GCSE
Mathematics

Paper 1 43651H
Mark scheme

43651H
June 2015

Version 1: Final Mark Scheme

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

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.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	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	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
[a, b)	Accept values a ≤ value < b
3.14 …	Accept answers which begin 3.14 e.g. 3.14, 3.142, 3.1416
Q	Marks awarded for quality of written communication
Use of brackets	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.

Paper 1 Higher Tier

Q	Answer	Mark	Comments

<table>
<tr><td rowspan="4">1(a)</td><td>$15x + 35$ or $35 + 15x$</td><td>B1</td><td></td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">Answer line takes precedence. Mark answer line even if correct answer seen in script.</td></tr>
<tr><td colspan="3">Do not award if incorrect further work. For example $15x + 35 = 50x$
but allow $15x + 35 = 5(3x + 7)$ as this is just checking answer is correct.</td></tr>
</table>

<table>
<tr><td rowspan="3">1(b)</td><td>$w = z – 3$ or $w = – 3 + z$
or $z – 3 = w$ or $– 3 + z = w$</td><td>B1</td><td>Must have $w =$ or $= w$</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">Many students write z like the number 2. Allow for this</td></tr>
</table>

<table>
<tr><td rowspan="6">1(c)</td><td>$2y(2y + 3)$</td><td>B2</td><td>B1 for $2(2y^2 + 3y)$ or $y(4y + 6)$</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">Allow $\times$ signs between numbers, brackets and letters, eg $2y \times (2y + 3)$ or $2(2 \times y^2 + 3 \times y)$</td></tr>
<tr><td colspan="3">Factorising may be done in two ‘steps’, ie $y(4y + 6)$ followed by $2y(2y + 3)$. If the second attempt is done wrongly, B1 can still be awarded.</td></tr>
<tr><td colspan="2">$y(4y + 6)$
$2y(2y + 6)$</td><td>B1
B0</td></tr>
<tr><td colspan="2">$2(2y^2 + 3y)$
$2y(y + 3)$</td><td>B1
B0</td></tr>
</table>

Q	Answer	Mark	Comments
2	Straight ruled line graph from (–3, –11) to (3, 7)	B3	B2 for correct partial straight-line graph that does not go from (–3, –11) to (3, 7) but does go to at least (–2, –8) on the left and (2, 4) on the right. B2 for no line but points (–3, –11), (3, 7) and one from {(–2, –8), (–1, –5), (0, –2), (1, 1), (2,4)} marked with no incorrect points. B1 for straight line graph with gradient of 3 of any length. or B1 for straight line graph passing through (0, –2) of any length. or B1 if no graph drawn and table of values with at least three correct points, ignore incorrect points. or B1 for at least three correct points marked on graph (points may be implied by a line passing through at least 3 integer values of x) with incorrect points or lines also drawn.
	Additional Guidance		
	Quality of plotting and drawing.		
	Points must be plotted within ½ square. Lines should pass within ½ square of the correct coordinate (not the plotted value). Any 'double lines' or choice maximum B2 Points plotted wrongly but line drawn correctly, line takes precedence for a maximum of B2.		

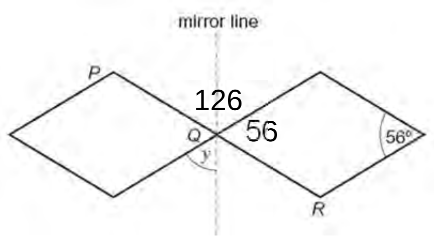
Q	Answer	Mark	Comments
3	**Alternative method 1**		
	3×4.5 or 13.5 or 3×4500 or 13500	M1	oe
	their $13.5 \div 10 \times 200$ or $\frac{\text{their } 13500 \div 10 \times 200}{1000}$	M1dep	oe
	270	A1	SC1 digits 27
	Alternative method 2		
	$(200 \times 4.5) \div 10$ or 90 (ml)	M1	oe
	their 90×3	M1dep	oe
	270	A1	SC1 digits 27
	Alternative method 3		
	200 : 10000 or $\frac{1}{50}$ **and** $\frac{1}{50} \times 3$ or 0.06	M1	oe
	Their $0.06 \times 4.5 \times 1000$	M1dep	oe
	270	A1	SC1 digits 27

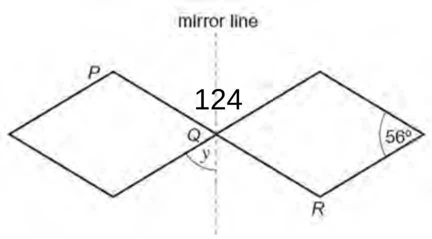
Q	Answer	Mark	Comments

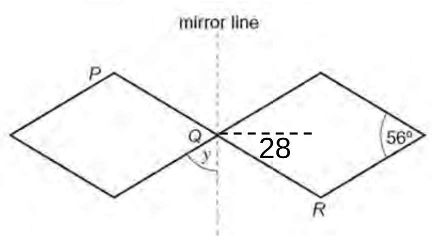
<table>
<tr><td rowspan="8">3</td><td colspan="2">Additional Guidance</td></tr>
<tr><td colspan="2">Students may convert wrongly to millilitres using a factor of 10 (ie 450) then convert back using the same ‘wrong’ factor to get the correct answer. Allow this, as the method is valid.
However, partial marks cannot be awarded if a wrong conversion factor is used but if digits 27 seen allow SC1</td></tr>
<tr><td>(1 gallon =) 45 millilitres
(3 gallons =) 135 millilitres
135 millilitres ÷ 10 = 13.5 litres
13.5 ÷ 10 × 200 = 270</td><td>M1,
M1dep, A1</td></tr>
<tr><td>(1 gallon =) 45 millilitres
(3 gallons =) 135 millilitres
135 ÷ 10 × 200 = 2700</td><td>SC1</td></tr>
<tr><td colspan="2">If a ‘build up’ method is used to get millilitres equivalent to 13.5 litres then it must be fully correct to get the M1dep</td></tr>
<tr><td>13.5
10 = 200, 1 = 20, 3 × 20 = 80, 0.5 = 10
200 + 80 + 10 = 290</td><td>M1
M1dep
A0</td></tr>
<tr><td>13.5
10 = 200, 1 = 20, 3 = 60, 0.5 = 10
200 + 20 + 60 + 10 = 290</td><td>M1
M0
A0</td></tr>
<tr><td><table>
<tr><td>Gallons</td><td>1</td><td>×3</td><td>3</td><td></td></tr>
<tr><td>Litres</td><td>4.5</td><td>10</td><td>13.5</td><td>13.5</td></tr>
<tr><td>Lawn feed (ml)</td><td></td><td>200</td><td>×1.35</td><td>270</td></tr>
</table></td><td>M1
M1dep
A1</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="13">4</td><td colspan="3">Alternative method 1</td></tr>
<tr><td>6 × 18 or 108</td><td>M1</td><td>(16.2 + 18.1 + 15.9 + 17.8 + 21 + x) ÷ 6 = 18</td></tr>
<tr><td>their 108 – (16.2+18.1+15.9+17.8+21)</td><td>M1 dep</td><td>oe eg complete repeated subtraction.
Look for total written under or by table.</td></tr>
<tr><td>19</td><td>A1</td><td>SC1 89 seen</td></tr>
<tr><td colspan="3">Alternative method 2</td></tr>
<tr><td>18 – each value in table, eg
1.8, –0.1, +2.1, +0.2, –3</td><td>M1</td><td>Allow one error</td></tr>
<tr><td>Totals their subtractions
their (1.8 + –0.1 + 2.1 + 0.2 + –3) or 1
and adds to 18</td><td>M1dep</td><td></td></tr>
<tr><td>19</td><td>A1</td><td></td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">16.2 + 18.1 = 34.2, 34.2 + 15.9 = 60.1
60.1 + 17.8 = 77.9, 77.9 + 21.0 = 88.9
6 × 18 = 118
118 – 88.9 = 30.9</td><td>M1
M1dep, A0</td></tr>
<tr><td>(16.2 + 18.1 + 15.9 + 17.8 + 21 + x) ÷ 6 = 18
x = 118 – 89.7
x = 28.3</td><td>Allow incorrect solution of equation if full method</td><td>M1
M1dep
A0</td></tr>
<tr><td>1.8 – 0.1 + 2.1 + 0.3 –3 = 1.1
19.1</td><td></td><td>M1,
M1dep, A0</td></tr>
</table>

Q	Answer	Mark	Comments
5	11×2.5 or 27.5 **or** 3.1×3^2 or 27.9 or 9π	M1	Allow 3.14×3^2 Accept 27.5^2 as meaning 27.5 cm^2
	27.5 and 27.9 or 28.26	A1	Do not accept 9π at this stage as comparison of values cannot be made without evaluation to a number.
	Correct conclusion based on both their areas using correct methods with at least one correct area	Q1	Strand (iii) Ignore any incorrect subtraction of 27.9 – 27.5
	Additional Guidance		
	Indication of which is bigger shape can be done by the name, the value or the calculation.		
	$11 \times 2.5 = 22.5$ $3.1 \times 3^2 = 27.9$ Circle	Both methods, one value incorrect, correct conclusion using name of shape	M1, A0, Q1
	$11 \times 2.5 = 27.5$ $3.1 \times 3^2 = 3.1 \times 6 = 18.6$ 11×2.5	Both methods, one value incorrect, correct conclusion using calculation	M1, A0, Q1
	$11 \times 2.5 = 22.5$ $3.1 \times 3^2 = 18.6$ Rectangle	Both methods, correct conclusion but Q0 as both values incorrect.	M1, A0, Q0
	$11 \times 2.5 = 27.5$ $2 \times 3.1 \times 3 = 3.1 \times 6 = 18.6$ 27.5	One method correct, Q0 as one method wrong, therefore one value wrong.	M1, A0, Q0
	$11 \times 2.5 = 27.5$ $3.1 \times 3 \times 3 = 3.1 \times 9 = 27.9$ Circle bigger by 0.3	Fully correct, ignore wrong subtraction.	M1, A1, Q1

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="7">6</td><td>56 marked at centre point or 124 marked in centre or 28 shown as ‘half angle’ at centre.
If no angles marked on diagram:
56 and 124 seen in script
or 248 ÷ 4 seen in script
or 90 – (56 ÷ 2) seen in script</td><td>M1</td><td>Accept Q = 56 stated in script.</td></tr>
<tr><td>62</td><td>A1</td><td>62 with no working or no contradictory working full marks.</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">Allow 56 marked at centre even if the exterior angle is wrongly calculated.</td></tr>
<tr><td colspan="2">

63</td><td>M1
A0</td></tr>
<tr><td colspan="2">

124 ÷ 2 = 62</td><td>M1
A1</td></tr>
<tr><td colspan="2">

90 – 28 = 78</td><td>M1
A0</td></tr>
</table>

Q	Answer	Mark	Comments
7	**Alternative method 1**		
	Correctly lists first three bus times to X or Y ie 7 25, 7 50, 8 15, … **or** 7 20, 7 40, 8 00, …	M1	Accept any notation for time eg 7.20, 7:20 7 20, 0720, 7-20, 20 past 7, 720
	Continues **both** lists at least as far as a common time ie 7 25, 7 50, 8 15, 8 40, ... **and** 7 20, 7 40, 8 00, 8 20, 8 40, ...	M1dep	Allow one error up to and including their common time, ignore errors after.
	8.40 (am) or 08 40 or after/in 100 minutes or after/in 1h 40 minutes	A1	SC2 No other working and any time that is 7 am + 100*n* minutes, eg 10 20, 12 00, 13 40 etc..
	Alternative method 2		
	Correctly lists first three multiples of 25 or 20 ie 25, 50, 75, … **or** 20, 40, 60, …	M1	25 × 4 and 20 × 5
	Stops both lists at 100 or identifies 100 or 1 hour 40 minutes	M1dep	
	8.40 (am) or 08 40 or after/in 100 minutes or after/in 1h 40 minutes	A1	SC2 No other working and any time that is 7 am + 100*n* minutes, eg 10 20, 12 00, 13 40 etc..

Additional guidance on next page

Q	Answer	Mark	Comments

Q	Additional Guidance		
7 cont	7 25, 7 50, 8 15, 8 40, 9 05, … 7 20, 7 40, 8 00, 8 20, 8 40, 9 00, .. (Answer =) 8 40 pm	pm is wrong.	M1 M1dep A0
	(No working) (Answer =) 8 40 pm	Method by implication	M2
	7 25, 7 50, 8 05, 8 30, 8 55, 9 20 7 20, 7 40, 8 00, 8 20, 8 40, 9 00 9 20 (Answer =) 9 20	Second list correct for 3 values. One error in first list. Both lists taken to a common value	M1 M1dep A0
	7 25, 7 50, 8 10, 8 30, 9 00, 9 15 7 20, 7 40, 8 00, 8 20, 8 40, 9 00 (Answer =) 9 00	Second list correct for 3 values. Both lists taken to a common value but more than one error in first list.	M1 M0dep A0
	25, 50, 75, 80, 20, 40, 60, 80, (Answer =) 8 10	At least one list correct for 3 values. Does not get to 100	M1 M0 A0
	7 00, 25, 50, 8 15, 40, 9 05, … 7 00, 20, 40, 8 00, 20, 40, 9 00 8 40	Intention to list times clear	M1 M1dep A1
	As question asks for ‘When..’ rather than ‘What time..’ then the students do not have to say 8.40 but could qualify it as a length of time **after** 7am. If so then the wording must be clear.		
	7 25, 7 50, 8 15, 8 40, 9 05, … 7 20, 7 40, 8 00, 8 20, 8 40, 9 00, .. (Answer =) 1 h 40 after 7	Must make it clear that the time is after 7 (am)	M1 M1dep A1
	7 25, 7 50, 8 15, 8 40, 9 05, … 7 20, 7 40, 8 00, 8 20, 8 40, 9 00, .. (Answer =) 1 h 40	Not clear that the time is after 7 am	M1, M1dep A0

Q	Answer	Mark	Comments
8	7, 8, 9, 11, 11, 11 7, 7, 9, 11, 11, 11 7, 9, 9, 11, 11, 11	B3	B2 All three conditions met but not all whole numbers B2 two conditions met with six numbers (need not be integers) B1 one condition met with six numbers (need not be integers) Numbers do not have to be in order.

Additional Guidance

Mark answer line unless blank, then look for an obvious set of 6 numbers.

Must be 6 numbers.

7, 9 , $9\frac{1}{2}$, $10\frac{1}{2}$, 11, 11	Mode, range and median but not all whole numbers	B2
7 8 10 11 11 11	Mode and range	B2
7 8 9 10 11 11	Mode and range	B2
8 9 10 10 11 12	Median and range	B2
8 9 10 11 12 11	Mode and range (order not important)	B2
7.5, 8, 10, 11, 11, 11.5	Mode and range	B2
8 9 10 10 11 11	Median	B1

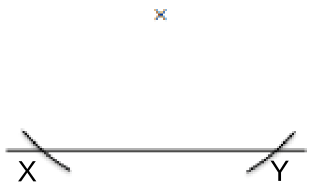
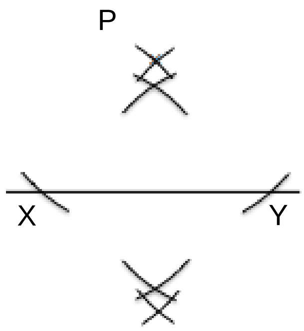
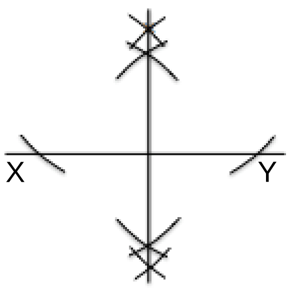
<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="5">9(a)</td><td>0.4 (relative frequency of carp)
or
1 (bream)</td><td>B1</td><td>oe</td></tr>
<tr><td>their roach frequency ÷ 10 (must be less than 1)
or
1 – their carp relative frequency – 0.1
or
0.5</td><td>M1</td><td>oe</td></tr>
<tr><td>Fully correct table ie
<table><tr><td>(4)</td><td>1</td><td>5</td></tr><tr><td>0.4</td><td>(0.1)</td><td>0.5</td></tr></table></td><td>A1</td><td>oe accept equivalent fractions or percentages for relative frequencies throughout</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">If table fully correct award 3 marks. If not check for 0.4 or 1. Either scores B1. Then check last column/bottom row. If the roach relative frequency = roach frequency ÷ 10 or if the total of the relative frequencies is 1 then award M1.</td></tr>
</table>

Q	Answer	Mark	Comments
9(b)	Increase sample size Repeat it Check some more Catch more fish	B1	oe

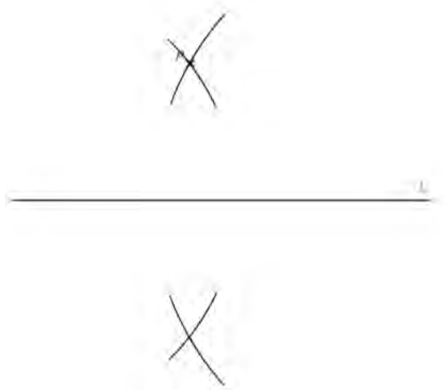
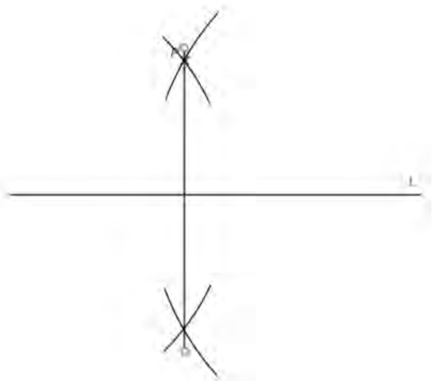
Additional Guidance

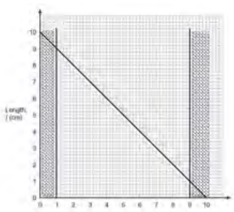
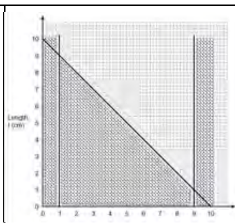
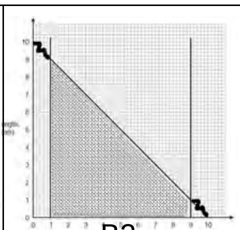
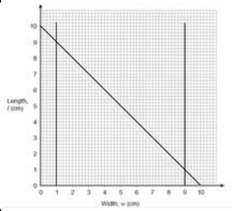
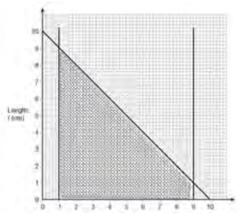
Count it again, catch more fish	Last bit scores	B1
Fish on more days	More implies increased sample	B1
Fish for longer	Longer implies increased sample	B1
Fish on different days	Different does not imply increased sample	B0
Do the estimate twice	Not implying increasing sample	B0
Catch them all	Not a sample	B0
Experiment at different times of day	Not implying increasing sample	B0

Q	Answer	Mark	Comments
10	$52 - 6n$ or $-6n + 52$	B2	B1 $-6n + k$ where k is any value, including zero (ie no constant), other than 52 Do not accept $-n6$ but $-n6 + 52$ is B1
	Additional Guidance		
	If $52 - 6n$ seen in script and 16 (next term) given on answer line allow B2		
	Allow any letter used, eg $52 - 6x$		
	Accept equivalent expressions such as $46 - 6(n - 1)$		
	Allow $\times$ signs, eg $-6 \times n + 52$, $n \times -6 + 52$		
	$46 - n - 5(n + 1)$		B1
	$52 - 6n = 0$		B1

Q	Answer	Mark	Comments
11	**Alternative method 1**		
		M1	Two arcs of equal radius centred on P, crossing L.
		M1dep	Arcs on other side of L measured from X and Y with same radius. Arcs on other side of L measured from X and Y with radius XP (effectively reflection of P), arcs need not be drawn at P. or arcs for perpendicular bisector of XY drawn on both sides of L.
		A1	Line within tolerance. Line does not have to go below *L*.
	Additional Guidance		
	This method requires starting at P and establishing two points on L from which to work. Only arcs on the other side of the line from L need be shown, although arcs on both sides often are. Use the overlay to establish if points X and Y are equidistant (± 1mm) from centre. Use measuring tool if necessary to establish if radii of arcs drawn are equal. Use the 'contrast slider' to darken the image if necessary as pencil does not show up well under scanning. If the second pair of arcs intersect on same side of L as P, above or below P, this is not an accurate method, however, allow if perpendicular within tolerance (± 1mm from centre)		

Question 11 continues next page

Q	Answer	Mark	Comments
11 cont	**Alternative method 2**		
		M2	Intersecting arcs centred on each end of *L* with radii equal to the distance to *P*, drawn on other side of *L*. Intersecting arcs centred on two points on *L* with radii equal to the distance to *P*, drawn on other side of *L*. The arcs need not be drawn through *P*.
		A1	Line within tolerance. Line does not have to go below *L*.
	Additional Guidance		
	This is a common method. Measuring from P from either end and drawing arcs on other side gives a reflection of P. Both arcs must be drawn to get M2. Use overlay to establish if the radii are accurate ±1 mm Another method combining elements of Alt 1 and 2, is to draw arcs through P from either end that intersect *L*. Then use these points to establish the radii to P to draw arcs on the other side. This (rare) method can be checked using the overlay on the drawing tools. Use the ‘contrast slider’ to darken the image if necessary as pencil does not show up well under scanning.		

Q	Answer	Mark	Comments
12(a)	Continuous graph from (1, 9) to (9, 1)	B2	B1 **all** integer points from (1, 9) to (9, 1) or B1 for a continuous graph beyond the given limits, unless $x \leq 1$ or $x \geq 9$ clearly shown as a crossed out region. Ignore any other shading or B1 for continuous graph from (2, 8) to (8, 2)
	Additional Guidance		
	Ignore lines, such as $w = 1$ or $w = 9$, but not any lines that may be a wrong $w + l = 10$. If there is a choice of lines then correct line must be clearly marked but not if the other line is $l = 3w$ or $w = 3l$		
	 B2  B2  B2  B1  B1		

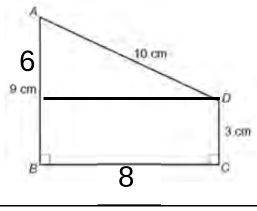
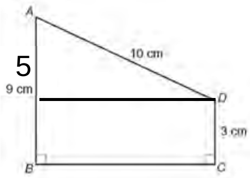
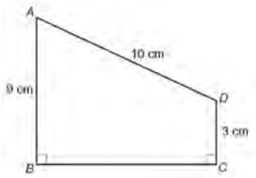
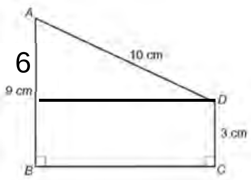
Q	Answer	Mark	Comments
12(b)	**Alternative method 1**		
	Graph of $l = 3w$ drawn	M1	
	2.5	A1	SC1 7.5 from $w = 3l$ drawn
	Alternative method 2		
	$4w = 10$	M1	oe
	2.5	A1	Allow embedded.
	Additional Guidance		
	If 2.5 stated in script, award full marks, otherwise scroll up to check graph for possible working.		

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="6">13</td><td>12 : 16 or 15 : 12
or $\frac{12}{16}$ or 0.75
or $\frac{16}{12}$ or 1.33
or $\frac{15}{12}$ or 1.25
or $\frac{12}{15}$ or 0.8</td><td>M1</td><td>oe</td></tr>
<tr><td>20</td><td>A1</td><td>From accurate working, eg 19.5 rounded to 20 is A0</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">$\frac{16}{12} = 1.3$, $1.3 \times 15 = 19.5$</td><td>M1, A0</td></tr>
<tr><td colspan="2">$1.33 \times 15 = 19.995$</td><td>M1, A0</td></tr>
<tr><td colspan="2">$1.3 \times 15 = 19.5$</td><td>M0, A0</td></tr>
</table>

Q	Answer	Mark	Comments
14	**Alternative method 1**		
	6 stated or shown on diagram as length from *A* to intersection of *AB* and horizontal line from *D*.	B1	Maybe on diagram
	10^2 – their 6^2 or 64 or $(BC)^2 + 6^2 = 10^2$	M1dep	their 6 is the length from *A* to intersection of *AB* and horizontal line from *D*. 10^2 + their 6^2 or 136
	√their 64	M1 dep	64 must come from 10^2 – their 6^2
	8	A1	8 with no working M0
	Alternative method 2		
	6 stated or shown on diagram as length from *A* to intersection of *AB* and horizontal line from *D*.	B1	Maybe on diagram
	3, 4, 5 Pythagorean triple shown	M1	
	6, 8 shown or stated	M1 dep	
	8	A1	8 with no working M0

Question 14 continues on next page

Q	Answer	Mark	Comments

Q	Additional Guidance		
14 cont			Minimum for 4 marks
		$10^2 - 5^2 = 75$ $\sqrt{75} \approx 8.5$	B0, M1 M1dep A0
		$10^2 - 5^2 = 75$ $\sqrt{75} \approx 8.5$	B0 M0
	Use of cos rule. If left with cos 90 M0		
		$10^2 = x^2 + 6^2 - 2 \times 6 \times x \times \cos 90$	B1 M0

Q	Answer		Mark	Comments
15	$5x - 3x > 7 - 2$ or $2x > 5$		M1	$8x > 5$ or $2x > 9$
	$x > 2.5$		A1	
	3		A1ft	ft if M1 awarded so that $8x > 5$ leads to 1 or $2x > 9$ leads to 5
	Additional Guidance			
	As the question asks for the smallest integer, solving an equation and choosing 3 implies the use of an inequality, but solving an equation and not choosing 3 implies that inequalities are not being considered.			
	Trial and improvement leading to 3 is full marks otherwise M0			
	3 with no working is full marks, but 3 from wrong work is zero marks			
	$8x > 5$, $x > \frac{5}{8}$, $x = 1$			M1, A0, A1ft
	$2x > 9$, $x > \frac{9}{2}$, $x = 5$			M1, A0, A1ft
	$2x = 5$, $x = 2\frac{1}{2}$, $x = 3$			M1, A1, A1
	$2x = 5$, $x = 2\frac{1}{2}$,			M0, A0, A0
	$2x > 5$, $x = 2\frac{1}{2}$, $x = 3$			M1, A1, A1
	$8x = 5$, $x = \frac{5}{8}$, $x = 1$			M1, A0, A1ft
	$2x = 9$, $x = \frac{9}{2}$, $x = 5$			M1, A0, A1ft
	$5x - 3x > 7 - 3$, $2x > 4$, $x > 2$, $x = 3$ (cannot assume a misread as 3 is a number in question)			M0, A0, A0
	$2x = 5$, $x = 3$	Could be the wrong solution of the equation		M0, A0, A0

Q	Answer	Mark	Comments
16a	$-\frac{3}{2}$	B1	

Q	Answer	Mark	Comments
16b	$\frac{4}{3}$	B1	

Q	Answer	Mark	Comments
17	16, 22, 12 or 17, 21, 12	B3	B2 for 16, 21, 13 B2 for 2 correct from 16, 22, 12 B2 for 2 correct from 17, 21, 12 B2 for 16.4, 21.4 and 12.2 B1 for 2 out of 16.4, 21.4 and 12.2 Or B1 for 1 correct ie 16 or 17, 22 or 21 or 12 or B1 for 0.2 or $\frac{1}{5}$ or ÷ 5 or B1 for any of $\frac{(82\times50)}{250}$, $\frac{(107\times50)}{250}$ or $\frac{(61\times50)}{250}$
	Additional Guidance		
	Mark table. Only check in script if table blank or not worth any marks		
	If decimal values and whole number given in the table, eg 16.4 or 16, then mark the integer.		
	If values given as fractions must be a mixed number in its simplest form.		
	16, 22, 13		B2
	16, 20, 13		B1
	16.4, 20.7, 12.2		B1
	16.2, 20.7, 12.2		B0

Q	Answer	Mark	Comments
18	$(3a - b)(3a + b)$	M1	
	$3a + b$	A1	Answer only 2 marks
	Additional Guidance		
	Check answer is from correct work, as spurious ‘cancelling’ could lead to the correct answer		
	$\dfrac{\overset{3a}{\cancel{9a^2}} \overset{+b}{\cancel{-b^2}}}{\cancel{3a} \cancel{-b}} = 3a + b$ $9a^2 \div 3a = 3a$ $-b^2 \div -b = +b$	M0	

Q	Answer	Mark	Comments
19(a)	**Alternative method 1**		
	BTC = 180 – y (angles on straight line) or y + *BTC* =180	B1	180 – y may be marked on diagram
	BCT = 180 – y (isosceles)	B1	180 – y may be marked on diagram
	CAB = 180 – y (alternate segment or angles in the opposite segment)	Q1	Strand (ii) Fully correct proof with reasons. Q0 if any reasons not given
	Alternative method 2		
	XCB = y (isosceles and symmetry)	B1	*X* is point to left of *SC* extended
	ACB = y – 90 (angles between tangent and radius is 90°)	B1	y – 90 may be marked on diagram
	CAB = 180 – (y – 90 + 90) (angles in triangle)	Q1	Strand (ii) Fully correct proof with reasons. Q0 if any reasons not given
	Alternative method 3		
	BTC = 180 – y (angles on straight line)	B1	180 – y may be marked on diagram
	BCT = 180 – y (isosceles)	B1	180 – y may be marked on diagram
	BCT + *ACB* = 90° (angle between tangent and radius/diameter) **and** *CAB* + *ACB* = 90° (angles in semicircle) so *CAB* = 180 – (y – 90 + 90) (angles in triangle)	Q1	Strand (ii) Fully correct proof with reasons. Q0 if any reasons not given

Additional guidance on next page

Q	Answer	Mark	Comments
19(a) cont	**Additional Guidance**		
	B1s can be awarded without reasons, but Q can only be awarded if **all** reasons given. Ignore numerical values. eg *BTS* marked or stated as 100 and *BTC* = 80 marked or stated. But *BTS* marked or stated as 100 and *BTC* = 180 – y = 80 marked or stated get B1 This is a proof and must be done algebraically.		
19(b)	*BTC* or *BCT* or *CAB* = 70	M1	These values may be seen on diagram. 20 + 180 – y = 90 (oe)
	110	A1	Check on diagram
	Additional Guidance		
	If (b) blank, check diagram and/or part (a). Answer for (b) given in (a) then award appropriate marks.		

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td>20(a)</td><td>m^3</td><td>B1</td><td>Do not accept $m \times m \times m$</td></tr>
</table>

<table>
<tr><td rowspan="8">20(b)</td><td>$3 \times 5 + 5 \times \sqrt{2} - 3 \times \sqrt{2} - \sqrt{2} \times \sqrt{2}$
or $3 \times 5 + 2\sqrt{2} - \sqrt{2}\sqrt{2}$
or $13 + 5\sqrt{2} - 3\sqrt{2}$</td><td>M1</td><td colspan="2">oe 4 terms or correct combination of 3 terms needed. If 4 terms given, 3 must be correct for M1
Allow in ‘box method’ or FOIL but watch out for correct signs (still allow one error).</td></tr>
<tr><td>$13 + 2\sqrt{2}$</td><td>A1</td><td colspan="2"></td></tr>
<tr><td colspan="4" align="center">Additional Guidance</td></tr>
<tr><td colspan="4">If answer correct allow 2 marks.</td></tr>
<tr><td colspan="3">$15 + 5\sqrt{2} - 3\sqrt{2} + 4$
$19 + 2\sqrt{2}$</td><td>M1
A0</td></tr>
<tr><td colspan="3"><table><tr><td>$\times$</td><td>3</td><td>$\sqrt{2}$</td></tr><tr><td>5</td><td>15</td><td>$5\sqrt{2}$</td></tr><tr><td>$\sqrt{2}$</td><td>$3\sqrt{2}$</td><td>2</td></tr></table>$17 + 8\sqrt{2}$</td><td>M0
(Only two terms correct)</td></tr>
<tr><td colspan="3"><table><tr><td>$\times$</td><td>3</td><td>$\sqrt{2}$</td></tr><tr><td>5</td><td>15</td><td>$5\sqrt{2}$</td></tr><tr><td>$-\sqrt{2}$</td><td>$3\sqrt{2}$</td><td>2</td></tr></table>$13 + 2\sqrt{2}$</td><td>M1
A1
(Terms incorrect in table but ‘recovered’)</td></tr>
<tr><td colspan="3">$5 \times 3 = 15$, $3 \times \sqrt{2} = 3\sqrt{2}$, $5 \times \sqrt{2} = 5\sqrt{2}$, $-\sqrt{2} \times \sqrt{2} = -2$
$13 + 8\sqrt{2}$</td><td>M1
A0</td></tr>
</table>

Q	Answer	Mark	Comments
20(c)	$\frac{27}{5}$ or $5\frac{2}{5}$ or 5.4	B3	B2 for 27 and $\frac{1}{5}$ B2 for $\frac{1}{5} \times 3^3$ B1 for 27 or $\frac{1}{5}$ B1 for 5 **and** 3 seen
	Additional Guidance		
	$\frac{1}{5} \times 3^3 = \frac{1}{5} \times 9 = 1.8$		B2
	$\frac{1}{5} \times 9 = 1.8$		B1
	$\sqrt{25} = \pm 5$ and $\sqrt[4]{81} = \pm 3$ (allow a mixture or + and – for 3 and 5 but negative elsewhere not allowed)		B1

Q	Answer	Mark	Comments
21(a)	$(6x - 5)^2 = 5x$	M1	oe allow invisible brackets ie $6x - 5 \times 6x - 5 = 5x$
	$36x^2 - 30x - 30x + 25 = 5x$	A1	oe
	Additional Guidance		
	It is not necessary to show the subtraction of $-5x$ from both sides. Getting to $36x^2 - 30x - 30x + 25 = 5x$ is sufficient.		
	Always worth checking diagram for potential working.		
	It has to be clear that the areas are equated, otherwise easy to 'fiddle' the algebra		
	$(6x - 5)^2 = 36x^2 - 30x - 30x + 25$ $36x^2 - 30x - 30x + 25 - 5x = 0$	No evidence of equating	M0
	$(6x - 5)^2 = 36x^2 - 30x - 30x - 25$ $36x^2 - 60x - 25 = 5x$ $36x^2 - 65x + 25 = 0$	Do not award if expansion of $(6x - 5)^2$ is wrong, even if 'recovered' as answer given	M1 A0

Q	Answer	Mark	Comments
21(b)	**Alternative method 1**		
	$(ax \pm c)(bx \pm d)$	M1	$ab = 36$ and $cd = 25$ but not $(6x - 5)(6x - 5)$
	$(4x - 5)(9x - 5)$	A1	
	$\frac{5}{4}$ and $\frac{5}{9}$ seen	A1ft	oe eg 1.25 and $0.\dot{5}$ (0.55 minimum) ft on $(4x \pm 5)(9x \pm 5)$ only
	$\frac{5}{4}$ given as answer and $\frac{5}{9}$ shown to give a negative length	Q1ft	Strand (ii) oe ft their values, evaluated correctly from their factorisation, for x if a valid conclusion reached

Q	Answer	Mark	Comments
21(b)	**Alternative method 2**		
	$\frac{-(-65) \pm \sqrt{(-65)^2 - 4(25)(36)}}{2 \times 36}$	M1	Allow 1 error, but not wrong formula, eg + instead of ±, 2 instead of 2a or only dividing root by 2a.
	$\frac{65 \pm \sqrt{625}}{72}$	A1	oe
	$\frac{5}{4}$ and $\frac{5}{9}$ seen	A1ft	oe $\frac{90}{72}$ and $\frac{40}{72}$ ft on –65 only for $-b$ giving $-\frac{5}{4}$ and $-\frac{5}{9}$ (oe)
	$\frac{5}{4}$ given as answer and $\frac{5}{9}$ shown to give a negative length	Q1ft	Strand (ii) oe ft their values for x if a valid conclusion reached

Question 21(b) continues on next page

Q	Answer	Mark	Comments

Q	Additional Guidance	
21(b) cont	$(4x + 5)(9x + 5) = 0$ $x = -\frac{5}{4}$ and $-\frac{5}{9}$ Both these values are impossible as they lead to negative lengths (oe)	M1, A0 A1ft Q1
	$(4x - 5)(9x + 5) = 0$ $x = \frac{5}{4}$ and $-\frac{5}{9}$ $\frac{5}{4}$ given as answer and $-\frac{5}{9}$ stated to give a negative length (oe)	M1, A0 A1ft Q1
	$(4x + 5)(9x - 5) = 0$ $x = -\frac{5}{4}$ and $\frac{5}{9}$ Both these values are impossible as they both lead to negative lengths	M1, A0 A1ft Q1
	$\frac{-65 \pm \sqrt{625}}{72}$ $x = -\frac{5}{4}$ and $-\frac{5}{9}$ Both these values are impossible as they lead to negative lengths (oe)	M1, A0 A1ft Q1