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GCSE

# Mathematics

93702F Applications of Mathematics

Unit 2: Foundation Tier

Mark scheme

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93702F

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November 2015

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Version 1.0 Final

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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.

<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 within the scheme 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>3.14...</b>	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
<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 candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

**Questions which ask candidates to show working**

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

**Questions which do not ask candidates to show working**

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

**Misread or miscopy**

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate 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.

Q	Answer	Mark	Comments																				
1	<table border="1" data-bbox="242 432 743 602"> <tr> <td data-bbox="242 432 505 510">Parts that are straight lines</td> <td data-bbox="505 432 743 510">Parts that have an area</td> </tr> <tr> <td data-bbox="242 510 505 602">diameter chord</td> <td data-bbox="505 510 743 602">sector segment</td> </tr> </table> <p data-bbox="242 622 611 656">with no incorrect responses</p>	Parts that are straight lines	Parts that have an area	diameter chord	sector segment	B3	<p data-bbox="922 439 959 472">B2</p> <table border="1" data-bbox="951 483 1449 577"> <tr> <td data-bbox="951 483 1211 577">diameter chord</td> <td data-bbox="1211 483 1449 577">incorrect</td> </tr> </table> <p data-bbox="986 589 1015 622">or</p> <table border="1" data-bbox="951 633 1449 728"> <tr> <td data-bbox="951 633 1211 728">incorrect</td> <td data-bbox="1211 633 1449 728">sector segment</td> </tr> </table> <p data-bbox="986 739 1015 772">or</p> <table border="1" data-bbox="951 784 1449 878"> <tr> <td data-bbox="951 784 1211 878">diameter only or chord only</td> <td data-bbox="1211 784 1449 878">sector only or segment only</td> </tr> </table> <p data-bbox="986 889 1015 922">or</p> <table border="1" data-bbox="951 934 1449 1068"> <tr> <td data-bbox="951 934 1211 1068">diameter and chord with one other</td> <td data-bbox="1211 934 1449 1068">sector and segment with one other</td> </tr> </table> <p data-bbox="906 1084 943 1117">B1</p> <table border="1" data-bbox="951 1140 1449 1274"> <tr> <td data-bbox="951 1140 1211 1274">diameter and chord with one other</td> <td data-bbox="1211 1140 1449 1274">incorrect</td> </tr> </table> <p data-bbox="986 1285 1015 1319">or</p> <table border="1" data-bbox="951 1330 1449 1464"> <tr> <td data-bbox="951 1330 1211 1464">incorrect</td> <td data-bbox="1211 1330 1449 1464">sector and segment with one other</td> </tr> </table> <p data-bbox="986 1476 1015 1509">or</p> <table border="1" data-bbox="951 1520 1449 1615"> <tr> <td data-bbox="951 1520 1211 1615">diameter only or chord only</td> <td data-bbox="1211 1520 1449 1615">incorrect</td> </tr> </table> <p data-bbox="986 1626 1015 1659">or</p> <table border="1" data-bbox="951 1671 1449 1765"> <tr> <td data-bbox="951 1671 1211 1765">incorrect</td> <td data-bbox="1211 1671 1449 1765">sector only or segment only</td> </tr> </table>	diameter chord	incorrect	incorrect	sector segment	diameter only or chord only	sector only or segment only	diameter and chord with one other	sector and segment with one other	diameter and chord with one other	incorrect	incorrect	sector and segment with one other	diameter only or chord only	incorrect	incorrect	sector only or segment only
Parts that are straight lines	Parts that have an area																						
diameter chord	sector segment																						
diameter chord	incorrect																						
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diameter only or chord only	sector only or segment only																						
diameter and chord with one other	sector and segment with one other																						
diameter and chord with one other	incorrect																						
incorrect	sector and segment with one other																						
diameter only or chord only	incorrect																						
incorrect	sector only or segment only																						

<b>1</b>	<b>Additional guidance</b>					
	Mark both sides of table independently					
	<u>Repeated entries</u> Treat a repeated entry in both columns as choice. Condone repeated entry in same column					
	Examples					
	Diameter Chord	Segment	B2	Diameter Chord Arc	Segment Sector	B2
	Diameter	Segment	B2	Diameter	Chord	B1
	Diameter Chord Segment	Arc	B1	Chord Arc Diameter	Centre Sector Segment	B2
Diameter Chord	Segment Diameter	B1	Diameter Chord Chord	Segment Sector	B3	
Diameter Chord Sector Centre	Segment Arc	B0	Diameter Chord Arc Centre	Segment Sector	B2	

Q	Answer	Mark	Comments
2(a)	12 700	B1	
2(b)	1.5 (cm) or 800 (mm) or 815 (mm)	M1	
	81.5	A1	SC1 78.5
2(c)	3.8	B1	
2(d)	0.7	B1ft	ft 4.5 – their (c) or their (c) – 4.5
	<b>Additional guidance</b>		
	Ignore any reference to increase/decrease		

Q	Answer	Mark	Comments	
<b>3(a)</b>	C3	B2	B1 B4 or 500 ml seen or 25 cl seen	
	<b>Additional guidance</b>			
	Allow 3C or 4B			
	Allow lower case letters			
<b>3(b)</b>	All 4 correct pairs with no incorrect pairs (A1 C2) A1 C3 A2 C2 A2 C3 B4 D1	B3	B2 3 correct pairs with no incorrect pairs or all 4 correct pairs with one incorrect pair that costs £1.40 B1 2 correct pairs with at most 2 incorrect pairs or at least 2 pairs that cost £1.40 with no pairs that do not cost £1.40 or all correct with any number of additional pairs that are drink and fruit	
	<b>Additional guidance</b>			
	Allow 1A for A1 etc			
	Allow lower case letters			
	Condone repeats			




Q	Answer	Mark	Comments
4(a)	congruent	B1	
4(b)	Card C	B1	
4(c)	2	B1	
4(d)	a quadrilateral with either length of long diagonal [8.8, 9.2] cm or at least 3 side lengths [4.8, 5.2] cm	B1	
	full construction shown	M1	See guidance
	accurate rhombus with full construction	A1	
	<b>Additional guidance</b>		
	<p>There are two possible constructions</p> <p><u>Starting with a 9cm diagonal</u> two pairs of intersecting arcs radii [4.8, 5.2] cm at each end of line of length their [8.8, 9.2] cm</p> <p><u>Starting with a 5cm side</u> two intersecting arcs one of length [4.8, 5.2] cm the other of length [8.8, 9.2] cm at each end of line of length their [4.8, 5.2] cm and one pair of intersecting arcs radii [4.8, 5.2] cm one at the end of one [4.8, 5.2] cm line the other at the end of the other [4.8, 5.2] cm line</p> <p>Diagrams with no construction arcs can score B1 maximum</p>		

Q	Answer	Mark	Comments
<b>5(a)</b>	$8 \times 20$ or 160 or $4 \times 24$ or 96	B1	
	$8 \times 20 + 4 \times 24 = 256$ or $256 - 8 \times 20 = 96$ or $256 - 4 \times 24 = 160$	Q1	Strand (ii) No numerical errors and full method shown
	<b>Additional guidance</b>		
	Q1 implies B1		
	$8 \times 20 + 4 \times 24 = 160 + 76 = 256$	B1 Q0	
	$8 \times 20 = 160$ $4 \times 24 = 96$ $160 + 96 = 256$	B1 Q1	

Q	Answer	Mark	Comments
5(b)	<b>Alternative method 1</b>		
	<p>attempts to work out cost of a combination of meals between £300 and £400</p> <p>eg1 <math>10 \times 20 + 5 \times 24</math> eg2 <math>1 \times 20 + 14 \times 24</math></p> <p>or</p> <p>Subtracts a multiple of 24 (at least <math>2 \times 24</math>) from 348 and divides answer by 20</p> <p>or</p> <p>Subtracts a multiple of 20 (at least <math>2 \times 20</math>) from 348 and divides answer by 24</p>	M1	
<p>9 (meal deal A) and 7 (meal deal B)</p> <p>or</p> <p>15 (meal deal A) and 2 (meal deal B)</p> <p>or</p> <p>3 (meal deal A) and 12 (meal deal B)</p>	A1		<p>SC1 £180 and £168 or £300 and £48 or £60 and £288</p>

Q	Answer	Mark	Comments
<b>5(b)</b>	<b>Alternative method 2</b>		
	348 – 256 or 92 and attempt to work out cost of a combination of meals costing between their (92 – 10) and their (92 + 10) eg1 $1 \times 20 + 3 \times 24$ eg2 $2 \times 20 + 2 \times 24$	M1	
	9 (meal deal A) and 7 (meal deal B) or 15 (meal deal A) and 2 (meal deal B) or 3 (meal deal A) and 12 (meal deal B)	A1	SC1 £180 and £168 or £300 and £48 or £60 and £288

Q	Answer	Mark	Comments
6(a)	[650, 680]	B1	
6(b)	Reads a conversion from graph within $\frac{1}{2}$ square and scales to 4000 pounds eg 1000 pounds = 3.8 bitcoins and $3.8 \times 4$	M1	Correct multiplier must be used
	[14.8, 15.2]	A1	
	<b>Additional guidance</b>		
	Alternatives for M1 - examples		
	£800 → 3 bitcoins and $5 \times 3$	£400 → 1.5 bitcoins and $10 \times 1.5$	
£200 → [0.7, 0.8] bitcoins and $20 \times [0.7, 0.8]$	£100 → [0.3, 0.4] bitcoins and $40 \times [0.3, 0.4]$		
7(a)	fully correct net (6 faces with two 4 cm by 4 cm squares and four 4 cm by 2 cm rectangles)	B3	B2 net of box with 5 faces all correct or net of box with 6 faces with all faces dimensionally compatible but with one incorrect dimension or net of box with one extra face
			B1 attempt at net of box with at least 5 faces and with two 4 cm by 4 cm squares and at least one 4 cm by 2 cm rectangle in compatible positions
			<b>Additional guidance</b>
For B1 must see the arrangement below and two or three other rectangles either with incorrect sizes and/or in incorrect positions.			

Q	Answer	Mark	Comments
7(b)	12 cm    4 cm    2 cm or 4 cm    4 cm    6 cm or 24 cm    2 cm    2 cm or 8 cm    6 cm    2 cm	B2	any order B1 96 seen or set of three numbers with product 96 or any B2 response with an error in one dimension only such that the balls fit exactly in box eg 12 cm 4 cm 4 cm
<b>Additional guidance</b>			
Examples of B1 answers 12 cm    6 cm    2 cm 24 cm    2 cm    4 cm 8 cm    8 cm    2 cm			

Q	Answer	Mark	Comments
8(a)	flowers → 10 by 4 rectangle and grass → 10 by 4 rectangle and vegetables → 10 by 6 rectangle all in correct positions as shown in the question and correctly labelled	B3	<p>B2 10 by 4 rectangle and 10 by 4 rectangle and 10 by 6 rectangle but not labelled or labelled incorrectly</p> <p>B2 whole garden covered by two congruent rectangles labelled flowers and grass and one other rectangle labelled vegetables</p> <p>B1 Whole garden covered by two congruent rectangles and one other rectangle can be not labelled or labelled incorrectly</p> <p>B1 Two rectangles of equal area drawn labelled flowers and grass – allow if whole garden space not filled</p>
			<b>Additional guidance</b>
			B1 is the maximum score if whole garden space is not filled
8(b)	60	B1ft	ft their diagram
	m <sup>2</sup> or sq(uare) m(etres)	B1	
	<b>Additional guidance</b>		
	ft allow unlabeled rectangles in the 'correct' position		

Q	Answer	Mark	Comments
<b>8(c)</b>	<b>Alternative method 1</b>		
	10 + 4 + 10 + 4 or 28	M1	
	their 28 ÷ 1.8 or [15.5, 15.6]	M1dep	Must be from edge length 1.8 × 15 or 27 or 1.8 × 16 or 28.8
	16	A1	
	<b>Alternative method 2</b>		
	10 + 4 or 14 and their 14 ÷ 1.8 or [7.7, 7.8] or 8	M1	
	their [7.7, 7.8] × 2 or [15.5, 15.6]	M1dep	Must be from edge length 1.8 × 7 or 12.6 or 1.8 × 8 or 14.4
	16	A1	
	<b>Alternative method 3</b>		
	10 ÷ 1.8 or [5, 5.6] or 6 or 4 ÷ 1.8 or [2, 2.2] or 3	M1	1.8 × 6 = 10.8 or 1.8 × 3 = 5.4
	2 × their [5, 5.6] + 2 × their [2, 2.2]	M1dep	2 × 6 + 2 × 3 or 18
	16	A1	
	<b>Additional guidance</b>		
	<b>Alt 3</b> Answer 18 with method		M1 M1dep A0



Q	Answer	Mark	Comments
9(a)	$40 \div 10 \times 6 = 24$ or $6 \div (10 \div 40) = 24$ or $40 \div 10 = 4$ and $24 \div 6 = 4$ or $10 \div 40 = 0.25$ and $6 \div 24 = 0.25$	B1	oe eg enlarged by (scale factor) 4 and $6 \times 4 = 24$
9(b)	<b>Alternative method 1</b>		
	$2 \times 10 + 40$ or 60	M1	
	$24 + 3 + 3$ or 30	M1	oe
	1800	A1ft	ft product of their dimensions if M1 M0 or M0 M1 SC1 570
	<b>Alternative method 2</b>		
	$10 \times 6 \div 2$ or 30 and their $24 \times 40 \div 2$ or 480	M1	
	attempts to split rectangle into small and large triangles and rectangles and adds to find total area	M1	allow if either one row of small triangles or the middle row of large triangles is correct top row $\rightarrow 10 \times$ their 30 or 300 middle row $2 \times$ their 480 + $2 \times$ 120 or 1200 bottom row $\rightarrow 10 \times$ their 30 or 300 and their 300 + their 1200 + their 300
	1800	A1	
	<b>Additional guidance</b>		
Alt method 2 allows M1 to be awarded for the area of both triangles			

Q	Answer	Mark	Comments
10(a)	40 cm	B1	
10(b)	$2 \times \pi \times$ their 40 or $80\pi$	M1	oe their 40 from (a)
	[251.2, 251.4] or 251 or 252	A1ft	ft their 40 from (a) or correct Do not allow 251 or 252 if value outside [251.2, 251.4] seen
	<b>Additional guidance</b>		
	their (a) is 44 → [276.3, 276.5] or 276 or 277 Do not allow 276 or 277 if value outside [276.3, 276.5] seen		
	their (a) is 48 → [301.4, 301.632] or 301 or 302 Do not allow 301 or 302 if value outside [301.4, 301.632] seen		
their (a) is 80 → [502.4, 502.72] or 502 or 503 Do not allow 502 or 503 if value outside [502.4, 502.72] seen			
11(a)	360 – 98 – 42 – 75 or 180 – 146	M1	oe eg 360 – 215
	$x = 145$	A1	
	$y = 34$	A1	
	<b>Additional guidance</b>		
One correct scores M1A1			

Q	Answer	Mark	Comments
11(b)	(B) C E A D or (B) E A C D or (B) A E C D or (B) C A E D	B2	Mark diagram if answer line blank B1 Arrangement where the first three tiles (including B) fit together, eg (B) C D
	<b>Additional guidance</b>		
	Repeated tile can score B1 max		
12(a)	5400 × 3 or 16 200 or 6000 × 1 $\frac{1}{2}$ or 9000	M1	oe
	25 200		

Q	Answer	Mark	Comments
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<b>12(b)</b>	<b>Alternative method 1</b>		
	6000 ÷ 60 or 100 or 5400 ÷ 60 or 90	M1	
	8550 ÷ (their 100 + their 90)	M1dep	Must include both machines
	45	A1	
	<b>Alternative method 2</b>		
	6000 + 5400 or 11 400	M1	Must include both machines
	8550 ÷ their 11 400 or 0.75	M1dep	oe
	45	A1	SC1 5700
	<b>Additional guidance</b>		
	75 minutes can imply 0.75 but only if method is shown		

<b>13(a)</b>	$3.4^2 - 3^2$ or 2.56	M1	
	$\sqrt{\text{their } 2.56}$	M1dep	
	1.6	A1	

Q	Answer	Mark	Comments
<b>13(b)</b>	$(3.4 + 3 + \text{their } 1.6) \div 3.2$ or 2.5	M1	
	2 (hours) 30 (minutes)	A1ft	ft their 1.6 only rounded or truncated to nearest minute
	<b>Additional guidance</b>		
	ft from $3.4^2 + 3^2$ in 13(a)		
	$(3.4 + 3 + [4.5, 4.534314]) \div 3.2$ or [3.4, 3.42] 3 (hours) [24, 25.2] (minutes)	M1 A1ft	

Q	Answer	Mark	Comments
14(a)	<b>Alternative method 1</b>		
	$3x + 18 = 52$	M1	oe eg $x + x + x + 2 \times 9 = 52$
	$3x = 52 - 18$ or $3x = 34$	M1	isolates term in $x$ for their equation of the form $ax + b = \dots\dots$
	$11\frac{1}{3}$ or $11.3(3\dots)$	A1ft	oe ft from M1 M0 or M0 M1 do not allow if their equation is of form $(1)x + b = \dots\dots$
	sets up and solves a linear equation	Q1ft	ft their equation allow one error in the solution of their equation do not allow if their equation is of form $(1)x + b = \dots\dots$
	<b>Alternative method 2</b>		
	$52 - 18$ or $34$	M1	
	their $34 \div 3$	M1	
	$11\frac{1}{3}$ or $11.3(3\dots)$	A1ft	oe ft from M1 M0 or M0 M1
		Q0	

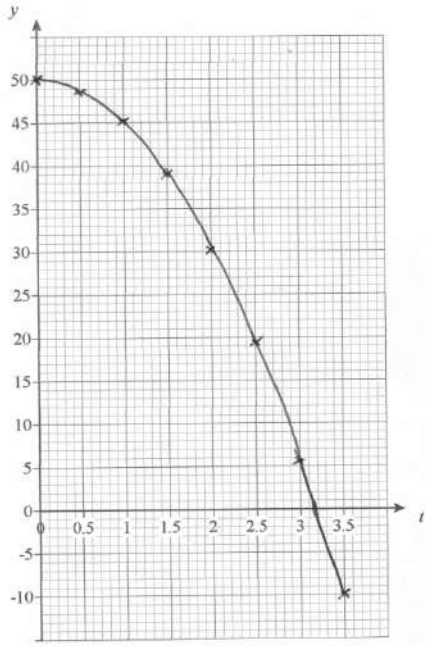
14(a)	<b>Additional guidance</b>			
Examples				
$3x + 18 = 52$ $3x = 70$ $x = 26.7$	M1 M0 A1ft Q1ft	$2x + 18 = 52$ $2x = 34$ $x = 17$	M0 M1 A1ft Q1ft	
$3x + 18 = 52$ $3x = 34$ $x = 102$	M1 M1 A0ft Q1ft	$x + 18 = 52$ $x = 34$	M0 M1 A0ft Q0ft	
$3x + 9 = 52$ $3x = 61$ $x = 20.33$	M0 M0 A0ft Q1ft	$52 + 18 = 70$ $70 \div 3$ $26.7$	M0 M1 A1ft Q0	M0 M1 A1ft Q0

Q	Answer	Mark	Comments	
14(b)	Identifies height of trapezium or parallelogram as 8	B1		
	$\frac{1}{2} \times (9 + 5) \times \text{their } 8$ or 56 or $(9 + 5) \times \text{their } 8$ or 112 or $\frac{1}{2} \times (23 + 19) \times \text{their } 8$ or 168	M1		
	224	A1		
	<b>Additional guidance</b>			
	$8 \times 5 + 2 \times 0.5 \times 8 \times 2$ B1 M1			

Q	Answer	Mark	Comments
15	<b>Alternative method 1</b>		
	$\frac{75}{5000} \times 100$	M1	oe
	1.5(%)	A1	oe
	Machine Q makes lower proportion of damaged parts	Q1ft	oe Comparison using their 1.5 Must have gained M1
	<b>Alternative method 2</b>		
	$0.02 \times 5000$	M1	oe
	100	A1	
	Machine Q makes lower proportion of damaged parts	Q1ft	oe Comparison using their 100 Must have gained M1
	<b>Alternative method 3</b>		
	Compares for the same number of parts eg for 1000 $0.02 \times 1000$ or 20 and $75 \div 5$ or 15	M1	oe
	Works out both calculations correctly eg for 1000 20 and 15	A1	eg for 200 4 and 3
	Machine Q makes lower proportion of damaged parts	Q1ft	oe Comparison using their values Must have gained M1



Q	Answer	Mark	Comments
16	18 (red) or 6 (blue)	B1	Necklace A
	35 ÷ (3 + 2) or 7	M1	Necklace B
	their 7 × 3 or 21 (red) or their 7 × 2 or 14 (blue) or 39 (red) or 20 (blue)	M1	
	19	A1ft	ft B0 M2
	<b>Additional guidance</b>		
	Allow build-up method, e.g. $3 : 2 \rightarrow 6 : 4 \rightarrow 9 : 6 \rightarrow 12 : 8 \rightarrow 15 : 10 \rightarrow 18 : 12 \rightarrow 21 : 14$ 21 : 14 must be identified or implied in subsequent work for M2 otherwise M1 if 21 : 14 included and not used		
	Example		
Necklace A → Red 16 Blue 8 Necklace B → Red 21 Blue 14 15	B0 M2 A1ft		

Q	Answer	Mark	Comments
17(a)	1 → 45.1	B1	
	2 → 30.4	B1	
17(b)	<p>Smooth decreasing curve passing through                      (0, 50), (0.5, 48.8), (1, their 45.1),                      (1.5, 39.0), (2, their 30.4),                      (2.5, 19.4), (3, 5.9), (3.5, -10.0) c  <math>\pm \frac{1}{2}</math> square</p> 	B2ft	<p>ft decreasing curve only                      B1 4 of their points plotted, <math>\pm \frac{1}{2}</math> square</p>
<b>Additional guidance</b>			
Straight line joining 'correct' points with decreasing y values scores B1 only			
17(c)	3.2	B1ft	ft their graph $\pm \frac{1}{2}$ square