

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE MATHEMATICS

# H

Higher Tier

Paper 2 Calculator

Thursday 8 June 2017

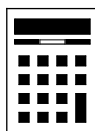
Morning

Time allowed: 1 hour 30 minutes

## Materials

For this paper you must have:

- a calculator
- mathematical instruments.



## Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

## Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

## Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use

Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26–27	
<b>TOTAL</b>	



J U N 1 7 8 3 0 0 2 H 0 1

Answer **all** questions in the spaces provided

- 1** Circle the decimal that is closest in value to  $\frac{39}{800}$  **[1 mark]**

0.04

0.048

0.049

0.05

- 2** Circle the area that is equal to  $36 \text{ mm}^2$  **[1 mark]**

 $360 \text{ cm}^2$  $3600 \text{ cm}^2$  $3.6 \text{ cm}^2$  $0.36 \text{ cm}^2$ 

- 3**  $A$  is  $(2, 12)$  and  $B$  is  $(8, 2)$   
Circle the midpoint of  $AB$ .

[1 mark]

$(3, 5)$

$(4, 6)$

$(5, 7)$

$(6, 10)$

- 4** Here is a sequence.

90

82

74

66

58

Circle the expression for the  $n$ th term of the sequence.

[1 mark]

$n - 8$

$98 - 8n$

$8n + 82$

$8n - 98$

Turn over for the next question

Turn over ►



- 5** A code has 4 digits.  
Each digit is a number from 0 to 9  
Digits may be repeated.

The code starts 5 4 1

5	4	1	
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- 5 (a)** Amy knows the last digit is odd but **not** 7  
She chooses a different odd number at random.  
What is the probability that she chooses the correct number?

**[1 mark]**

Answer \_\_\_\_\_

- 5 (b)** The 4-digit code is changed to an even number.  
The first digit is 3  
How many possible codes are there?

**[2 marks]**

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Answer \_\_\_\_\_



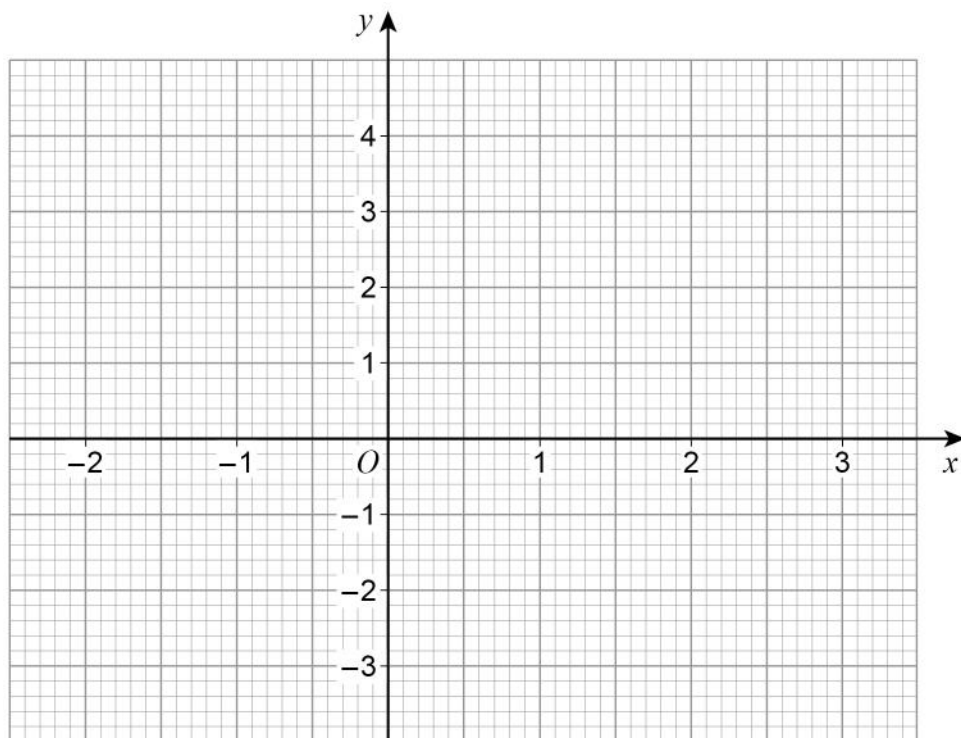
**6 (a)** Complete the table of values for  $y = x^2 - x - 2$

**[2 marks]**

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

**6 (b)** Draw the graph of  $y = x^2 - x - 2$  for values of  $x$  from -2 to 3

**[2 marks]**



**6 (c)** Write down the  $x$ -coordinate of the turning point of the graph.

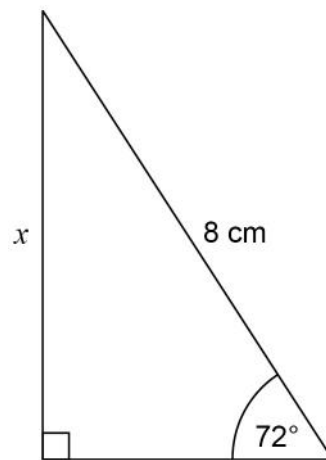
**[1 mark]**

Answer \_\_\_\_\_

Turn over ►



- 7 Use trigonometry to work out the length  $x$ .



Not drawn  
accurately

[2 marks]

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Answer \_\_\_\_\_ cm



8

Lily goes on a car journey.

For the first 30 minutes her average speed is 40 miles per hour.

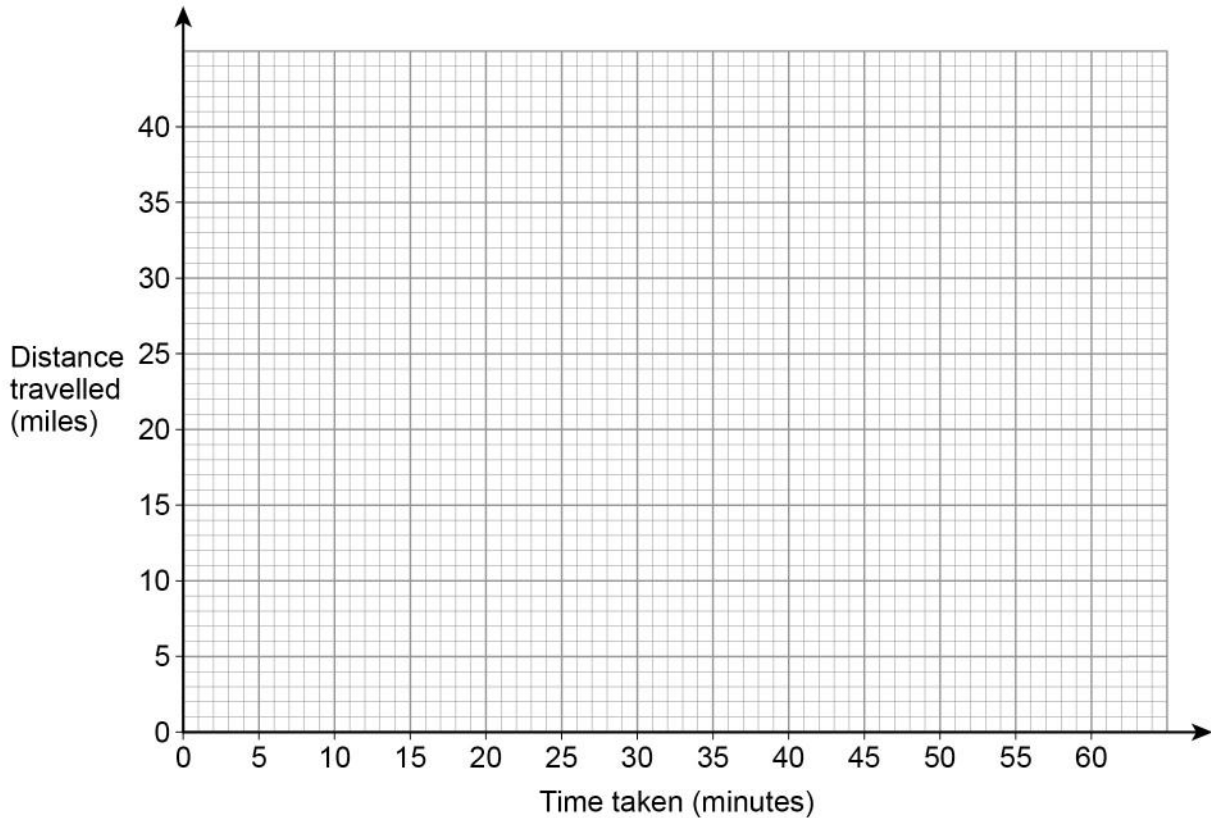
She then stops for 15 minutes.

She then completes the journey at an average speed of 60 miles per hour.

The total journey time is 1 hour.

8 (a) Draw a distance-time graph for her journey.

[3 marks]



8 (b)

Write down the average speed for the total journey.

[1 mark]

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Answer \_\_\_\_\_ mph

**Turn over for the next question**



- 9 The table shows information about some CDs.

Type	Rock	Pop	Jazz
Number of CDs	2	$x$	$2x + 5$

A CD is chosen at random.

The probability it is **rock** is  $\frac{1}{20}$

Work out the probability it is jazz.

**[4 marks]**

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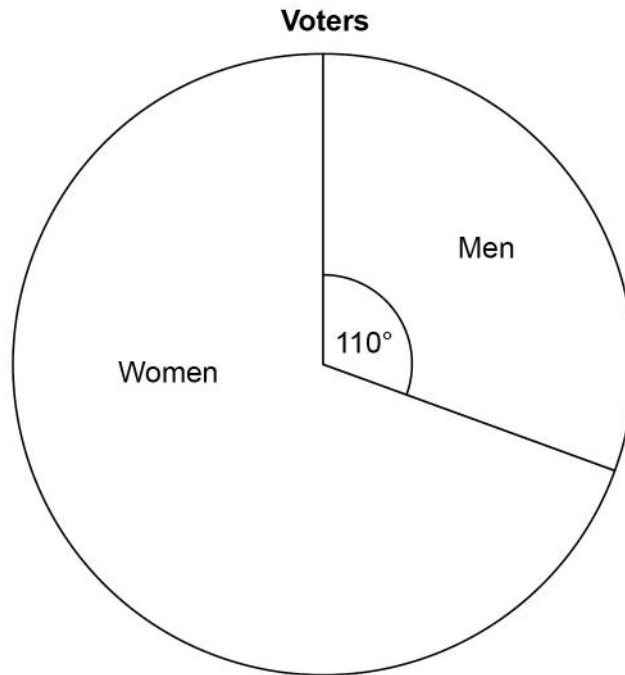
Answer \_\_\_\_\_





10

The pie chart shows information about voters in an election.



3360 **more** women voted than men.

Work out the total number of voters.

[3 marks]

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Answer \_\_\_\_\_

Turn over ►



11 Write these numbers in **descending** order.

9563

$9.56 \times 10^3$

$9.56 \times 3^{10}$

[2 marks]

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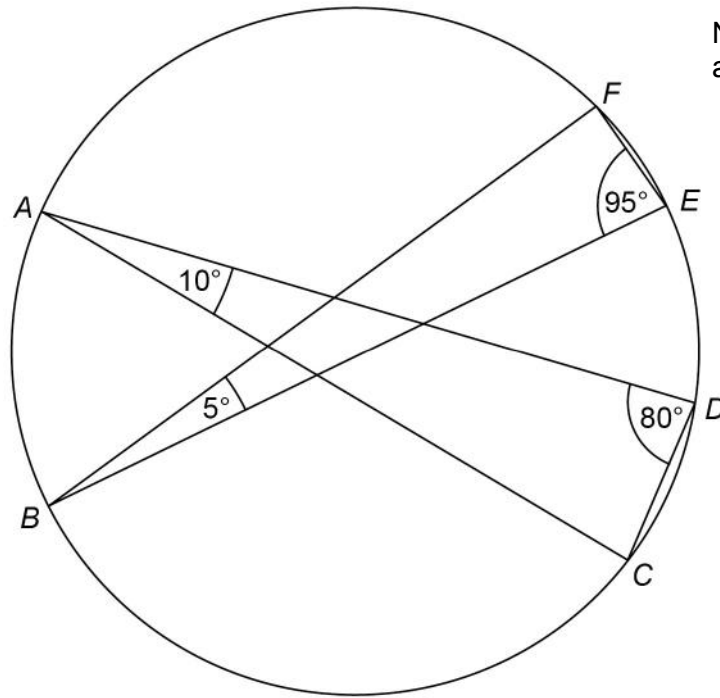
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Answer \_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_



12

$A, B, C, D, E$  and  $F$  are points on a circle.



Not drawn  
accurately

Circle the line that is a diameter of the circle.

[1 mark]

$BE$

$AD$

$AC$

$BF$

Turn over for the next question

Turn over ►



- 13 To make one cheese sandwich, Gina uses one bread roll and two cheese slices.

**Pack of 15 bread rolls**

£1.88

**Pack of 20 cheese slices**

£2.15

She is going to buy enough packs to  
have exactly twice as many cheese slices as bread rolls  
make **more than** 100 cheese sandwiches.

Work out the least amount she can spend.

**[4 marks]**

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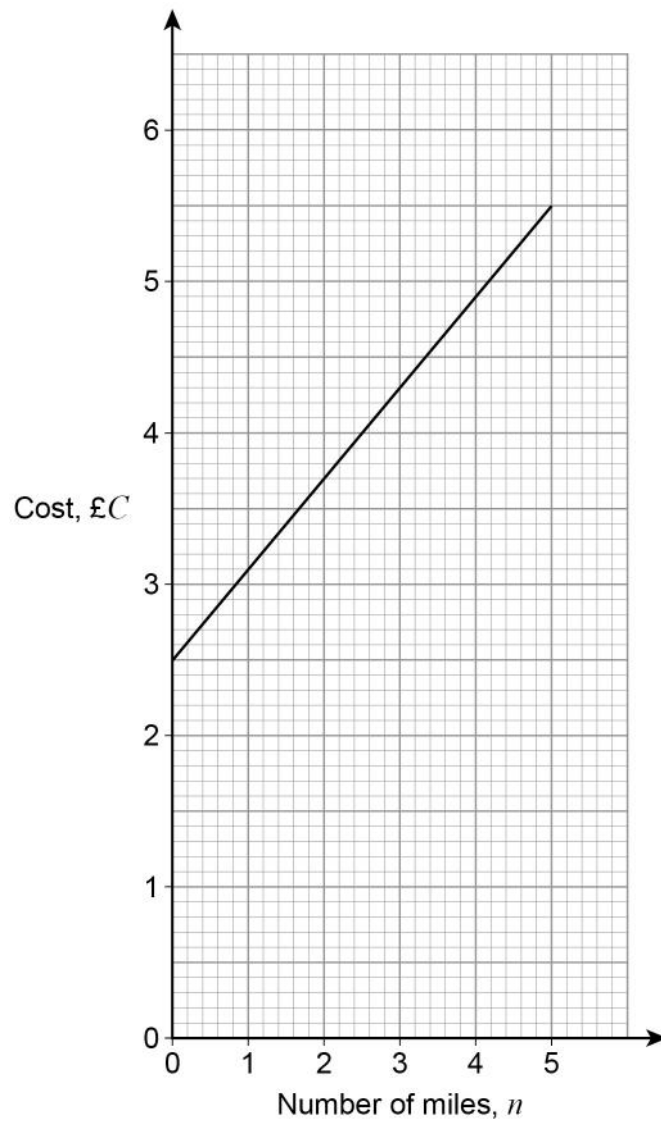
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Answer £ \_\_\_\_\_



- 14** The graph shows the cost of some taxi journeys.



Work out a formula for  $C$  in terms of  $n$ .

**[3 marks]**

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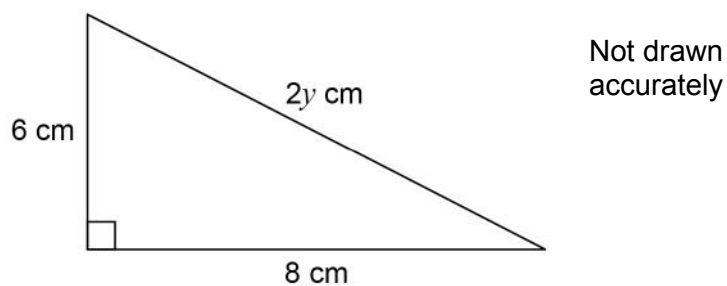


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Answer \_\_\_\_\_



- 15** Sami is trying to work out the exact value of  $y$  using Pythagoras' theorem.



Here is her working.

$$(2y)^2 = 6^2 + 8^2$$

$$2y^2 = 36 + 64$$

$$2y^2 = 100$$

$$y^2 = 100 \div 2$$

$$y^2 = 50$$

$$y = \sqrt{50}$$

- 15 (a)** What error has she made in her working?

**[1 mark]**

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**15 (b)** Kai works out that  $y = 5$

Mel says,

“ $y$  cannot be 5 because the hypotenuse should be the longest side and the other sides are longer than 5 cm”

Is Mel correct?

Tick a box.

Yes

☐

No

☐

Give a reason for your answer.

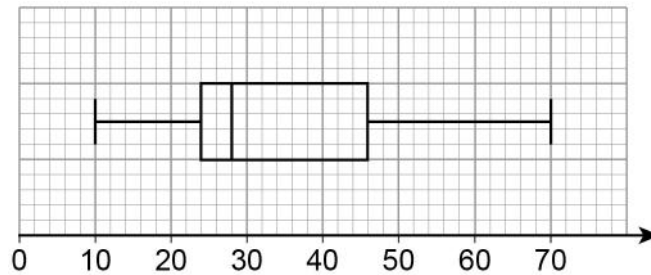
[1 mark]

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**16** Here is a box plot.



Circle the median value.

[1 mark]

28

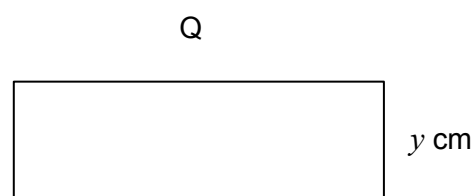
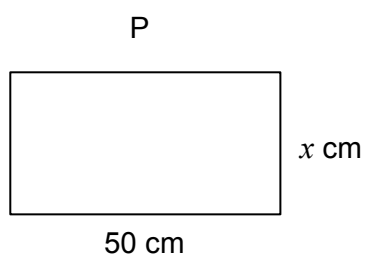
35

24

22



17

P is a rectangle with length 50 cm and width  $x$  cmQ is a rectangle with width  $y$  cmNot drawn  
accuratelyThe length of Q is 20% **more** than the length of P.The area of Q is 10% **less** than the area of P.Work out the ratio  $x : y$ 

Give your answer in its simplest form.

**[4 marks]**


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Answer \_\_\_\_\_ : \_\_\_\_\_





**18** A school has 86 teachers.

42 are male and 44 are female.

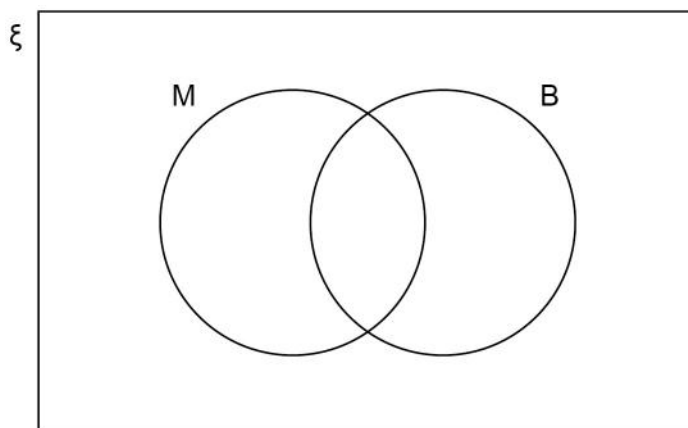
$\frac{1}{3}$  of the male teachers have blue eyes.

$\frac{1}{4}$  of the female teachers have blue eyes.

**18 (a)**  $\xi$  = teachers in the school

M = male teachers

B = teachers who have blue eyes



Complete the Venn diagram.

**[3 marks]**

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**18 (b)** One teacher who has blue eyes is chosen at random.

Work out the probability that the teacher is male.

**[1 mark]**

Answer \_\_\_\_\_



**19** Rana sells 192 cakes in the ratio small : medium : large = 7 : 6 : 11

The profit for one medium cake is twice the profit for one small cake.

The profit for one large cake is three times the profit for one small cake.

Her total profit is £532.48

Work out the profit for one small cake.

**[5 marks]**

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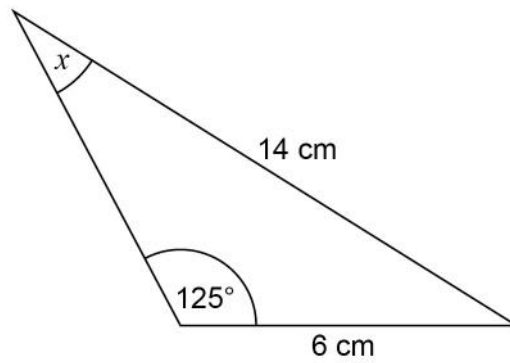
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Answer £ \_\_\_\_\_



20

Work out the size of angle  $x$ .Not drawn  
accurately**[3 marks]**

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Answer \_\_\_\_\_ degrees

**Turn over for the next question****Turn over ►**

**21**Solve  $5x^2 = 10x + 4$ 

Give your answers to 2 decimal places.

**[4 marks]**

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Answer \_\_\_\_\_



**22**

A ball, dropped vertically, falls  $d$  metres in  $t$  seconds.

$d$  is directly proportional to the square of  $t$ .

The ball drops 45 metres in the first 3 seconds.

How far does the ball drop in the **next** 7 seconds?

**[4 marks]**

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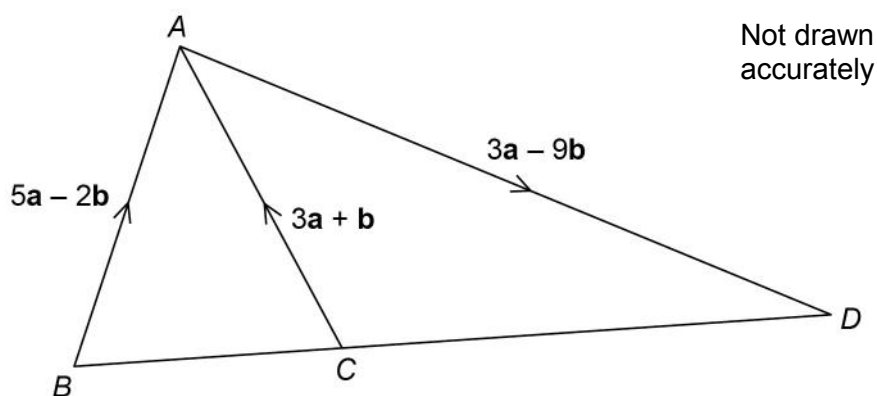
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Answer \_\_\_\_\_ metres

**Turn over for the next question**

**Turn over ►**

23



Is  $BCD$  a straight line?

Show working to support your answer.

[3 marks]

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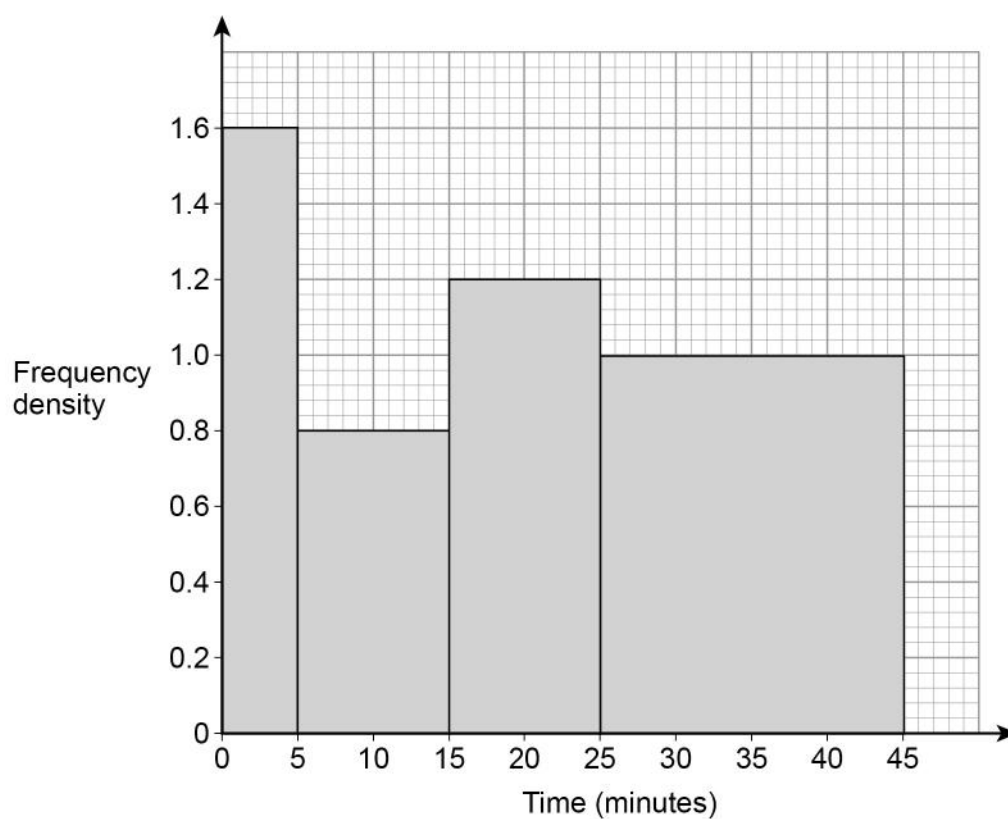
Answer \_\_\_\_\_



24

48 students completed some homework.

This histogram shows information about the times taken.



Work out an estimate of the interquartile range.

You **must** show your working.**[4 marks]**


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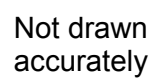
Answer \_\_\_\_\_ minutes

Turn over ►



The diagram shows a logo.

$BCE$  is a sector of a circle, centre  $E$ .

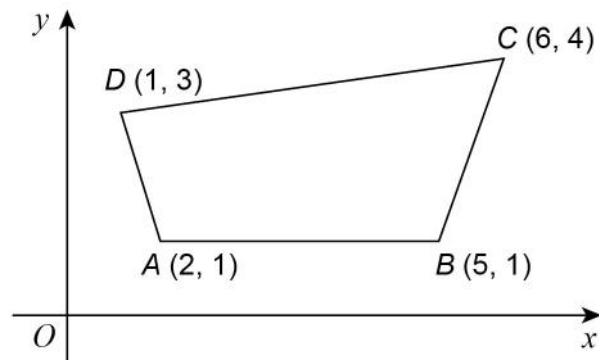


**[5 marks]**

[illegible]



- 26 (a)** A sketch of a quadrilateral  $ABCD$  is shown.



Not drawn  
accurately

$ABCD$  is enlarged, centre  $B$ , scale factor  $\frac{1}{3}$

Circle the vertex that is invariant.

[1 mark]

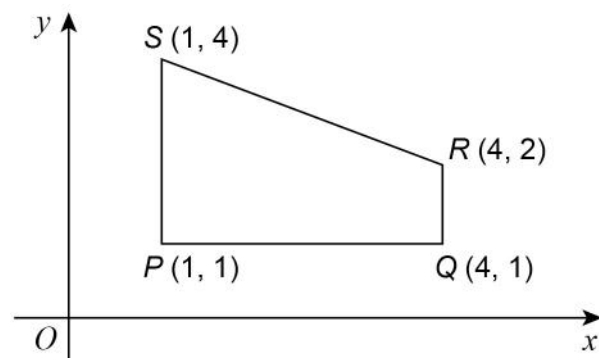
$A$

$B$

$C$

$D$

- 26 (b)** A sketch of a quadrilateral  $PQRS$  is shown.



Not drawn  
accurately

$PQRS$  is reflected in the line  $y = x$

Circle the vertex that is invariant.

[1 mark]

$P$

$Q$

$R$

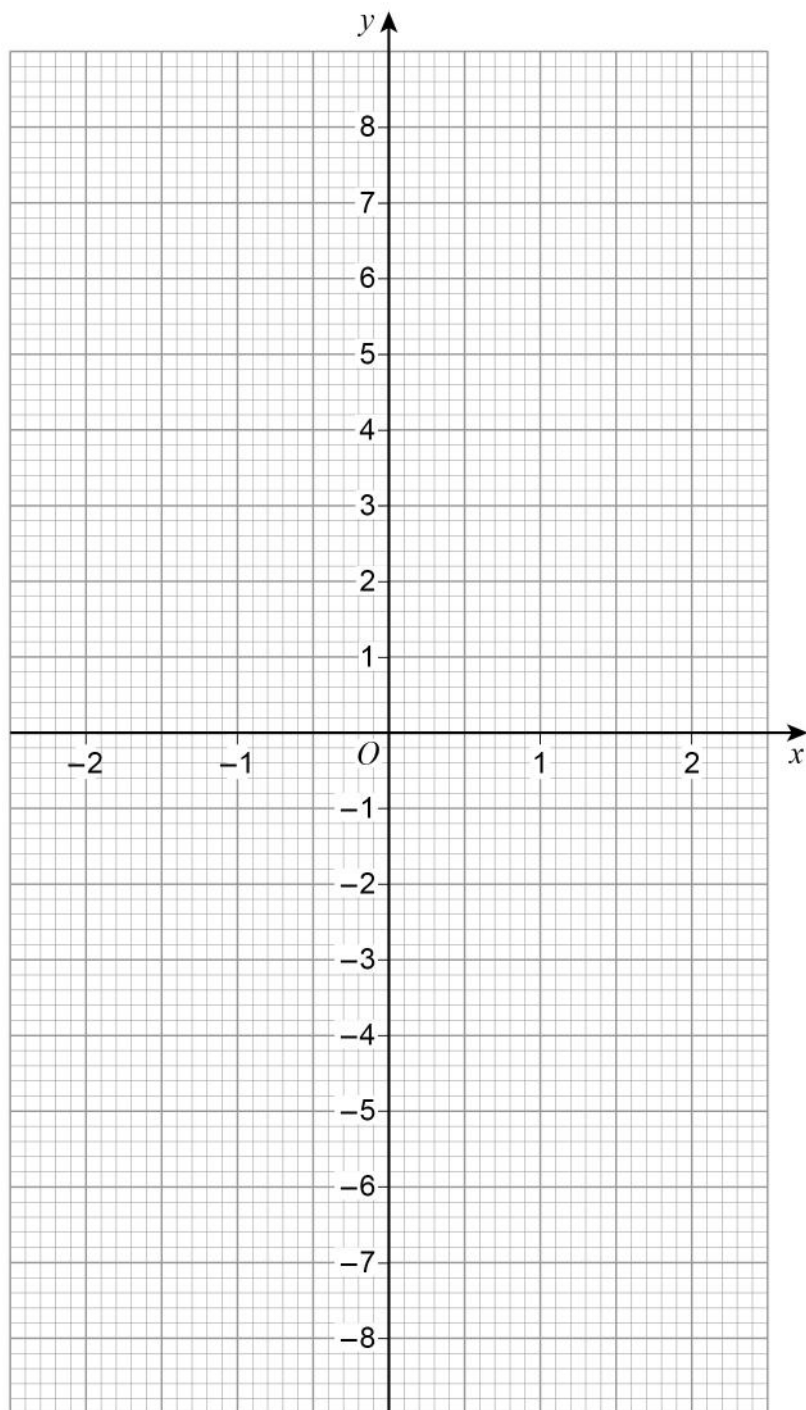
$S$



**27 (a)**  $h(x) = \sqrt[3]{x}$  for all values of  $x$

On the grid, draw the graph of the inverse function  $y = h^{-1}(x)$  for  $-2 \leq x \leq 2$

**[2 marks]**



**27 (b)** For all values of  $x$

$$f(x) = \sin x$$

$$g(x) = x + 90$$

On the grid, draw the graph of the composite function  $y = fg(x)$  for  $0^\circ \leq x \leq 360^\circ$

**[2 marks]**

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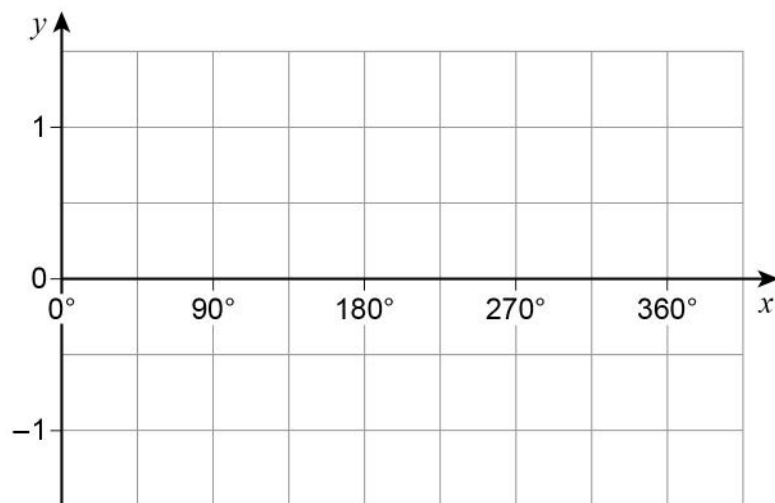
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**END OF QUESTIONS**



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**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

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# GCSE Mathematics

Paper 2 Higher Tier

Mark scheme

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8300  
June 2017

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Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from [aqa.org.uk](http://aqa.org.uk)

**Glossary for Mark Schemes**

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
<b>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between a and b inclusive.
<b>[a, b)</b>	Accept values $a \leq \text{value} < b$
<b>3.14...</b>	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
<b>Use of brackets</b>	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

### **Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

### **Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

### **Questions which ask students to show working**

Instructions on marking will be given but usually marks are not awarded to students who show no working.

### **Questions which do not ask students to show working**

As a general principle, a correct response is awarded full marks.

### **Misread or miscopy**

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

### **Further work**

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

### **Choice**

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

### **Work not replaced**

Erased or crossed out work that is still legible should be marked.

### **Work replaced**

Erased or crossed out work that has been replaced is not awarded marks.

### **Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

### **Continental notation**

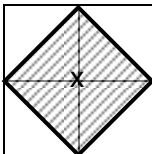
Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.



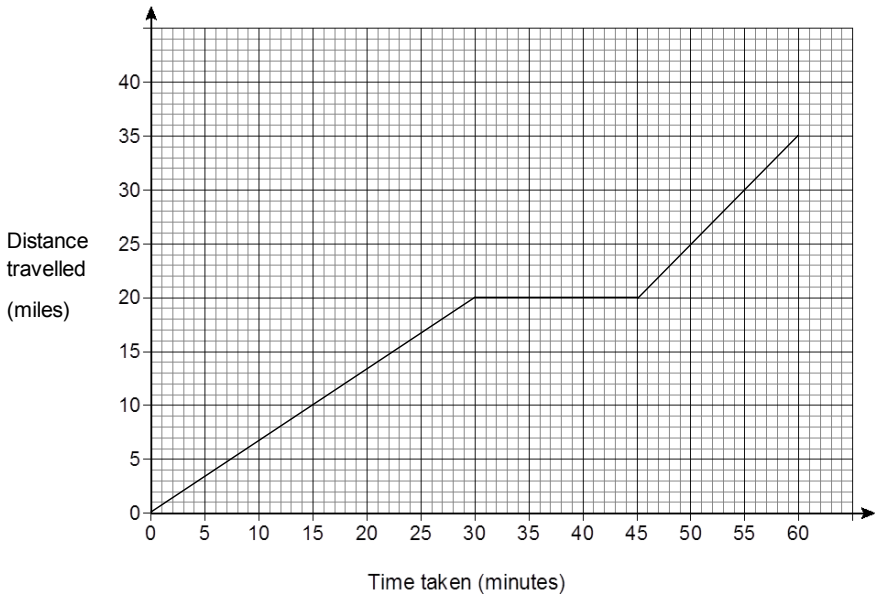
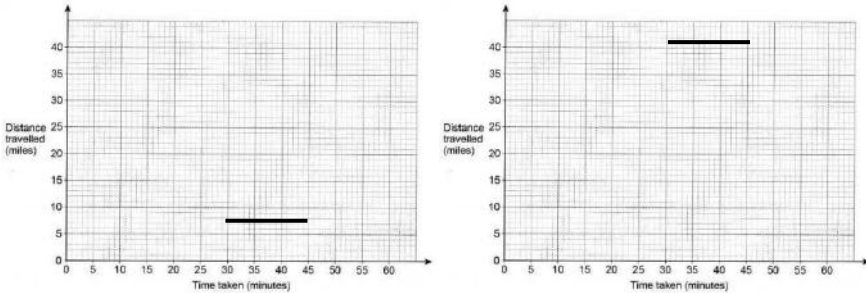
Question	Answer	Mark	Comments
1	0.049	B1	
	Additional Guidance		
2	$0.36 \text{ cm}^2$	B1	
	Additional Guidance		
3	(5, 7)	B1	
	Additional Guidance		
4	$98 - 8n$	B1	
	Additional Guidance		

Question	Answer	Mark	Comments
5(a)	$\frac{1}{4}$ or 0.25 or 25%	B1	oe
	<b>Additional Guidance</b>		
	Ratio eg 1 : 4 or 1 : 3		B0
	$\frac{1}{4}$ seen and answer 1 : 4		B1
	Expressed only in words eg 1 out of 4		B0
	1 out of 4 and $\frac{1}{4}$		B1
	$\frac{1}{4}$ seen with change to incorrect decimal or incorrect percentage eg $\frac{1}{4}$ and answer 0.4		B1
	Ignore chance words if $\frac{1}{4}$ seen eg $\frac{1}{4}$ and answer Likely		B1

5(b)	(1 x) 10 (x) 10 (x) 5 or $\frac{10 \times 10 \times 10}{2}$ or $\frac{1000}{2}$	M1	oe
	500	A1	SC1 5 or 324 or 400 or 405
	<b>Additional Guidance</b>		
	10 + 10 + 5		M0A0
	SCs are for the answers from not including zero at least once ie $9 \times 9 \times 4$ or $10 \times 10 \times 4$ or $9 \times 9 \times 5$ or from a misread ie $1 \times 1 \times 1 \times 5$		

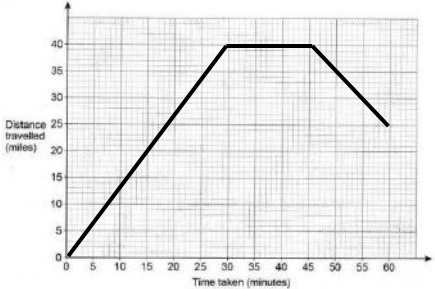
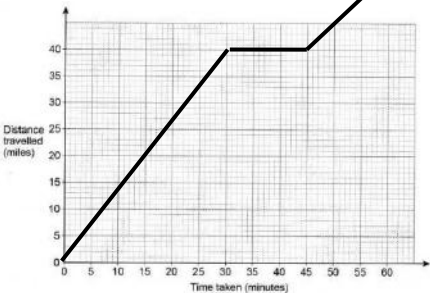
Question	Answer	Mark	Comments														
6(a)	<table><tr><td><math>x</math></td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td><math>y</math></td><td>4</td><td>0</td><td>-2</td><td>-2</td><td>0</td><td>4</td></tr></table>	$x$	-2	-1	0	1	2	3	$y$	4	0	-2	-2	0	4	B2	B1 1 or 2 values correct
	$x$	-2	-1	0	1	2	3										
	$y$	4	0	-2	-2	0	4										
	Additional Guidance																
6(b)	5 or 6 points plotted correctly	M1	Correct or ft their table in (a) Tolerance of $\pm 1$ small square Points can be implied by graph passing through them														
	Correct smooth parabolic curve and  y-coordinate of minimum point in the range $-2.5 \leq y \leq -2.1$	A1	Tolerance of $\pm 1$ small square for the six <b>correct</b> points from the table  No further tolerance for the minimum														
	Additional Guidance																
	Tolerance of $\pm 1$ small square means it is on the edges of or within the shaded area																
																	
	Ignore extra points plotted																
	If their table in (a) has points that are beyond the grid these points will not be able to be plotted correctly																
	Ignore any curve drawn for $x < -2$ or $x > 3$																
	Curve passing through all correct points within tolerance		M1A1														
	Ruled straight lines		A0														

Question	Answer	Mark	Comments
6(c)	$\frac{1}{2}$ or 0.5	B1	Ignore any y-coordinate
	<b>Additional Guidance</b>		
	(−2.25, 0.5)		B0
	Ignore their graph drawn in (b) – there is no ft		
	Condone 0.5, −2.25		B1
7	$\sin 72 = \frac{x}{8}$ or $8 \times \sin 72$ or $\cos (90 - 72) = \frac{x}{8}$ or $8 \times \cos (90 - 72)$ or $\frac{x}{\sin 72} = \frac{8}{\sin 90}$ or $\frac{\sin 72}{x} = \frac{\sin 90}{8}$	M1	oe eg $8 \cos 72$ or 2.47... or 2.5 <b>and</b> $\sqrt{8^2 - (8 \cos 72)^2}$
	[7.6, 7.61]	A1	
	<b>Additional Guidance</b>		
	If trigonometry and Pythagoras are used it must be a fully correct method that would lead to the correct value of $x$		
	Accept $\sin 72 \times 8$		M1
	Accept opp or o for $x$ eg $\sin 72 = \frac{\text{opp}}{8}$		M1
	$\sin = \frac{x}{8}$ or $\sin \theta = \frac{x}{8}$ (unless recovered)		M0
	Answer coming from scale drawing		M0A0
	Answer in range seen followed by 7 or 8		M1A1

Question	Answer	Mark	Comments
8(a)	Joins (0, 0) to (30, 20)	B1	Line does not need to be straight but must start and finish at correct points and not be decreasing Mark intention
	Horizontal <b>line</b> for 15 minutes from their (30, 20)	B1ft	Mark intention
	Line with gradient 1 or a curve from their (45, 20) <b>and</b> stops at 60 minutes or stops at top edge of grid or higher but not beyond 60 minutes	B1ft	A curve must not be decreasing and must start and finish at two points that could be joined by a line with gradient 1 Condone a horizontal or vertical line from 60 minutes Mark intention
	<b>Additional Guidance</b>		
			B3
	<p>Allow any horizontal line between 30 minutes and 45 minutes if first part of journey is blank</p> <p>eg</p> 		B0B1

Additional Guidance continues on the next page

<p style="text-align: center;"><b>Additional Guidance continued</b></p>	
<p>Do not allow second mark if their first line is followed by a drop back towards the horizontal axis before she stops</p> <p>eg</p>	<p>B1B0</p> <p>B0B0</p>
<p>8(a) cont</p> <p>If there are more than 3 lines or curves, assume the last part is the part where she completes her journey</p> <p>eg</p>	<p>B1B0B1ft</p>
<p>If their (45, 20) is too high to fit a line of gradient 1 ending at 60 minutes, allow the final line to stop at the top of the grid or higher, but not beyond 60 minutes</p> <p>eg</p>	<p>B0B1ftB1ft</p>
<p>Points but no lines</p>	<p>B0</p>
<p>Ignore any lines that could be working for part (a) or part (b)</p>	

Question	Answer	Mark	Comments
8(b)	35	B1ft	Correct or ft total distance travelled for their graph at 60 minutes
	<b>Additional Guidance</b>		
	35 from any or no graph		B1
	If their graph extends beyond 60 minutes, read off at 60 minutes for ft		
	Follow through total distance travelled eg (a)		
			B0ft B1ft
	(b) answer 25 (b) answer 55		
	Ignores the stationary parts		B0
	Do not follow through a graph above the grid at 60 eg (a)		
			B0ft
	(b) answer 55		

Question	Answer	Mark	Comments
9	<b>Alternative method 1</b>		
	40	B1	May be implied eg $\frac{2}{40}$
	$2 + x + 2x + 5 = \text{their } 40$ or $3x + 7 = \text{their } 40$ or $(\text{their } 40 - 2 - 5) \div 3$ or $33 \div 3$	M1	oe equation eg $3x + 5 = 38$ (scores B1M1) their 40 must be an integer
	$(x =) 11$	A1ft	ft B0M1 Does not have to be an integer Accept answer rounded or truncated to at least 2 sf
	$\frac{27}{40}$ or 0.675 or 67.5%	B1ft	Only ft evaluation of $\frac{2 \times \text{their integer } x + 5}{40}$ and $0 < \text{answer} < 1$ Denominator must be 40 (may subsequently be simplified)
	<b>Alternative method 2</b>		
	$\frac{2}{2+x+2x+5} = \frac{1}{20}$ or $\frac{x+2x+5}{2+x+2x+5} = \frac{19}{20}$	M2	oe equation
	$(x =) 11$	A1	
	$\frac{27}{40}$ or 0.675 or 67.5%	B1ft	Only ft evaluation of $\frac{2 \times \text{their integer } x + 5}{40}$ and $0 < \text{answer} < 1$ Denominator must be 40 (may subsequently be simplified)

Alternative methods 3, 4 and Additional Guidance continue on the next two pages



Question	Answer	Mark	Comments
9 cont	<b>Alternative method 3</b>		
	$3x \rightarrow 100\% - 5\% - 12.5\%$ or $3x \rightarrow 82.5\%$	M1	Using $2 \rightarrow 5\%$ and $5 \rightarrow 12.5\%$ oe
	$x \rightarrow 82.5\% \div 3$ or $x \rightarrow 27.5\%$	M1dep	oe
	$2x + 5 \rightarrow 2 \times 27.5\% + 12.5\%$	M1dep	oe
	$\frac{27}{40}$ or 0.675 or 67.5%	A1	
	<b>Alternative method 4</b>		
	$3x \rightarrow 1 - \frac{1}{20} - \frac{2.5}{20}$ or $3x \rightarrow \frac{16.5}{20}$	M1	Using $2 \rightarrow \frac{1}{20}$ and $5 \rightarrow \frac{2.5}{20}$ oe
	$x \rightarrow \frac{16.5}{20} \div 3$ or $x \rightarrow \frac{5.5}{20}$	M1dep	oe
	$2x + 5 \rightarrow 2 \times \frac{5.5}{20} + \frac{2.5}{20}$ or $2x + 5 \rightarrow \frac{13.5}{20}$	M1dep	oe
	$\frac{27}{40}$ or 0.675 or 67.5%	A1	

**Additional Guidance continues on the next page**

9 cont	Additional Guidance	
	(Alt 1) $x = 6$ (no working)    Answer $\frac{17}{40}$ (first B1 implied)	B1M0A0B1ft
	(Alt 1) $2 + x + 2x + 5 = 20$ $x = \frac{13}{3}$ Answer $\frac{13.666}{20}$	B0M1 A1ftB0ft
	Answer $\frac{13.5}{20}$	B1M1A1B0
	11 by inspection or T & I scores the first 3 marks	
	Answer $\frac{2x+5}{40}$	B1M0A0B0
	Answer $\frac{2x+5}{3x+7}$	Zero
	Ratio eg 27 : 40	B1M1A1B0
	Expressed only in words eg 27 out of 40	B1M1A1B0
	27 out of 40 and $\frac{27}{40}$	B1M1A1B1
	$\frac{27}{40}$ seen with incorrect change of form or incorrect cancelling eg $\frac{27}{40}$ and answer 0.27	B1M1A1B1
	Ignore chance words if $\frac{27}{40}$ seen eg $\frac{27}{40}$ and answer Unlikely	B1M1A1B1

Question	Answer	Mark	Comments
10	<b>Alternative method 1</b>		
	360 – 110 or 250 or 360 – 110 – 110 or 140	M1	May be seen on diagram oe
	3360 ÷ their 140 or 24 or 2640 (men) or 6000 (women)	M1dep	their 140 must be from 360 – 110 – 110 oe
	8640	A1	SC2 4838 or 4839
	<b>Alternative method 2</b>		
	$100 - \frac{110}{360} \times 100$ or 100 – 30.5(...) or 100 – 30.6 or 69.4(...%) or 69.5(%) or $100 - \frac{110}{360} \times 100 - \frac{110}{360} \times 100$ or 100 – 30.5(...) – 30.5(...) or 100 – 30.6 – 30.6 or 38.8(...%) or 38.9(%)	M1	May be seen on diagram oe
	3360 ÷ (their 69.4 – their 30.5) or 3360 ÷ their 38.8(...) or 86.4	M1dep	their 69.4 must be from $100 - \frac{110}{360} \times 100$ their 30.5 must be from $\frac{110}{360} \times 100$
	8640	A1	SC2 4838 or 4839

**Alternative method 3 and Additional Guidance continue on the next page**

<b>10 cont</b>	<b>Alternative method 3</b>		
	$\frac{250}{360}x - \frac{110}{360}x = 3360$ or $m = \frac{110}{360} \times (m + 3360 + m)$ or $w = \frac{250}{360} \times (w + w - 3360)$	M1	Sets up a correct equation to work out total ( $x$ ), men ( $m$ ) or women ( $w$ )  oe
	$x = 3360 \div \left( \frac{250 - 110}{360} \right)$ or $m = 336\,000 \div 140$ or 2640 or $w = 840\,000 \div 140$ or 6000	M1dep	oe
	8640	A1	SC2 4838 or 4839
	<b>Additional Guidance</b>		
	Condone 8639.9... → answer 8640		M2 A1
	2640 or 6000		M2
	4838 and 4839 come from 3360 women		SC2
<b>11</b>	$9.56 \times 3^{10}$ 9563 $9.56 \times 10^3$ or 564 508 (.44) 9563 9560 with no incorrect evaluations seen	B2	B1 $9.563 \times 10^3$ or 9560 or 564 508 (.44) or $5.6(450844) \times 10^5$  SC1 $9.56 \times 10^3$ 9563 $9.56 \times 3^{10}$ with no incorrect evaluations seen
	<b>Additional Guidance</b>		
	Allow numbers to be written in original or converted form or as a mixture for B2 or SC1		
	Incorrect evaluation seen scores a maximum of B1		
<b>12</b>	AD	B1	
	<b>Additional Guidance</b>		

Question	Answer	Mark	Comments
13	<b>Alternative method 1</b>		
	Valid number of bread rolls and cheese slices	M1	eg 30 bread and 60 cheese or 60 bread and 120 cheese or 90 bread and 180 cheese or 120 bread and 240 cheese Valid number means ratio 1 : 2 and can be bought in exact numbers of packs May be implied by valid number of packs
	Valid number of packs of bread rolls and cheese slices	M1dep	eg 2 packs bread and 3 packs cheese or 4 packs bread and 6 packs cheese or 6 packs bread and 9 packs cheese or 8 packs bread and 12 packs cheese Valid number of packs means ratio 2 : 3
	their number of packs of bread $\times$ 1.88 and their number of packs of cheese $\times$ 2.15	M1dep	eg 15.04 and 25.8(0)
	40.84	A1	SC2 27.94 or 42.98

**Alternative method 2 and Additional Guidance continue on the next page**

Question	Answer	Mark	Comments
13 cont	<b>Alternative method 2</b>		
	Valid number of sandwiches	M1	eg Common multiple of 15 and 20 identified eg 15 30 45 <u>60</u> 75 and 20 40 <u>60</u> Valid number means can be bought in exact numbers of packs
	$1.88 \div 15 + 2.15 \div 10$ or $0.125(\dots) + 0.215$ or $0.34(0\dots)$	M1	oe Cost of one sandwich
	their $0.34(0\dots) \times$ their number of sandwiches	M1dep	dep on M2
	40.84	A1	SC2 27.94 or 42.98
	<b>Additional Guidance</b>		
	Alt 1 3rd M1 Allow working in pence		
	Alt 2 2nd M1 Allow working in pence		
	30 bread and 60 cheese/2 packs bread and 3 packs cheese $2 \times 1.88$ or 3.76 <b>and</b> $3 \times 2.15$ or 6.45 (Answer £10.21)	M3 A0	
	60 bread and 120 cheese/4 packs bread and 6 packs cheese $4 \times 1.88$ or 7.52 <b>and</b> $6 \times 2.15$ or 12.9(0) (Answer £20.42)	M3 A0	
	90 bread and 180 cheese/6 packs bread and 9 packs cheese $6 \times 1.88$ or 11.28 <b>and</b> $9 \times 2.15$ or 19.35 (Answer £30.63)	M3 A0	
	150 bread and 300 cheese/10 packs bread and 15 packs cheese $10 \times 1.88$ or 18.8(0) <b>and</b> $15 \times 2.15$ or 32.25 (Answer £51.05)	M3 A0	
	SC2 from 120 bread and 120 cheese or 240 bread and 120 cheese		

Question	Answer	Mark	Comments
14	$C = 0.6(0)n + 2.5(0)$	B3	oe Must have $C =$ for B3 B2 $C = 0.6n + k$ ( $k \neq 0$ ) or $C = an + 2.5$ ( $a \neq 0$ ) or $0.6n + 2.5$ B1 $0.6n$ or $an + 2.5$ ( $a \neq 0$ ) or $C = 60n + 250$
	<b>Additional Guidance</b>		
	Allow correct fractions eg $\frac{3}{5}$ or $\frac{1}{1.6}$ for 0.6 and/or $\frac{5}{2}$ for 2.5		
	Allow $0.6 \times n$ or $n \times 0.6$ for $0.6n$ eg $C = 0.6 \times n + 2.5$ $n \times 0.6 + 2.5$ $0.6 \times n$		B3 B2 B1
	Penalise by one mark the use of $n0.6$ for $0.6n$ eg $C = n0.6 + 2.5$ $n0.6 + 2.5$ $n0.6$		B2 B1 B0
	Penalise by one mark the use of different letters eg $y = 0.6x + 2.5$ $0.6x + 2.5$ $2p + 2.5$		B2 B1 B0
	Transposing 0.6 and 2.5 scores zero eg $C = 2.5n + 0.6$		B0
	Ignore £ signs eg $£C = £0.6n + £2.5$ or $C = £0.60n + £2.5$		B3
	$C = 1.2n + 2.5$		B2
	$1.2n + 2.5$		B1
	$C = 0.6n + 2.5$ in working with $0.6n + 2.5$ on answer line		B3
	Equivalent formula but $C$ not the subject scores B2 eg $100C = 60n + 250$		B2

Question	Answer	Mark	Comments
15(a)	Identifies error in working	B1	eg $2y^2$ should be $4y^2$ 2 should be 4 2 should be squared Should have worked out $(2y)^2$ but has only worked out $y^2$
	<b>Additional Guidance</b>		
	Answer may be seen next to Sami's method below the diagram		
	Adding brackets around $2y$ to Sami's working in line 2 (working lines may be blank)		B1
	Showing the error being corrected eg1 $(2y)^2 = 100$ and $2y = 10$ eg2 $4y^2 = 36 + 64$		B1 B1
	She hasn't squared the bracket		B1
	Has only squared $y$		B1
	The brackets have been left out		B1
	$(2y)^2$ is not equal to $2y^2$		B1
	Should have square rooted 100 before dividing by 2 because the $2y$ should not have been taken out of the bracket		B1
	Should have square rooted 100 before dividing by 2 (could be referring to working from line 3 to line 4)		B0
	Line 2 is wrong (has not identified which part of line 2 is wrong)		B0
	Answer should be $y = 5$ (has not shown what the error is)		B0
	Ignore non-contradictory work if correct response seen		



Question	Answer	Mark	Comments
15(b)	No and valid reason	B1	eg No and the hypotenuse is 10 No and $2y$ is 10 No and if you double $y$ it is more than 8
	<b>Additional Guidance</b>		
	Valid reason must be for Mel's argument		
	Neither box ticked with valid reason can score B1 if decision in words eg $2y$ is 10 so Mel is wrong		B1
	No and she didn't double it to 10		B1
	No and she didn't double $y$		B0
	No and she has to double 5 which makes it 10		B1
	No and she has to double 5		B0
	No and the hypotenuse is $2y$ so that's more than 8		B1
	No and the hypotenuse is $2y$		B0
	No and the hypotenuse is the longest side		B0
	No and $y$ is 5		B0
	No and if you double $y$ it is more than 6 and 8		B1
	No and if you double $y$ it is more than 6		B0
	Yes and valid reason		B0
16	28	B1	
	<b>Additional Guidance</b>		

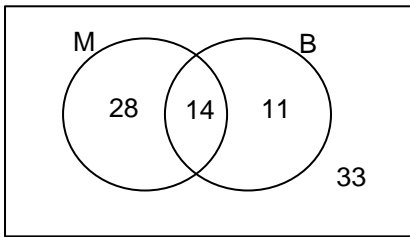
Question	Answer	Mark	Comments
17	<b>Alternative method 1</b>		
	$50 \times 1.2$ or $60$	M1	oe length of Q May be on the diagram
	$50 \times x \times 0.9$ or $45 \times x$	M1	oe area of P reduced by 10% May be on the diagram
	their $60 \times y =$ their $45 \times x$ or $\frac{y}{x} = \frac{\text{their } 45}{\text{their } 60}$ or $y : x =$ their $45 : \text{their } 60$ or equivalent ratio to 4: 3 not in simplest form or equivalent fraction to $\frac{4}{3}$ not in simplest form	M1dep	oe dep on M2 M3 $\frac{1.2}{0.9}$
	$4 : 3$ or $1 : \frac{3}{4}$ or $1 : 0.75$ or $\frac{4}{3} : 1$	A1	

**Alternative method 2 and Additional Guidance continue on the next two pages**

Question	Answer	Mark	Comments
<b>17 cont</b>	<b>Alternative method 2</b>		
	$50 \times 1.2$ or 60	M1	oe length of Q May be on the diagram
	Chooses a value for $x$ and reduces area of P by 10%	M1	oe eg ( $x = 8$ ) $50 \times 8 \times 0.9$
	their $60 \times y =$ their area of P reduced by 10% or equivalent ratio to 4 : 3 not in simplest form or equivalent fraction to $\frac{4}{3}$ not in simplest form	M1dep	oe eg $60y = 50 \times 8 \times 0.9$ or $60y = 360$ or ( $y =$ ) $360 \div 60$ or 6 dep on M2  M3 $\frac{1.2}{0.9}$
	$4 : 3$ or $1 : \frac{3}{4}$ or $1 : 0.75$ or $\frac{4}{3} : 1$	A1	

**Additional Guidance continues on the next page**

17 cont	Additional Guidance	
	Allow 1.33(...) for $\frac{4}{3}$	
	4 : 3 in working with 3 : 4 on answer line	M3A0
	1 : $\frac{45}{60}$	M3A0
	(Alt 1) $50x = 60y \times 0.9$	M1M0M0A0
	(Alt 1) $50x = 60y \times 1.1$	M1M0M0A0
	(Alt 1) $45x : 60y$ Answer 3 : 4	M1M1 M0A0
	(Alt 1) $y : x = 3 : 4$ Answer 3 : 4	M3A0
	Alt 2 example $50 \times 10 = 500$ (working not seen for reduction by 10% but completed correctly in next line) $450 \div 60 = 7.5$ (60 here gains first M1) $10 : 7.5 = 20 : 15$	M1M1 M1A0
	Do not allow misreads eg increases length of P by 10% (instead of 20%)	
	Alt 2 Allow choice of $x$ to be 50	

Question	Answer	Mark	Comments
18(a)	Fully correct diagram <div><math>\xi</math> </div>	B3	B2 Two or three correct numbers in correct positions B1 One correct number in correct position
	Additional Guidance		
	Three correct numbers in correct positions and one missing		B2
	Two correct numbers in correct positions and two missing		B2
18(b)	$\frac{14}{25}$ or 0.56 or 56%	B1ft	Correct or ft their diagram oe fraction
	Additional Guidance		
	$\frac{14}{25}$ or 0.56 or 56% always scores B1		
	ft answer correct with subsequent incorrect simplification	B1ft	
	Ratio eg 14 : 25	B0	
	Expressed only in words eg 14 out of 25	B0	
	$\frac{14}{25}$ and 14 out of 25	B1	
	$\frac{14}{25}$ seen with change to incorrect decimal or incorrect percentage eg $\frac{14}{25}$ and answer 0.8	B1	
	Ignore chance words if $\frac{14}{25}$ seen eg $\frac{14}{25}$ and answer likely	B1	
	For a ft answer that is only seen as a decimal or %, accept truncation or rounding to at least 2sf		

Question	Answer	Mark	Comments
19	<b>Alternative method 1</b>		
	$192 \div (7 + 6 + 11)$ or $192 \div 24$ or 8	M1	May be implied
	7 × their 8 or 56 and 6 × their 8 or 48 and 11 × their 8 or 88	M1dep	56 : 48 : 88 is M2
	their 56 (× 1) + their 48 × 2 + their 88 × 3 or 56 + 96 + 264 or 416	M1dep	May use $x$ , $2x$ and $3x$ (any letter)
	$532.48 \div$ their 416	M1dep	Allow working in pence
	1.28	A1	
	<b>Alternative method 2</b>		
	$7 (\times 1) + 6 \times 2 + 11 \times 3$ or $7 + 12 + 33$ or 52	M1	May use $x$ , $2x$ and $3x$ (any letter)
	$532.48 \div$ their 52 or 10.24	M1dep	Allow working in pence
	$192 \div (7 + 6 + 11)$ or $192 \div 24$ or 8	M1	May be implied
	their 10.24 ÷ their 8	M1dep	dep on M3 oe eg their $10.24 \times 7$ or 71.68 and their $71.68 \div (7 \times \text{their } 8)$
	1.28	A1	
	<b>Additional Guidance</b>		
	(Alt 1) 56 : 96 : 264 with no subsequent addition	M1M1M0M0A0	
	$532.48 \div 24$ (= 22.18... or 22.19) with no further valid working	Zero	
	$532.48 \div 192$ (= 2.77...) with no further valid working	Zero	
	(Alt 1) 56 and 48 and 88 (or correct method leading to them) but not subsequently used	M2	
	(Alt 1) 8 (or correct method leading to it) but not subsequently used	M1	
	(Alt 2) 10.24 (or correct method leading to it)	M2	
	1.28 in working with Answer 71.68 (from $1.28 \times 56$ )	M4A0	

Question	Answer	Mark	Comments
20	$\frac{\sin x}{6} = \frac{\sin 125}{14}$ or $\frac{6}{\sin x} = \frac{14}{\sin 125}$	M1	oe eg $\frac{\sin x}{6} = 0.058(\dots)$ or 0.059 or 0.06 or $\frac{6}{\sin x} = 17.(0\dots)$ or 17.1
	(sin x =) $\frac{\sin 125}{14} \times 6$ or 0.35(1...)	M1dep	oe eg $\sin^{-1} \left( \frac{\sin 125}{14} \times 6 \right)$
	[20.5, 20.6] or 21	A1	
	<b>Additional Guidance</b>		
	Condone incorrect notation if recovered eg $x = \frac{\sin 125}{14} \times 6$ Answer 20.6		M2 A1
	$\frac{\sin}{6} = \frac{\sin 125}{14}$ not recovered		Zero
	Answer [20.5, 20.6] from scale drawing		M1M1A1
	Answer 21 from scale drawing		Zero
	Answer only [20.5, 20.6] or 21		M1M1A1

Question	Answer	Mark	Comments
21	<b>Alternative method 1</b>		
	$5x^2 - 10x - 4 (= 0)$ or $-5x^2 + 10x + 4 (= 0)$	B1	If no rearrangement seen implied by $a = 5, b = -10, c = -4$ or $a = -5, b = 10, c = 4$ seen or used correctly
	$\frac{-(-10) \pm \sqrt{(-10)^2 - 4 \times 5 \times -4}}{2 \times 5}$	M1	ft their 3-term quadratic (equation) <b>seen</b> Allow one sign error Allow $10^2$ for $(-10)^2$ (do not count as a sign error) Allow recovery of invisible brackets Conceptual error (omission of square root, incomplete square root symbol, $\pm$ not included, short fraction line) is M0 unless recovered
	$\frac{-(-10) \pm \sqrt{(-10)^2 - 4 \times 5 \times -4}}{2 \times 5}$ or $\frac{10 \pm \sqrt{100 + 80}}{10}$ or $\frac{10 \pm \sqrt{180}}{10}$ or $\frac{10 \pm 6\sqrt{5}}{10}$ or 2.341(...) or 2.342 and -0.341(...) or -0.342	A1ft	Fully correct substitution ft their 3-term quadratic (equation) <b>seen</b> oe eg $\frac{5 \pm 3\sqrt{5}}{5}$ Allow $10^2$ for $(-10)^2$ Allow recovery of invisible brackets Two correct solutions > 2 dp for their 3-term quadratic equation
	2.34 and -0.34	A1ft	ft B0M1A1ft ft answers must be rounded to 2 dp

**Alternative method 2 and Additional Guidance continue on the next two pages**



Question	Answer	Mark	Comments
<b>21 cont</b>	<b>Alternative method 2</b>		
	$5(x^2 - 2x - \frac{4}{5}) (= 0)$ or $x^2 - 2x - \frac{4}{5} (= 0)$ or $5(x^2 - 2x) = 4$ or $x^2 - 2x = \frac{4}{5}$	B1	May be implied
	$5[(x - 1)^2 - 1^2 - \frac{4}{5}] (= 0)$ or $(x - 1)^2 - 1^2 - \frac{4}{5} (= 0)$ or $5[(x - 1)^2 - 1^2] = 4$ or $(x - 1)^2 - 1^2 = \frac{4}{5}$	M1	ft their 3-term quadratic (equation) <b>seen</b> Allow one sign error but $(x - 1)^2$ must be correct
	$1 \pm \sqrt{1^2 + \frac{4}{5}}$ or 2.341(...) or 2.342 and -0.341(...) or -0.342	A1ft	Fully correct ft their 3-term quadratic (equation) <b>seen</b> oe eg $\frac{5 \pm 3\sqrt{5}}{5}$ Two correct solutions > 2 dp for their 3-term quadratic equation <b>seen</b>
	2.34 and -0.34	A1ft	ft B0M1A1ft ft answers must be rounded to 2 dp

**Additional Guidance continues on the next page**

21 cont	Additional Guidance	
	Do not count a sign error in $a$ (or $b$ ) as two sign errors eg If $a$ should be $-5$ but $a = 5$ is used in both $4ac$ and $2a$ , only count as one sign error	
	Final A1 mark can be awarded if both answers seen in working but only one is written on answer line	
	$5x^2 + 10x - 4 (= 0)$ <b>seen</b> with solutions $-2.34$ and $0.34$ (no incorrect method seen)	B0M1A1ftA1ft
	$5x^2 - 10x + 4 (= 0)$ <b>seen</b> with solutions $0.55$ and $1.45$ (no incorrect method seen)	B0M1A1ftA1ft
	$5x^2 + 10x + 4 (= 0)$ <b>seen</b> with solutions $-0.55$ and $-1.45$ (no incorrect method seen)	B0M1A1ftA1ft
	Note that the pairs of solutions seen in the three rows above can come from incorrect method so will not always score 3 marks	
	$2.34$ and $-0.34$ with no working or from T & I	4 marks
	$2.34$ or $-0.34$ with no working or from T & I	Zero
	$2.3$ and/or $-0.3$ with no working or from T & I	Zero

Question	Answer	Mark	Comments
22	<b>Alternative method 1</b>		
	$d = kt^2$ or $45 = k \times 3^2$ or $45 \div 9$	M1	oe equation
	$d = 5t^2$ or $(k =) 5$	M1dep	oe equation 245 implies M2
	their $5 \times 10^2$ or 500	M1dep	oe M3 $\left(\frac{10}{3}\right)^2 \times 45$ oe
	455	A1	
	<b>Alternative method 2</b>		
	$kd = t^2$ or $k \times 45 = 3^2$ or $9 \div 45$	M1	oe equation
	$0.2d = t^2$ or $(k =) 0.2$	M1dep	oe equation 245 implies M2
	$10^2 \div$ their 0.2 or 500	M1dep	oe M3 $45 \div \left(\frac{3}{10}\right)^2$ oe
	455	A1	
	<b>Additional Guidance</b>		
	$d \propto t^2$ with no further valid working		Zero
	$d = kt$ or $d = kt^3$ or $d = \frac{k}{t^2}$ etc not recovered		Zero
	45 : 9 with no further valid working		Zero
	$d = 5t^2$ or $(k =) 5$ scores M2 even if not subsequently used		M2
	$d = kt^2$ or $45 = k \times 3^2$ or $45 \div 9$ scores M1 even if not subsequently used		M1
	$0.2d = t^2$ or $(k =) 0.2$ scores M2 even if not subsequently used		M2
	$kd = t^2$ or $k \times 45 = 3^2$ or $9 \div 45$ scores M1 even if not subsequently used		M1
	Allow use of other letters		

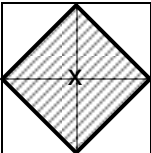
Question	Answer	Mark	Comments
23	$(BC =) 5a - 2b - 3a - b$ or $2a - 3b$ or $(CD =) 3a + b + 3a - 9b$ or $6a - 8b$ or $(BD =) 5a - 2b + 3a - 9b$ or $8a - 11b$	M1	oe eg $(CB =) 3a + b - 5a + 2b$ or $-2a + 3b$ or $(DC =) -3a + 9b - 3a - b$ or $-6a + 8b$ or $(DB =) -3a + 9b - 5a + 2b$ or $-8a + 11b$  Allow with brackets eg $(BC =) 5a - 2b - (3a + b)$
	Correct expressions for any two of <b>BC</b> , <b>CD</b> and <b>BD</b>	M1dep	oe eg1 correct expressions for <b>BC</b> and <b>DB</b> eg2 correct expressions for <b>CB</b> and <b>DC</b>  Allow with brackets eg $(BC =) 5a - 2b - (3a + b)$ and $(DB =) -(3a - 9b) - (5a - 2b)$
	Correct simplified expressions for any two of <b>BC</b> , <b>CD</b> and <b>BD</b> and valid explanation and No	A1	oe eg correct expressions for <b>BC</b> and <b>DB</b> and valid explanation and No  eg $BC = 2a - 3b$ and $CD = 6a - 8b$ and $3(2a - 3b) = 6a - 9b$ and No or $DC = -6a + 8b$ and $BD = 8a - 11b$ and <b>DC</b> is not a multiple of <b>BD</b> and not straight

Additional Guidance continues on the next page

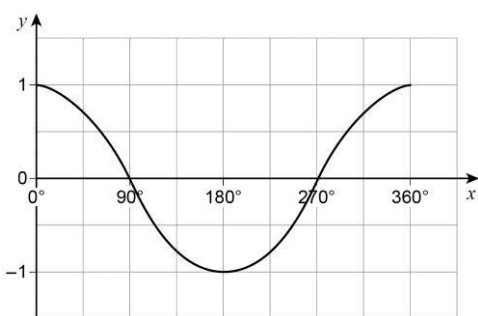
23 cont	Additional Guidance	
	Award marks for correct expressions, ignoring any incorrect ones unless contradictions of correct ones	
	<b>BAD</b> means <b>BD</b>	
	<b>BD</b> = $5a - 2b + 3a - 9b$ or $8a - 11b$ and <b>BAD</b> = their <b>BC</b> + their <b>CD</b> and answer not $8a - 11b$ Do not take <b>BAD</b> to be a contradiction to <b>BD</b>	
	Two correct simplified expressions used for a valid explanation and saying No with any incorrect non-contradictory expressions seen	M2A1
	Condone absence of vector notation eg Condone CD to mean the vector from C to D	
	$\vec{CD}$ means the vector from C to D and $\overleftarrow{CD}$ means the vector from D to C	
	Do not allow any misreads	
	Missing brackets may be recovered	
	Allow for up to M2 expressions like ( <b>BC</b> =) $5a - 2b + -3a + -b$	
	Valid explanations: eg1 <b>BC</b> = $2a - 3b$ and <b>CD</b> = $6a - 8b$ and $3(2a - 3b) = 6a - 9b$ is acceptable as there is a matching coefficient of <b>a</b> eg2 <b>CD</b> = $6a - 8b$ and <b>BD</b> = $8a - 11b$ and $2(6a - 8b) = 12a - 16b$ is <u>not</u> acceptable because there is no matching coefficient of <b>a</b> or <b>b</b> eg3 <b>BC</b> = $2a - 3b$ and <b>CD</b> = $6a - 8b$ and $6a - 8b = 3(2a - 2.6b)$ is acceptable because there is a matching coefficient of <b>a</b> and no error in factorisation (just a truncation) eg4 <b>BC</b> = $2a - 3b$ and <b>CD</b> = $6a - 8b$ and $3(2a - 3b) = 6a - 10b$ is <u>not</u> acceptable because there is an error in expansion	
	Allow not parallel or not same gradient for No	
	Allow <b>DC</b> is not a factor of <b>BD</b> as a valid explanation	
	Do not allow <b>DC</b> is not a scalar of <b>BD</b> as a valid explanation	
	Look for decision in working lines if answer line is blank	
	Note that <b>BD</b> = <b>BC</b> + <b>CD</b> is a fact but is not a valid explanation	

Question	Answer	Mark	Comments
24	<b>Alternative method 1</b>		
	(LQ =) 10 and (UQ =) 33 and answer 23	B4	B3 (LQ =) 10 <b>and</b> (UQ =) 33 B2 (LQ =) 10 <b>or</b> (UQ =) 33 B1 Any two correct frequencies from 8, 8, 12 and 20
	<b>Alternative method 2</b>		
	(LQ =) 10.3125 and (UQ =) 33.75 and answer 23.4375	B4	B3 (LQ =) 10.3125 <b>and</b> (UQ =) 33.75 B2 (LQ =) 10.3125 <b>or</b> (UQ =) 33.75 B1 Any two correct frequencies from 8, 8, 12 and 20
	<b>Additional Guidance</b>		
	Alt 2 is using $\frac{48+1}{4} = 12.25$ and $\frac{3(48+1)}{4} = 36.75$ to work out quartiles		
	Correct frequencies must be for the correct bar		
	33.75 may come from $\frac{3}{4} \times 45$		B0
	Allow B1 for two correct frequencies even if not subsequently used		B1
	Frequency of 8 seen once with no other correct frequencies counts as one correct		
	Frequency of 8 seen twice counts as two correct		B1
	$36 - 12 = 24$ or $36.75 - 12.25 = 24.5$ with < 2 correct frequencies		B0
	Answer 23 with neither quartile correct and < 2 correct frequencies		B0
	10-33 and 23		B4
	10-33		B3
	Do not allow dashes or vertical lines at 10 and/or 33 to imply correct quartiles		

Question	Answer	Mark	Comments
25	$15^2 + 26^2 - 2 \times 15 \times 26 \times \cos 38$ or [286, 286.4] or [16.9, 17]	M1	May be seen in a square root May be seen on diagram
	$\frac{108}{360}$ or 0.3 or $\frac{360}{108}$ or 3.33(...)	M1	oe eg $108 \div 360$ or 30% May be seen in two steps eg $\times 108 \div 360$
	their $\frac{108}{360} \times \pi \times [286, 286.4]$ or $\pi \times \text{their } [286, 286.4] \div \text{their } \frac{360}{108}$ or [269, 272.4114]	M1dep	dep on 1st and 2nd M1 oe eg $\frac{108}{360} \times \pi \times (\text{their } [16.9, 17])^2$
	$(2 \times) \frac{1}{2} \times 15 \times 26 \times \sin 38$ or [120, 120.1] or [240, 240.2]	M1	oe
	[509, 512.6114] and 510	A1	Must see a value in range [509, 512.6114] and 510
	<b>Additional Guidance</b>		
	15 × 26 × sin 38 scores 4th M1 unless subsequently doubled		
	If (sector) 270 and (2 triangles) 240 followed by 270 + 240 = 510		M4A1
	Working back from 510. Apply scheme but maximum mark is M4A0		
	Assuming angle $AEB = 72$ and then using sine rule to work out $BE$ does lead to area = 510 to 2sf but can score a maximum of M0M1M0M1depA0 $BE = \frac{26}{\sin 72} \times \sin 38 = 16.8$ (or 17) $\frac{108}{360} \times \pi \times 16.8^2 = 266$ $2 \times \frac{1}{2} \times 15 \times 26 \times \sin 38 = 240.2$ 506.2 → 510		M0 M1M0depM1 A0
	$BE = [16.9, 17]$ seen with no working scores first M1 (and possibly all other marks)		
	$BE = 35 \div 2 = 17.5 \rightarrow 17$ does not score first M1		

Question	Answer	Mark	Comments
26(a)	<i>B</i>	B1	
	<b>Additional Guidance</b>		
26(b)	<i>P</i>	B1	
	<b>Additional Guidance</b>		
27(a)	Fully correct graph passing through (-2, -8) (-1, -1) (0, 0) (1, 1) and (2, 8)	B2	B1 $x^3$ or $y^3 = x$ or at least 4 points from (-2, -8) (-1, -1) (0, 0) (1, 1) and (2, 8) plotted or seen in a table Tolerance of $\pm 1$ small square Points can be implied by graph passing through them
	<b>Additional Guidance</b>		
	Tolerance of $\pm 1$ small square means it is on the edges of or within the shaded area 		
	Ignore graph drawn outside of $-2 \leq x \leq 2$		
	Ruled straight lines joining (-2, -8) (-1, -1) (0, 0) (1, 1) and (2, 8)	B1	
	Condone positive gradient at (0, 0)		
	Ignore working lines if fully correct graph seen	B2	



Question	Answer	Mark	Comments
27(b)	Fully correct graph 	B2	B1 $\sin (x+90)$ or $\cos x$ or at least 4 points from (0, 1) (90, 0) (180, -1) (270, 0) and (360, 1) plotted or seen in a table  Mark intention
	<b>Additional Guidance</b>		
	Ignore graph drawn outside of $0^{\circ} \leq x \leq 360^{\circ}$		
	Ignore working lines if fully correct graph seen		B2
	Ruled straight lines joining (0, 1) (90, 0) (180, -1) (270, 0) and (360, 1)		B1
	$\sin x+90$ with < 4 correct points and incorrect graph		B0