AQA

GCSE

Mathematics (Linear)

4365/1H Paper 1

Mark scheme

4365

June 2016

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.

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.

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 candidate intended it to be a decimal point.

Paper 1 Higher Tier

Q	Answer	Mark	Comments
1	**Alternative method 1**		
	(10% =) 19 or (50% =) 95 or (20% =) 38 or (30%) = 57 or (5% =) 9.5 or (1% =) 1.9 etc	M1	Any correct comparison of a percentage and a value except 100% = 190
	Any combination of values that make 35% eg 95 – their 19 – their 9.5, their 19 + their 19 + their 19 + their 9.5 or 66.5	M1dep	Must be correct values or valid method shown leading to their values 256.5 or $256\frac{1}{2}$ or 256.50p
	256.50	Q1ft	Strand (i) ft 190 + their 35% if M1, M0 awarded Must be correct money notation
	Alternative method 2		
	0.35 or 1.35 seen or $\frac{35}{100}$ or $\frac{135}{100}$ or 135%	M1	
	0.35 × 190 or 1.35 × 190 or 66.5 or $\frac{135}{100}\times\frac{190}{1}$ or $\frac{35}{100}\times\frac{190}{1}$	M1dep	oe 256.5 or $256\frac{1}{2}$ or 256.50p
	256.50	Q1	Strand (i) Must be correct money notation

	Additional Guidance		
1	19 38 5% = 19 ÷ 2 = 8 35% = 19 + 38 + 8 = 65 255		M1 M1dep Q0
	10% = 19 20% = 38 5% = 8 35% = 19 + 38 + 8 = 65 255		M1 M0dep Q1ft
	10% = 19 20% = 38 5% = 9.5 35% = 19 + 38 + 9.5 = 64.5 254.50		M1 M1dep Q0 ft
	190 × 1.35 Uses box method to get 256.5 265.50	Transcription error.	M1 M1dep Q1
	10% = 19 20% = 36 5% = 9.5 35% = 19 + 36 + 9.5 = 44.5 224.50		M1 M0dep Q0ft

Q	Answer	Mark	Comments
2	**Alternative method 1**		
	(Width =) 10 or (length =) 15 seen	B1	May be on the diagram
	their height × their width × their length with at least two values correct or 5 × 10 × 15	M1	
	750	A1	Ignore incorrect units, eg cm^2 SC2 for 6000 from using 10 as diameter
	Alternative method 2		
	5 × 5 × 5 or 125	B1	
	6 × their 125	M1	their 125 must be from 5 × 5 × 5
	750	A1	Ignore incorrect units, eg cm^2 SC2 for 6000 from using 10 as diameter
	Additional Guidance		
	On diagram, height marked as 10, width as 10 and length as 15 10 × 10 × 15 1500		B1 M1 A0
	On diagram, height marked as 10, width as 20 and length as 15 10 × 20 × 15 3000		B1 M0 A0
	On diagram, height marked as 10, width as 20 and length as 30 10 × 20 × 30 6000		SC2
	On diagram, height marked as 5, width as 10 and length as 15 In script 10 × 20 × 30 6000	Mark method that leads to answer.	SC2
	On diagram, height marked as 5, width as 20 and length as 30 5 × 20 × 30 3000		B0 M0 A0
	5 × 10 × 15 = 750 750 ÷ 3 = 250 (on answer line)	Mark whole method	B1 M0, A0

Q	Answer	Mark	Comments
3	'half' dimension of either smaller rectangle seen, ie 3 **or** 5	B1	Could be on any diagram 15 **or** 9 implies B1
	3 cm **and** 5 cm marked or stated as sides of shaded rectangle or 6 – their (6 ÷ 2) **and** 5 or 10 – their (10 ÷ 2) **and** 3 or sides of larger rectangle marked or stated as 15 cm **and** 9 cm or 48 stated as answer	M1	May be implied by 3 × 5 or 15 × 9
	16	A1	
	Additional Guidance		
	Note M1 is for finding dimensions of large or shaded rectangle. Ignore further working		
	Lengths of 5, 10, 3, 6, (5, 10, 3, 6) marked around side(s) of the larger rectangle 3 × 5 15		B1 M1 A0
	Lengths of 5, 10, 3, 6, (5, 10, 3, 6) marked around side(s) of the larger rectangle 9 × 15 135		B1 M1 A0
	Lengths of 4 and 5 marked as 'half' dimension on rectangles at top of page 5 and 2 marked as dimensions of shaded rectangle 12		B1 M1 A0
	Lengths of 5, 10, 3, 6, (5, 10, 3, 6) marked around side(s) of the larger rectangle only		B1, M0, A0
	3 × 5 (= 15) seen		B1, M1, A0
	15 on answer line with no correct or no working		B0, M0, A0
	16 on answer line with no working		B1, M1, A1

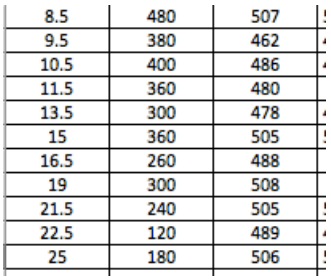
Q	Answer	Mark	Comments
4a	0.4 and 0.2	B2	B1 for 1 – (0.1 + 0.3) or 0.6 or total of White and Yellow = 0.6
	Additional Guidance		
	Mark table but if table blank or scores zero look in script for working or answers White (W) = 0.4 and Yellow (Y) = 0.2 must be clearly stated to get B2		
	1 – (0.1 + 0.3) = 0.4 White 0.8, Yellow 0.4		B1
	No working White 0.5 Yellow 0.1		B1
	White blank, Yellow 0.6		B1
	Table blank. W 0.4, Y 0.2 in script		B2
	Table blank. W 0.2, Y 0.4 in script		B1
	Table blank 0.4 and 0.2 in script		B1
	White 0.8, Yellow 0.4		B0
	White 0.6, Yellow 0.3		B0

Q	Answer	Mark	Comments
4b	200, 150 and 100	B2ft	B2ft their probabilities in (a) but only for probabilities that total 1 B1 White 200 or Blue 150 or Yellow 100 B1ft for **one** of their (a) for white × 500 or their (a) for yellow × 500 Do not allow B1ft for any probabilities that are greater than 1
	Additional Guidance		
	If answer of 200, 150 and 100 given do not check for ft even if table in (a) wrong. 2 marks. They could have started again		
	In (a) Red 0.1, White 0.2, Blue 0.3, Yellow 0.4 Answers (50) 100, 150 and 200	B2ft	
	In (a) Red 0.1, White 0.5, Blue 0.3, Yellow 0.1 Answers (50) 250, 150 and 50	B2ft	
	In (a) Red 0.1, White 0.3, Blue 0.3, Yellow 0.3 Answers (50) 150, 150 and 150	B2ft	
	In (a) Red 0.1, White 1.2, Blue 0.3, Yellow 0.2 Answers (50) 600, 150 and 100	B1	
	In (a) Red 0.1, White 0.2, Blue 0.3, Yellow 0.1 Answers (50) 100, 250 and 100	B1ft	
	In (a) Red 0.1, White 1.2, Blue 0.3, Yellow 0.2 Answers (50) 600, 150 and 200	B1	

Q	Answer	Mark	Comments
4c	$\frac{50}{400}$	B2ft	oe eg $\frac{1}{8}$, 0.125, 12.5% ft their table in (b) B2ft for numerator of 50 and denominator from their (b) B1 for 50 out of 400 B1 for 50 ÷ 400 B1ft for 50 out of their 400 from (b) B0 for any ratio Ignore any incorrect cancelling or change of form once correct answer seen
	Additional Guidance		
	For follow through from their (b) denominator is either 500 – their Yellow **or** 50 + their White + their Blue		
	Table in (b) (50), 100, 150, 200 $\frac{50}{300}$ oe	B2ft	
	$\frac{100}{400}$	B0	

Q	Answer	Mark	Comments
5	$6^2 + 8^2$ or 36 + 64 or 100 or $8^2 – 6^2$ or $6^2 + 8^2 – 2 \times 6 \times 8 \times \cos 90$	M1	3, 4, 5 seen If $6^2 + 8^2$ used in cosine rule must be correct
	$\sqrt{6^2 + 8^2}$ or $\sqrt{\text{their } 36 + \text{their } 64}$ or $\sqrt{100}$	M1dep	oe $\frac{5 \times 6}{3}$ or $\frac{5 \times 8}{4}$
	10	A1	10 no working is full marks
	Additional Guidance		
	Scale drawing is M0		
	(3, 4, 5) × 2 = (6, 8, 10)		M1, M1dep, A1
	$\sqrt{6^2 + 8^2} = \sqrt{110} = 10.5$		M1, M1dep, A0
	$6^2 + 8^2 – 2 \times 6 \times 8 \times \cos 90$ 100 – 96		M1, M0dep
	$6^2 + 8^2 – 6 \times 8 \times \cos 90$		M0
	$\sqrt{6^2 + 8^2} =$ $\sqrt{6^2} + \sqrt{8^2} = 6 + 8 = 14$		M1, M1dep A0
	$6^2 + 8^2 = 12 + 16 = 28$ $\sqrt{28}$		M1 M1dep, A0
	6 × 8 ÷ 2 = 24 24 – 8 – 6 = 10	Correct answer but from wrong method	M0

Q	Answer	Mark	Comments
6a	Higher temperature lower soup sales Lower temp more soup sold	B1	
	Additional Guidance		
	Less soup when warm	B1	
	Sales go down as temperature goes up	B1	
	Sell more soup when it is cold	B1	
	As temperature gets higher the soup gets lower	B1	
	The hotter the day is the less people want soup because it is hot	B1	
	The hotter the temperature the less likely someone is going to buy soup	B1	
	When more soup is sold the weather gets colder	B0	
	Soup sales depend on temperature	B0	
	Negative correlation	B0	
	As the temperature decreases the monthly sales of soup decreases	B0	
	As the soup gets hotter the sales go down	B0	
	The lower the average the more sales of soup	B0	
	It decreases as monthly temperature increases	B0	

Q	Answer	Mark	Comments
6b	**Alternative method 1**		
	Straight line of best fit drawn	M1	Line of best fit must be long enough to go between [(4, 460), (4, 600)] and [(22.5, 120) , (25, 180)]
	470	A1ft	ft their line if M1 awarded (± ½ small square accuracy) Must be read from 7 (± ½ small square) SC1 no LOBF or wrong LOBF and answer in range [420, 540]. If point shown must be at 7 (± ½ small square)
	Alternative method 2		
	Chooses (4, 560) and any other point (x_1, y_1) or (10, 390) Calculates $560 - 3 \times \frac{(560 - y_1)}{(x_1 - 4)}$ or $y_1 + \frac{(x_1 - 7)(560 - y_1)}{(x_1 - 4)}$	M1	
	Correct answer for their chosen value (10, 390) gives 475 Value given to 3 sf at least	A1	 SC1 interpolation does not score M1 but answer in range [420, 540]
	Additional Guidance		
	(4, 560) to (10, 390) (4 + 10) ÷ 2 = 7 (560 + 390) ÷ 2 = 475		M1, A1
	(4, 560) to (8.5, 480) 480 + (1.5 ÷ 4.5) × (560 – 480) 506.66		M1, A1
	Line of best fit in range and answer in range but read from 7.5		M1, A0

8.5	480	507
9.5	380	462
10.5	400	486
11.5	360	480
13.5	300	478
15	360	505
16.5	260	488
19	300	508
21.5	240	505
22.5	120	489
25	180	506

Q	Answer	Mark	Comments
7	$35x + 40$ or $40x + 17.5$ seen	B1	Any letter, eg h, symbol eg ? or _
	$35x + 40 = 40x + 17.5$ or $40x + 17.5 - (35x + 40)$	M1	oe
	$5x = 22.5$	A1	oe
	4.5 or 4 h 30 m oe	A1ft	ft their equation if M awarded and equation is of the form $5x = a$ or $bx = 22.5$ SC2 correct answer without minimum algebra shown Ignore wrong units, eg £4.50
	Additional Guidance		
	Minimum algebra is B1, M1 SC2 can be scored after B1, M0 but 2 marks maximum		
	$35x + 40 = 40x + 17.5$ $75x = 22.5$ $x = 0.3$		B1, M1 A0 A1ft
	$35 \times x + 40 = 40 \times x + 17.5$ $5x = 57.5$ $x = 11.5$		B1, M1 A0 A1ft
	$40x + 17.5 = y$ $35x + 40 = y$ – $5x - 22.5 = 0$ $x = 4.5$		B1 M1 A1 A1
	$40x + 17.5$ $35x + 40$ - $5x - 22.5$ $x = -4.5$	The solution implies that an equation was present. BOD	B1 M1 A1 A0ft
	$35x + 40 = 40x + 17.5$ $5x = 22.5$ Cost of job = £197.50		B1, M1 A1 A0
	35 × number of hours + 40 = 40 × number of hours + 17.5		B1 (by implication) M1
	35 × number of hours + 40	Repeats question	B0

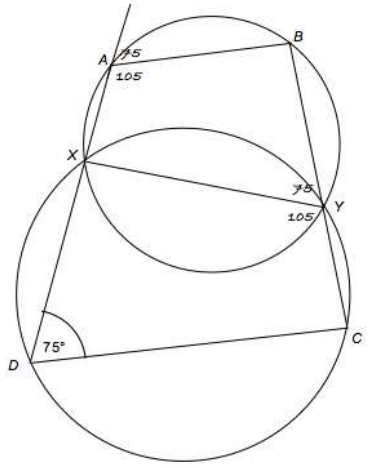
Q	Answer	Mark	Comments
8a	4	B1	
8b	1, 1, 2, 3 or 1, 1, 4, 4 or 1, 2, 3, 4 or 1, 2, 5, 5 or 1, 3, 4, 5 or 1, 3, 6, 6 or 1, 4, 5, 6 or 2, 2, 3, 5 or 2, 2, 5, 6 or 2, 3, 4, 6	B2	Numbers do not have to be in order B1 for any set of 4 **whole** numbers between 1 and 6 with middle two values when ordered that differ by an odd number SC1 for a correct answer that uses **whole** numbers greater than 6 and/or 0, eg 3, 4, 5, 8 2 × range = (sum middle two values + 1)
	Additional Guidance		
	5, 1, 3, 4		B2
	1, 1, 4, 5		B1
	2, 2, 3, 4		B1
	4, 1, 4, 5		B0
	1, 3, 4, 8		B0
	4, 5, 6, 10		SC1
	0, 0, 1, 1		SC1

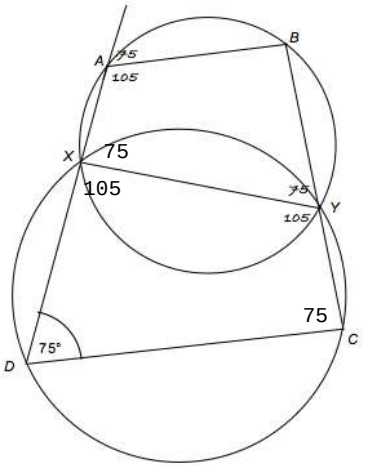
Q	Answer	Mark	Comments
9a	w^5	B1	Any letter is OK, eg x^5
9b	$8x^3y^5$	B2	B1 If all parts correct but × or one + included B1 for 2 correct (× may be included but + may not) B1 if wrong further work after correct answer seen
	Additional Guidance		
	$8x^3y^6$		B1
	$6x^3y^5$		B1
	$8x^2y^5$		B1
	$8 \times x^3 \times y^5$		B1
	$8 \times x^3 + y^5$		B1
	$8x^3y^5 = 8xy^8$		B1
	$8 \times x^3 \times y^6$		B1
	$8 + x^3 + y^5$		B0
9c	$6a^2b^4$	B2	B1 If all parts correct but × or one + included B1 for 2 correct (× may be included but + may not) B1 if wrong further work after correct answer seen
	Additional Guidance		
	$10a^2b^4$		B1
	$6a^3b^4$		B1
	$6a^2b^5$		B1
	$6 \times a^2 \times b^4$		B1
	$6 \times a^2 + b^4$		B1
	$6a^2b^4 = (3ab^2)^2$		B1
	$10 \times a^2 \times b^4$		B1
	$6 + a^2 + b^4$		B0

Q	Answer	Mark	Comments
10a	1.8×10^4	B2	B1 18×10^3 or 18 000 seen B1 for $\frac{1800\,000}{100}$ oe B1 for $300\,000 \times 0.06$
	Additional Guidance		
	18,000	Standard notation	B1
	18.000	Continental notation	B1
	$1\,800\,000 \times 0.01$		B1
10b	5×10^3	B2	B1 0.5×10^4 or 5 000 seen B1 for 120 000 seen
	Additional Guidance		
	5,000	Standard notation	B1
	5.000	Continental notation	B1

Q	Answer	Mark	Comments
11	Enlarge(ment)	B1	Allow poor spelling but do not accept any word that may imply a 'shrink' eg delargement
	(Scale factor) $\frac{1}{3}$	B1	Implied by word 'by' or 'of' If decimal 0.33 minimum Do not accept ratio, eg 3 : 1 or 1 : 3
	(centre) (10, 10) or 10, 10	B1	Do not accept $\begin{pmatrix} 10 \\ 10 \end{pmatrix}$ If no centre given in script look on diagram for rays clearly showing centre at (10, 10)
	Additional Guidance		
	Any combined transform		B0
	Enlarge factor 3 from (10, 10)		B2
	Enlarged by $\frac{1}{3}$ from (1, 4)		B2
	Enlarge by scale factor –3 from (10, 10)		B2
	Shrink of $\frac{1}{3}$ from (8, 10)		B1
	Enlarged factor ÷ 3 from (4, 10)		B1
	3 times smaller		B0
12a	35	B1	
12b	25	B1	

Q	Answer	Mark	Comments
12c	*XYC* = 105 (cyclic quadrilateral)	B1	Reason not necessary
	BYX = 75 (straight line) **and** *XAB* = 105 (cyclic quad)	B1	Reason not necessary
	(Parallel as) (co) interior (allied) angles add up to 180 (supplementary) or *DA* extended and 75 shown (Parallel as) angles (at *A* and *D*) are corresponding or *BA* extended and 75 shown (Parallel as) angles (at *A* and *D*) are alternate or *CD* extended and 105 shown (Parallel as) angles (at *A* and *D*) are alternate	Q1	Strand (ii) Complete argument for parallel lines. Both Bs must be scored before Q mark can be awarded Parallel can be assumed to gain full marks but one of the reasons given on left must be stated as starting point. Q0 If any angles are wrongly marked or stated

<table>
<tr><td rowspan="6">12c</td><td colspan="2">Additional Guidance</td></tr>
<tr><td colspan="2">If 105 shown as angle opposite 75 in XDCY award B1 even if other angles are shown
If 75 and 105 shown as BYX and XAB then award B1 even if other angles shown
Award Q1 only if there are no other angles than CYX, BYX and XAB shown and a valid reason given</td></tr>
<tr><td colspan="2">If CYX not shown or stated and 75 given as BYX using exterior angle of cyclic quad = opposite interior angle, this should be stated to gain 1st B1, otherwise it is B0, B0 as it could be a misinterpretation of circle theorems</td></tr>
<tr><td>correspor
 

Angles are</td><td>B1
B1
Q1</td></tr>
<tr><td>and D
 

Parallel as angles at A
are corresponding</td><td>B1
B1
Q0</td></tr>
<tr><td>If AB parallel to DC XAB + XDC = 180 as interior angles,
∴ XAB = 105
∴ BYX = 75 (opposite angle in a cyclic quad)
∴ XYC = 105 (angles on a straight line)
∴ XYC + XDC = 180 (opposite angles in a cyclic quad) QED</td><td>If parallel assumed must be stated.
B1
B1
Q1</td></tr>
</table>

Q	Answer	Mark	Comments
13a	$12x^2 + 18x – 2x – 3$	M1	Must have four terms, one in x^2, 2 in x and a constant term. 3 terms correct Terms may be in box method but must have correct signs
	$12x^2 + 16x – 3$	A1	
	Additional Guidance		
	$8x^2 + 18x – 2x – 3$		M1
	$12x^2 + 18x + 2x – 3$		M1
	$8x^2 + 18x + 2x – 3$		M0
	$12x + 18x – 2x – 3$		M0
	<table><tr><td></td><td>$6x$</td><td>$–1$</td></tr><tr><td>$2x$</td><td>$12x^2$</td><td>$–2x$</td></tr><tr><td>3</td><td>$18x$</td><td>$–3$</td></tr></table>		M1
	<table><tr><td></td><td>$6x$</td><td>$–1$</td></tr><tr><td>$2x$</td><td>$12x^2$</td><td>$2x$</td></tr><tr><td>3</td><td>$18x$</td><td>3</td></tr></table>		M0 (but can be recovered)

Q	Answer	Mark	Comments
13b	**Alternative method 1**		
	$(ax \pm c)(bx \pm d)$	M1	$ab = 4$ **and** $cd = \pm 3$
	$(4x - 3)(x + 1)$	A1	
	$\frac{3}{4}$ and -1	A1ft	ft their brackets if M1 awarded
	Alternative method 2		
	$\frac{-1 \pm \sqrt{1^2 - 4 \times 4 \times -3}}{2 \times 4}$	M1	Allow one error from wrong sign for $-b$, wrong signs for $-4ac$, b^2 as -1 Do not accept wrong formula, ie + not ±, 2 not $2a$ or only dividing root by $2a$
	$\frac{-1 \pm \sqrt{49}}{8}$	A1	
	$\frac{3}{4}$ and -1	A1	oe ft on wrong sign for $-b$ only eg $-\frac{3}{4}$ and 1
	Alternative method 3		
	$(x + \frac{1}{8})^2 = \frac{49}{64}$	M1	
	$x = \pm \sqrt{\frac{49}{64}} - \frac{1}{8}$	A1	
	$\frac{3}{4}$ and -1	A1ft	oe

Q	Answer	Mark	Comments

13b	**Alternative method 4**		
	Writes $x^2 + x - 12$ **and** writes $\left(x \pm \frac{a}{4}\right)\left(x \pm \frac{b}{4}\right)$ where $ab = -12$	M1	$(4x \pm 4)(4x \pm 3)$
	$\left(x + \frac{4}{4}\right)\left(x - \frac{3}{4}\right)$	A1	oe eg $(4x + 4)(4x - 3)$
	$\frac{3}{4}$ and -1	A1ft	oe ft their brackets if M1 awarded
	Additional Guidance		
	$(2x - 1)(2x + 3)$, $\frac{1}{2}$ and $-1\frac{1}{2}$		M1, A0, A1 ft
	$\frac{1 \pm \sqrt{1^2 - 4 \times 4 \times -3}}{2 \times 4}$, $-\frac{3}{4}$ and 1		M1, A0, A1ft
	$(4x + 3)(x - 1)$, $-\frac{3}{4}$ and 1		M1, A0, A1ft
	$x^2 + x - 12$ $\left(x + \frac{2}{4}\right)\left(x - \frac{6}{4}\right)$ $1\frac{1}{2}$ and $-\frac{1}{2}$		M1 A0 A1ft

Q	Answer	Mark	Comments
14	**Alternative method 1**		
	$\frac{1}{2} \times 3\sqrt{2} \times \frac{1}{\sqrt{2}} \times x = 12$	M1	Must substitute values and must = 12
	8	A1	Correct answer with no working or no contradictory working is 2 marks
	Alternative method 2		
	Drops perpendicular from *A* to *BC* **and** calculates height as $3\sqrt{2} \times \frac{1}{\sqrt{2}}$ (or 3) **and** $\frac{1}{2} \times BC \times$ their 3 = 12	M1	
	8	A1	Correct answer with no working or no contradictory working is 2 marks
	Additional Guidance		
	Allow any letter or a dash for x but be careful with the letter h as this may be the hypotenuse of a right-angled triangle		
	Do not award M1 for wrong use of formula		
	$\frac{1}{2} \times 3\sqrt{2} \times \_ \times \frac{1}{\sqrt{2}} = 12$	M1	
	$24 = 3\sqrt{2} \times x \times \frac{1}{\sqrt{2}}$	M1	
	$\frac{1}{2} \times 3\sqrt{2} \times x \times \sin 45 = 12$ $\frac{1}{2} \times 3\sqrt{2} \times x \times 45 \times \frac{1}{\sqrt{2}} = 12$	M0	
	$3\sqrt{2} \times x \times \frac{1}{\sqrt{2}} = 12$	M0	

Q	Answer	Mark	Comments
15	**Alternative method 1**		
	$yx = 3x + 5$	M1	Cross multiplying Allow $y \times x = 3 \times x + 5$
	$yx - 3x = 5$ or $3x - yx = -5$	M1dep	oe
	$x = \frac{5}{y - 3}$ or $x = \frac{-5}{3 - y}$	A1ft	Must have $x =$ as part of answer ft on one rearrangement error
	Alternative method 2		
	$y = 3 + \frac{5}{x}$	M1	
	$y - 3 = \frac{5}{x}$	M1dep	oe
	$x = \frac{5}{y - 3}$ or $x = \frac{-5}{3 - y}$	A1ft	Must have $x =$ as part of answer ft on one rearrangement error
	Additional Guidance		
	$yx = 3x + 5$ $yx + 3x = 5$ $x = \frac{5}{y + 3}$		M1 M0dep A1ft
	$yx = 3x + 5$ $3x - yx = 5$ $x = \frac{5}{3 - y}$		M1 M0dep A1ft
	$y = 3 + \frac{5}{x}$ $y + 3 = \frac{5}{x}$ $x = \frac{5}{y + 3}$		M1 M0dep A1ft

Q	Answer	Mark	Comments
16	**Alternative method 1**		
	$8(3x - 1) < 6(x + 1)$ or $24x - 8 < 6x + 6$ or $4(3x - 1) < 3(x + 1)$ or $12x - 4 < 3x + 3$	M1	If expanded, must be 4 terms with at least 3 correct
	$24x - 6x < 6 + 8$ or $18x < 14$	M1dep	oe
	$x < \frac{7}{9}$	A1ft	oe ft one expansion or rearrangement error Must have $x <$ Must be fraction with whole number numerator and denominator Accept $x < \frac{14}{18}$
	Alternative method 2		
	$1.5x - 0.5 < 0.375x + 0.375$	M1	oe eg $\frac{3}{2}x - \frac{1}{2} < \frac{3}{8}x + \frac{3}{8}$ Must have 4 terms with at least 3 correct
	$1.5x - 0.375x < 0.375 + 0.5$ or $1.125x < 0.875$	M1dep	oe eg $\frac{9}{8}x < \frac{7}{8}$
	$x < \frac{875}{1125}$	A1ft	oe ft one expansion or rearrangement error Must have $x <$ Must be fraction with whole number numerator and denominator $x < \frac{0,875}{1,125}$ is A0

Q	Answer	Mark	Comments
16	**Alternative method 3**		
	$3x - 1 < \frac{6}{8}(x + 1)$ or $3x - 1 < \frac{3}{4}x + \frac{3}{4}$	M1	oe
	$3x - \frac{3}{4}x < \frac{3}{4} + 1$ $2\frac{1}{4}x < 1\frac{3}{4}$	M1dep	oe
	$x < \frac{7}{9}$	A1ft	oe ft one expansion or rearrangement error Must have $x <$ Must be fraction with whole number numerator and denominator $x < \frac{1.75}{2.25}$ is A0

Q	Additional Guidance		
16	Allow ≤		
	Student replaces < with equals and gets $x = \frac{7}{9}$ but does not recover		M0
	Student replaces < with equals and gets $x = \frac{7}{9}$ but recovers to $x < \frac{7}{9}$		M1, M1dep, A1
	$3x - 1 = \frac{3}{4}x + \frac{3}{4}$ $2\frac{1}{4}x = 1\frac{3}{4}$ $< \frac{7}{9}$	Recovered < to allow method and partial accuracy but omits x so loses last mark	M1 M1dep A0
	$24x - 8 < 6x + 7$, $18x < 15$, $x < \frac{5}{6}$	One expansion error	M1, M0dep, A1ft
	$12x - 4 < 3x + 3$, $15x < 7$, $x < \frac{7}{15}$	One rearrangement error	M1, M0dep, A1ft
	$1.5x - 0.5 < \frac{3}{8}x + \frac{3}{8}$	Mix of decimal and fractions OK	M1

Q	Answer	Mark	Comments
17a	y = 15 drawn to cut both or one side(s) of graph or markings on graph at y = 15	M1	
	[2.6, 2.8] and [–2.8, –2.6]	A1	SC1 no line or incorrect line drawn and two answers in range Answers can be given as coordinates, eg (–2.8, 15), (2.8, 15)
	Additional Guidance		
	As the clip starts above the graph when scrolling through you may see a line y = 15 or marks on graph at y = 15, this will be M1 (also note if y = 10 drawn). Then check answers		
	No line drawn Answers 2.75 and –2.75		SC1
	Line y = 15 drawn Answers 2.38 and –2.38		M1 A0
17b	Line or markings at y = 10 to cut graph at least once	M1	
	[2.2, 2.4] and/or [–2.4, –2.2]	A1	SC1 one (or two) answers in range SC1 no line or marks on graph at y = 10 and no answer(s) in range, but y = 10 stated Answer(s) can be given as coordinates, eg (–2.2, 10), (2.25, 10)
	Additional Guidance		
	Parts (a) and (b) are marked together. Clip starts above graph so when scrolling through for part (a) look for line or marks at y = 10. If seen this is M1. Once (a) is marked clip will jump to part (b). Check for answer(s)		
	No line drawn Answer 2.25		SC1
	Line y = 10 drawn Answer 2.1		M1 A0

Q	Answer	Mark	Comments
18	$15 - 3\sqrt{3} - 5\sqrt{3} + \sqrt{3} \times \sqrt{3}$	M1	oe Must have 4 terms with at least 3 correct for M1 Terms may be in box method but must have correct signs
	$18 - 8\sqrt{3}$	A1	
	$9 - 4\sqrt{3}$	A1ft	oe Final answer must be in form $a \pm b\sqrt{3}$ Do not award A1 if further incorrect work, eg $9 - 4\sqrt{3} = 5\sqrt{3}$ ft if M awarded and at most one error, ie 3 correct terms with no further errors in collecting or 4 correct terms and one error in collecting

Q	Answer	Mark	Comments

18

Additional Guidance

$15 - 3\sqrt{3} - 5\sqrt{3} - \sqrt{9}$ $12 - 8\sqrt{3}$ $6 - 4\sqrt{3}$		M1 A0 A1ft
$15 + 3\sqrt{3} - 5\sqrt{3} + \sqrt{9}$ $18 - 2\sqrt{3}$ $9 - \sqrt{3}$		M1 A0 A1ft
$15 - 3\sqrt{3} - 5\sqrt{3} + \sqrt{3}$ $15 - 7\sqrt{3}$ $7\frac{1}{2} - \frac{7}{2}\sqrt{3}$		M1 A0 A1ft
$15 - 3\sqrt{3} - 5\sqrt{3} + \sqrt{9}$ $18 + 8\sqrt{3}$ $9 + 4\sqrt{3}$		M1 A0 A1ft
$\frac{15 - 3\sqrt{3} - 5\sqrt{3} + 3}{2}$ $2(15 - 3\sqrt{3} - 5\sqrt{3} + 3)$ $30 - 6\sqrt{3} - 10\sqrt{3} + 6$ $36 - 16\sqrt{3}$	First A1 for $18 - 8\sqrt{3}$ by implication	M1 A1 A0
$15 + 3\sqrt{3} - 5\sqrt{3} - \sqrt{9}$		M0
<table><tr><td></td><td>5</td><td>$-\sqrt{3}$</td></tr><tr><td>3</td><td>15</td><td>$-3\sqrt{3}$</td></tr><tr><td>$-\sqrt{3}$</td><td>$-5\sqrt{3}$</td><td>–3</td></tr></table>		M1
<table><tr><td></td><td>5</td><td>$-\sqrt{3}$</td></tr><tr><td>3</td><td>15</td><td>$3\sqrt{3}$</td></tr><tr><td>$-\sqrt{3}$</td><td>$5\sqrt{3}$</td><td>3</td></tr></table>		M0 (but can be recovered)

Q	Answer	Mark	Comments
19a	$y = \frac{1}{x}$	B1	
19b	(0, 1)	B1	

20	**Alternative method 1**		
	$2x \times 2x \times x$	M1	
	$\frac{4}{3}\pi x^3$ **and** $4x^3$	A1	Allow × signs, eg $\frac{4}{3} \times \pi \times x^3$
	$\frac{4}{3}\pi x^3$ **and** $4x^3$ and justification such that $\frac{\pi}{3} > 1$ or $\frac{4}{3}\pi > 4$	Q1	Strand (ii)
	Alternative method 2		
	Chooses a value for r, say 10 $\frac{4}{3} \times \pi \times 10^3$ **and** $20 \times 20 \times 10$	M1	
	$\frac{4000\pi}{3}$ **and** 4000 or numerical values if π taken as 3.1, say	A1	If values are calculated wrongly do not award this mark but Q mark can still be gained
	their $\frac{4000\pi}{3}$ **and** their 4000 with at least one correct and justification such that $\frac{\pi}{3} > 1$ or $\frac{4}{3}\pi > 4$ oe	Q1	$\pi > 3$ not enough without justification that $\frac{4000\pi}{3}$ will be greater than 4000

Q	Answer	Mark	Comments

20	**Additional Guidance**		
	Note that $\frac{4}{3}\pi r^3$ is just quoting the given formula. Must have $\frac{4}{3}\pi x^3$ and $4x^3$		
	Note that truncation of π to 3.1 or 3.14 is OK but rounding up is not. This would negate the Q mark.		
	Let r = 2, $\frac{4}{3}\times\pi\times 2^3 = 1.3 \times \pi \times 8 = 10.4\pi$ $4 \times 4 \times 2 = 32$ $10.4 \times 3.1 = 31.2 + 1.04 = 32.24 > 32$	Truncating values of $\frac{4}{3}$ and π but showing that this still gives a value greater than 3 is acceptable	M1 A1 Q1
	$2x \times 2x \times x = 4x^3$ $= 1.3 \times 3.14 \times x^3$ Uses box method to get $4.29x^3$ Sphere = $4.29x^3$ > Cuboid $4x^3$	$1.3 \times 3.14 \neq 4.29$	M1 A0 Q1
	Let r = 4, $\frac{4}{3}\times\pi\times 4^3 = \frac{4}{3} \times \pi \times 64 = \frac{256}{3}\pi$ $8 \times 8 \times 4 = 256$ $\frac{256}{3}\pi > 256$ $\frac{\pi}{3} > 1$ $\pi > 3$		M1 A1 Q1