marks minor inaccuracies from rounding, such as $\sqrt{7256}$ seen</p> <p>May be done in steps</p>
	b		40.2 nfw	3 1 AO1.3a 2 AO3.1c	<p>M2 for $\sin [...] = \frac{55}{\text{their } 85.18 \text{ to } 85.2}$</p> <p>or $\tan [...] = \frac{55}{\text{their } \sqrt{46^2 + 46^2}}$</p> <p>or $\cos [...] = \frac{\text{their } \sqrt{46^2 + 46^2}}{\text{their } 85.18 \text{ to } 85.2}$</p> <p>OR</p> <p>M1 for indication of required angle</p>	<p>Accept 40° and answers rounding to 40.2 if correct working seen</p> <p>0 for $\tan [...] = \frac{55}{46}$</p> <p>M2 for cosine rule with cos as subject</p> <p>eg diagram showing angle</p>

APPENDIXExemplar responses for Q3(a)(ii)

Response	Mark
(line drawn on graph) no, following the scatter diagram points there would be an estimate of around 240 visitors <i>Take "following the scatter diagram points" refers to the line and a supporting value</i>	2
no as with 1mm rain its 280 visitors so with 2mm you should get around 245 <i>B1 for 245 expected at 2mm but no reference to trend</i>	1
having drawn a line of best fit the scatter diagram wouldn't support this as it's too big a number <i>No explicit supporting value used</i>	1
no, by looking at the diagram you would expect about 240 <i>Supporting value in range but no justification</i>	1
no because with 1mm there's less than 320 visitors <i>1 mm and 320 are the supporting values but no reference to trend</i>	1
no because there were 320 visitors on a day with 0mm rainfall <i>0 mm and 320 are the supporting values but no reference to trend</i>	1
the scatter diagram doesn't support his statement as there isn't any rainfall that is 2mm <i>No supporting value</i>	0
no it doesn't because when the rainfall was 2mm he didn't have any visitors <i>Wrong</i>	0
the closest amount of visitors to 2mm of rainfall is 290 <i>An estimate that is out of range and is probably referring to the nearest point plotted. No reference to trend</i>	0
No we expect 250 (reference to line or markings drawn)	2
No, a line of best fit would show 250 (no line)	2
No we expect 250 (nothing else)	1
(No valid comment) line of best fit within overlay	1
OR	
No, 0-1 mm shows 320 but we would expect less as it is decreases/negative trend	2
No, 0-1 mm shows 320	1
No, 320 is for 1mm	1
No, negative trend	1
No, as on a day with 1mm there are fewer customers	0
OR	
No, (point below 2mm and point above 2mm stated) so there is a negative trend	2
No, (point below 2mm and point above 2mm stated)	1
Yes ...	0

Exemplar responses for Q3(a)(iii)

Response	Mark
Outside range of data collected <i>Perfect!!</i>	1
because there is no data to show above 6mm of rainfall <i>Equivalent answer</i>	1
because the values of 7 and 8mm are not plotted, therefore it would be hard to estimate 9mm <i>Similar to "no data around 9mm"</i>	0
no record of any visitors are shown at 9mm of rainfall. Visitors stop coming when it hits 6mm of rainfall <i>Equivalent to "no data for 9mm"</i>	0
because there is not enough data to estimate the amount of visitors for 9mm of rainfall <i>Does not say "no data beyond 5.5 (or 6) mm"</i>	0
we don't have the data to do a line of best fit <i>Wrong</i>	0
there is nothing recorded <i>Wrong</i>	0
you can't plot this data the graph isn't big enough <i>Wrong</i>	0
because that would create an outlier or anomalous piece of data <i>Maybe but wrong</i>	0

Exemplar responses for Q3(b)

Response	Mark
The total number of visitors is not known <i>True</i>	1
there is no value of the amount of visitors that day <i>For value read number</i>	1
because there are more children and it don't say how many there are in total <i>Mark the best bit and no contradiction</i>	1
there is no numbers to help us find our answer <i>Too vague, could be referring to angles or number of adults</i>	0
the pie chart doesn't show any figures or percentages <i>Too vague, could be referring to angles or number of adults (and final part incorrect)</i>	0

they don't have enough information	<i>Too vague</i>	0
because you can't tell what the percentage is	<i>Wrong</i>	0
the tourist attraction could be aimed at children	<i>Wrong</i>	0
its different every day	<i>Wrong</i>	0
the pie chart is not as accurate as others	<i>Wrong</i>	0

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