AQA

GCSE

Mathematics

93652H Methods in Mathematics
Unit 2: Higher Tier
Mark scheme

93652H

June 2015

Version 1.0 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.

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 within the scheme 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. eg, accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
3.14 …	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
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.

Q	Answer	Mark	Comments
1	$2 \times \pi \times 15$	M1	oe
	[94, 94.3] or 30π	A1	Correct answer only full marks
	Additional Guidance		
	Wrong formula is M0, A0. Be careful of $\pi \times 15^2 = 30\pi$ which is M0, A0		
	$2 \times \pi \times 15$ 30π $30\pi \div 2 = 15\pi = [47, 47.15]$	Correct formula followed by incorrect work	M1 A0
	$\frac{1}{2} \times 2 \times \pi \times 15$ 15π	Incorrect formula	M0 A0
2	9×6 or 9×11 or $\frac{9}{2} \times 11$ or $\frac{1}{2} \times 9 \times 5$ or $\frac{1}{2} \times \frac{9}{2} \times 5$ or $\frac{1}{2} \times \frac{9}{2} \times (11 + 6)$	M1	54 or 99 or 49.5 or 22.5 or 11.25 or 38.25
	$9 \times 6 + \frac{1}{2} \times 9 \times 5$ or $9 \times 11 - 2 \times \frac{1}{2} \times \frac{9}{2} \times 5$ or $2 \times \frac{1}{2} \times \frac{9}{2} \times (11 + 6)$	M1dep	54 + 22.5 or 99 – 22.5 or 2×38.25
	76.5	A1	Allow 76 or 77 after 76.5 seen

Q	Answer	Mark	Comments
3	Reflection, Reflected, Reflect	B1	Allow poor spelling if meaning clear
	$x = -1$ written or drawn and labelled as $x = -1$	B1	Must have $x =$
	Additional Guidance		
	Ignore any linking words such as 'in', 'on', 'about', 'over', 'by'		
	Mirror about $x = -1$	B0, B1	
	Relefted in $y = -1$	B1, B0	
	Reflex in $x - 1$	B1, B0	
	Flipped over $x - 1 = 0$	B0, B0	

Q	Answer	Mark	Comments
4	$8x - 3x = 10 + 7$ or $5x = \ldots.$ or $\ldots. x = 17$	M1	
	$5x = 17$	A1	
	3.4	A1ft	oe eg $\frac{17}{5}$ or $3\frac{2}{5}$ ft on any equation of the form $5x = b$ where b is any number other than ±10 or ±7 or of the form $ax = 17$ where a is any number other than ±8 or ±3
	Additional Guidance		
	Trial and Improvement must lead to a correct answer to score		
	$5x = 3$, $x = 0.6$		M1, A0, A1ft
	$11x = 17$, $x = \frac{17}{11}$ or 1.54 (decimal values must be correct to 2dp)		M1, A0, A1ft
	$5x = 10$, $x = 2$	ft not allowed on $5x = 10$ or $5x = 7$	M1, A0, A0ft
	$11x = 3$	2 errors	M0

Q	Answer	Mark	Comments
5	405 ÷ 27 or 15	M1	oe
	3 and 5	A1	Correct answer only full marks
	Additional Guidance		
	Trial and improvement must be completely correct to score		
	No working 1, 15		M1 (by implication) A0
	No working 2, 13		M1 (by implication) A0
6	$\pi \times 20^2$ seen	M1	
	$\pi \times 20^2 \times 45$ or [55 800, 56556] or 18000	M1dep	oe
	18000π or $18000 \times \pi$ or $\pi 18000$	A1	Allow [55 800, 56556] seen after 18000π but not any other further numerical work.
	Be careful as 1800π can come from circumference and curved surface area $2\pi rh$		
	$\pi \times 20^2 = 40\pi$ $40\pi \times 45$ 1800π		M1 M1dep A0
	$2 \times \pi \times 20$ $40\pi \times 45$ 1800π		M0 M0dep A0

Q	Answer	Mark	Comments
7	$10(x + 7) + 3x$ or $13 \times x + 7 \times 10$	M1	oe Excess in black rods = 7×10 or 70
	Their $10(x + 7) + 3x = 343$	M1dep	343 – their 70 or 273
	$13x = 273$	A1	$273 \div 13$
	21	Q1ft	Strand (ii) ft their equation or 343 – their 70 if both Ms awarded and no further errors **or** correct answer. SC2 38.5 from $5(x + 7) + 3x$
	Trial and improvement must be fully correct to score		
	$10(x + 7) + 3x$ $13x + 7 = 343$ $13x = 336$ $x = 25.8$		M1 M1dep A0 Q1ft
	Extra black = $7 \times 10 = 70$ $343 – 70 = 263$ $263 \div 13$ 20.2		M1 M1dep A0 Q1ft

Q	Answer	Mark	Comments
8	$\begin{pmatrix} 2 \\ 6 \end{pmatrix}$ or $\left(\frac{2}{6}\right)$ or translation (or similar) and $\frac{2}{6}$ or translation (or similar) and 2 right 6 up	B2	B1 for translation (or similar) and a wrong vector or words B1 for 2 right 6 up B1 for $\begin{pmatrix} 2 \\ 6 \end{pmatrix}$ with incorrect transformation given , eg reflection. B1 for $\begin{pmatrix} 2 \\ a \end{pmatrix}$ where $a \neq 6$ B1 for $\begin{pmatrix} b \\ 6 \end{pmatrix}$ where $b \neq 2$ B1 for $\frac{2}{6}$ B1 for $\begin{pmatrix} -2 \\ -6 \end{pmatrix}$

Q	Answer	Mark	Comments
9	**Alternative method 1**		
	$\frac{8}{100}$ × 350 or 280 or 168	M1	oe
	$\frac{8}{100}$ × their 280 or 168 **and** their 60% value ÷ 350 (× 100)	M1dep	oe
	48	A1	
	Alternative method 2		
	0.8 or 0.6 seen	M1	oe
	0.8 × 0.6 or 0.48	M1dep	oe
	48	A1	
	Additional Guidance		
	Build up methods must be fully correct to score M1dep		
	168 10% = 35, 40% = 140, 1% = 3.5, 8% = 28 40 + 1 + 8 = 49		M1 M0dep A0
	168 10% = 35, 40% = 140, 1% = 3.5, 28 ÷ 3.5 = 7.5% 40 + 7.5 = 47.5		M1 M1dep A0

Q	Answer	Mark	Comments
10	$80^2 + 39^2$ or 6400 + 1521 or 7921	M1	$80^2 - 39^2$ or 6400 – 1521 or 4879
	$\sqrt{80^2 + 39^2}$ or $\sqrt{their\ 7921}$	M1dep	7921 must be from $80^2 + 39^2$
	89	A1	
	Additional Guidance		
	$80^2 + 39^2 = 238$ $\sqrt{238} = 15.4$		M1 M1dep, A0
	Use of alternative methods must be a full method for M2		
	tan x = 0.4875 x = 26° (x =) 80 ÷ cos 26 89	39 ÷ sin 26	M2 A1
	tan x = 2.05 x = 64.01° (x =) 80 ÷ sin 64 89	39 ÷ cos 64	M2 A1
	(x^2 =) $39^2 + 80^2 - 2 \times 39 \times 80 \times \cos 90$ (x^2 =) $39^2 + 80^2$ $\sqrt{80^2 + 39^2}$ 89	Must know cos 90 = 0 If cos 90 left in expression M0 until $39^2 + 80^2$ seen with no other values	M2 A1

Q	Answer	Mark	Comments
11(a)	$2 \times (4x + 6) + 2 \times (2x – 1)$ or $8x + 12 + 4x – 2$	M1	oe Allow invisible brackets If expanded straight away then 3 terms must be correct for M1
	$12x + 10$ or $2(6x + 5)$	A1	SC1 $6x + 5$ NB $6x + 5$ given as answer after $12x + 10$ seen in script is B1
	Additional Guidance		
	$2 \times 4x + 6 + 2 \times 2x – 1$ $12x + 5$	M1 A0	
	$2 \times (4x + 6) + 2 \times (2x – 1)$ $= 8x + 6 + 4x – 1$ $= 12x + 5$	M1 A0	
	$= 8x + 6 + 4x – 1$ $= 12x + 5$	M0 A0	
	$= 8x + 12 + 4x – 1$ $= 12x + 11$	M1 A0	
	Misreads are common. Mark as scheme but do not allow accuracy mark		
	$2 \times (4x + 6) + 2 \times (2x – 7)$ $= 8x + 12 + 4x – 14$ $= 12x – 2$	Misread, no errors	M1 A0
	$2 \times (4x + 6) + 2 \times (2x – 7)$ $= 8x + 6 + 4x – 14$ $= 12x – 8$	Misread, at least one error	M0 A0

Q	Answer	Mark	Comments
11(b)	$8x^2 – 4x + 12x – 6$	M1	Allow one arithmetic or sign error. Must have 4 terms, one in x^2, two in x and a constant term.
	$8x^2 + 8x – 6$	A1	
	Additional Guidance		
	$8x – 4x + 12x – 6$		M0
	$8x^2 – 4x + 12x – 6$ $8x^2 + 8x – 6$ $4x^2 + 4x – 3$		M1 A0 (further work)

Q	Answer	Mark	Comments
12(a)	60	B1	
12(b)	**Alternative method 1**		
	$\frac{9}{60}$ and $\frac{44}{60}$	M1	Fractions with same denominator
	$\frac{44}{60} - \frac{9}{60}$ or $\frac{35}{60}$	M1dep	Subtraction of their fractions
	$\frac{35}{60} \div 5 \times 2$ or $\frac{35}{60} \div 5 \times 3$ or $\frac{14}{60}$ (oe) or $\frac{21}{60}$ (oe) or 14 : 21	M1dep	Splitting their difference into 2 : 3 or finding $\frac{2}{5}$
	$\frac{23}{60}$	A1	oe eg $\frac{115}{300}$
	Alternative method 2		
	0.15 and 0.73…	M1	
	0.73 – 0.15 = 0.583…	M1dep	
	their 0.583 ÷ 5 × 2 or 0.23… or their 0.583 ÷ 5 × 3 or 035	M1dep	
	0.383…	A1	Must be to 0.383 or better
	Alternative method 3		
	$\left(\frac{11}{15} - \frac{3}{20}\right)$	M1	
	$\frac{7}{12}$	M1dep	oe $\frac{7}{12}$ with no working is M2
	their $\frac{7}{12} \div 5 \times 2$ or $\frac{7}{30}$	M1dep	their $\frac{7}{12} \div 5 \times 3$ or $\frac{7}{20}$
	$\frac{23}{60}$	A1	

Q	Answer	Mark	Comments
13	108 seen or stated as the interior angle of the pentagon or 72 seen or stated as the exterior angle of the pentagon	M1	
	72 shown or stated as both angles of the appropriate triangle	A1	
	36	A1ft	36 with no working is 1 mark ft only on a wrong calculation from interior angle calculated as 540 ÷ 5 or exterior angle calculated as 360 ÷ 5
	Additional Guidance		
	If 108 or 72 shown or stated as exterior or interior angles respectively then it is M0	M0	
	540 ÷ 5 does not score until the answer (right or wrong) is shown or implied to be the interior angle		
	540 ÷ 5 = 110, 180 – 110 = 70, 180 – 2 × 70 = 40	M1, A0, A1ft	
	360 ÷ 5 does not score until the answer (right or wrong) is shown or implied to be the exterior angle		
	360 ÷ 5 = 75, 180 – 2 × 75 = 30	M1, A0, A1ft	
	Be careful of 36 from wrong work. This is M0		
	72 marked as angle between sides of star, angle, 108 marked as interior angle of triangle 180 – 2 × 108 = 36 Answer = 36	M0	
	180 ÷ 5 = 36	M0	

Q	Answer	Mark	Comments
14	Use of tan 30 or tan 60 and 12	M1	
	12 × tan 30 or 12 ÷ tan 60	M1dep	
	$4\sqrt{3}$ or [6.9, 7]	A1	7 with working
	$\frac{1}{2}$ × (their 6.9 + 10 + 10) × 12	M1dep	oe Dependent on first M
	[161.4, 162]	A1	Full method which should include: Splitting shape into rectangle and triangle (could be implied); using trig to calculate valid length; then calculating the sum of 2 areas. SC2 from using hypotenuse as 12 leading to 156
	Additional Guidance		
	162 is from rounding correct answer or using 7. Do not penalise this as premature rounding.		
	12 ÷ tan 30 = 20.78, 0.5 × 20.78 × 12 = 124.68 124.68 + 120 = 244.68		M1, M0dep, A0, M1dep, A0
	12 × cos 60 (or 12 × sin 30) = 6 0.5 × (6 + 10 + 10) × 12 156	Must be a full method	SC2
	If 12 used with cos or sin to get the 'hypotenuse', then Pythagoras used to get the side it must be a complete method to score M2		
	12 ÷ sin 60 (or 12 ÷ cos 30) (= 13.86) $\sqrt{their\ 13.86^2 - 12^2}$	After this the last 3 lines of scheme apply	M2

Q	Answer	Mark	Comments
15(a)	C	B1	Any clear indication, eg letter circled within triangle.
15(b)	12.5 ÷ 5 or 2.5 or $\frac{12.5}{5}$ 5 ÷ 12.5 or 0.4 or $\frac{2}{5}$ or 6 ÷ 5 or 1.2 or $\frac{6}{5}$ or 5 ÷ 6 or 0.833.. or $\frac{5}{6}$	M1	
	15	A1	Must come from exact working
	Additional Guidance		
	12.5 – 5 = 7. 6 + 7.5 = 13.5		M0 A0
	5 ÷ 6 = 0.833 12.5 ÷ 0.833 = 15.006 = 15	Answer not from exact working	M1 A0

Q	Answer	Mark	Comments
16	5 : 3 : 12	M1	oe
	60 ÷ their (5 + 3 + 12) or 3	M1dep	
	9	A1	9 with no wrong or contradictory work is 3 marks.
	Additional Guidance		
	10 : 6 : 24 60 ÷ 40 = $1\frac{1}{2}$ 6 × $1\frac{1}{2}$ = 9		M1 M1dep A1
	Blue : red red : Yellow 5 : 3 1 : 4 10 : 6 6 : 24 15 : 9 9 : 36 No further working. No answer	Need to see that the total is 60	M1 M1dep A0
	Blue : red red : Yellow 5 : 3 3 : 12 = 20 10 : 6 6 : 24 = 40 15 : 9 9 : 36 = 60 No further working. No answer	Clearly see that red = 9 out of 60 balls	M1 M1 A1

Q	Answer	Mark	Comments
17(a)	90	B1	
17(b)	40	B1	

Q	Answer	Mark	Comments
18(a)	**Alternative method 1**		
	$\frac{1}{2} \times 12 \times 13 \times \sin CAB = 48$	M1	
	(sin *CAB* =) $\frac{96}{12\times13}$ or $\frac{8}{13}$ or [0.6, 0.6154]	A1	oe
	[37.95, 38]	A1	If radians [0.66, 0.663] If gradians [42, 42.2] Allow M1, A1, A0
	Alternative method 2		
	$\frac{13}{2} \times h = 48$ $h = \frac{96}{13}$	M1	
	sin $x = \frac{96}{13} \div 12$ or $\frac{8}{13}$ or [0.6, 0.6154]	M1dep	
	[37.95, 38]	A1	If radians [0.66, 0.663] If gradians [42, 42.2] Allow M1, A1, A0
	Additional Guidance		
	Answer outside range is premature rounding		
	sin x = 0.61, x = 37.58		M1, A1, A0

Q	Answer	Mark	Comments
18(b)	(x^2 =) $23^2 + 19^2 - 2\times23\times19\times\cos 42$	M1	Wrong formula is M0
	(x^2 =) [240, 240.5]	A1	
	[15.5, 16]	A1ft	16 with working ft √their 240 if M1 awarded and cos 42 prematurely rounded to 0.74, for example, but not on a miscalculation. Answer must be given accurately to a minimum of 3sf. If Radians 1239 and [35, 35.21] If Gradians 199 and [14, 14.12] Allow M1, A1, A0
	Additional Guidance		
	16 cos 42 = 11.89, x = 3.44		M1, A0, A0
	$23^2 + 19^2 - 2 \times 23 \times 19 \times 0.7 = 278.2$, x = 16.7		M1, A0, A1ft

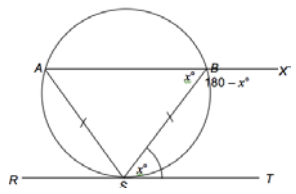
Q	Answer	Mark	Comments
19	**Alternative method 1**		
	Differencing to get second difference as 3 or stating second difference as 3	M1	
	Stating $1\frac{1}{2}n^2$	A1	Can be implied by $1\frac{1}{2}$, 6, $13\frac{1}{2}$, 24, $37\frac{1}{2}$
	Linear part $2\frac{1}{2}$, 2, $1\frac{1}{2}$, 1, $\frac{1}{2}$	M1dep	
	$1\frac{1}{2}n^2 - \frac{1}{2}n + 3$	A1	$1\frac{1}{2}n^2$ is 2 marks $-\frac{1}{2}n$ is 1 mark (dependent) + 3 is 1 mark (dependent)
	Alternative method 2		
	Differencing to get second difference as 3	M1	
	Working table backwards to get 0th term	A1	3 4 8 15 1 4 7 3 3
	Recognising $2a = 3$, $a + b = 1$ and $c = 3$	M1dep	
	$1\frac{1}{2}n^2 - \frac{1}{2}n + 3$	A1	

Q	Answer	Mark	Comments
19	**Alternative method 3**		
	Differencing to get second difference as 3	M1	
	Stating two of $2a = 3$, $3a + b = 4$ or $a + b + c = 4$	A1	4 8 15 4 7 3
	Stating all of $2a = 3$, $3a + b = 4$ and $a + b + c = 4$	M1dep	
	$1\frac{1}{2}n^2 - \frac{1}{2}n + 3$	A1	
	Alternative method 4		
	$a + b + c = 4$ $4a + 2b + c = 8$ $9a + 3b + c = 15$	M1	
	$3a + b = 4$ $5a + b = 7$	M1dep	
	$a = 1\frac{1}{2}$ and $b = -\frac{1}{2}$	A1	
	$1\frac{1}{2}n^2 - \frac{1}{2}n + 3$	A1	Allow any letter

Q	Answer	Mark	Comments
20	**Alternative method 1**		
	$(ax \pm c)(bx \pm d)$ (= 0)	M1	$ab = 2$, $cd = 9$
	$(2x - 3)(x + 3)$ (= 0)	A1	
	$1\frac{1}{2}$ and –3	A1ft	ft if M awarded.
	Alternative method 2		
	$\left(x + \frac{3}{4}\right)^2 - \frac{9}{16} - \frac{9}{2}$ (= 0)	M1	Allow one arithmetic error but must be $\left(x + \frac{3}{4}\right)^2$
	$x + \frac{3}{4} = \pm \sqrt{\frac{81}{16}}$	M1dep	
	$1\frac{1}{2}$ and –3	A1	
	Alternative method 3		
	$\frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times (-9)}}{2 \times 2}$	M1	Allow one error
	$\frac{-3 \pm \sqrt{81}}{4}$	A1	
	$1\frac{1}{2}$ and –3	A0	As not by factorisation

Q	Answer	Mark	Comments

20	**Additional Guidance**		
	$(2x + 3)(x – 3)$, $x = -1\frac{1}{2}$ and 3		M1, A0, A1ft
	$(2x + 1)(x – 9)$, $x = -\frac{1}{2}$ and 9		M1, A0, A1ft
	$\left(x - \frac{3}{4}\right)^2 + \frac{9}{16} - \frac{9}{2}$, $x - \frac{3}{4} = \pm\sqrt{\frac{63}{16}}$, $x = \frac{3}{4} + \sqrt{\frac{63}{16}}$ and $x = \frac{3}{4} - \sqrt{\frac{63}{16}}$		M1, A0, A1ft
	Errors when using formula are wrong sign for b, –9 for b^2, –54 for $–4ac$.		
	Unacceptable errors are wrong formula, eg + for ±, 2 for $2a$, dividing square root only by $2a$, or any wrong value for a, b or c.		
	$\frac{-2 \pm \sqrt{2^2 - 4 \times 2 \times (-9)}}{2 \times 2}$	Wrong value for b	M0
	$\frac{-3 \pm \sqrt{3^2 + 4 \times 2 \times (-9)}}{2 \times 2}$	Wrong formula	M0
	$\frac{-3 \pm \sqrt{3^2 + 4 \times 2 \times 9}}{2 \times 2}$	Could be wrong formula but could be minus minus making a plus. BOD	M1

21	Alternate or opposite segment (theorem)	Q1	Strand (i)
	(*ABS*) alternate angles (to *BST*)	Q1	Strand (i)
	Additional Guidance		
	Students could draw extra lines on diagram and then give a valid reason in last statement.		
	 *SBX* is 180 – x, so co-interior angles add to 180°		B1

Q	Answer	Mark	Comments
22	$(3x + 2)(3x – 2)$	B1	
	$(ax \pm c)(bx \pm d)$	M1	$ab = 6$, $cd = 2$
	$(3x + 2)(2x – 1)$	A1	
	$\frac{3x - 2}{2x - 1}$	A1ft	ft on B1 and M1 but must have a bracket that cancels top and bottom. Any further work A0

Q	Answer	Mark	Comments
23	AB = 13	B1	Check diagram
	tan used with 4 and their 13	M1	their 13 must come from use of Pythagoras
	$\tan^{-1}$ (4 ÷ their 13) or tan $x = \frac{4}{13}$	M1dep	oe
	[17, 17.103]	A1ft	Answers outside this range will be due to premature rounding ft on their 13 if angle correct to 2sf or better. Radians 0.298 A0
	Additional Guidance		
	If AC used, then it must be a complete method for M2 and answer must be in range or A0		
	$AC^2 = 13^2 + 4^2$ AC = 13.6.. $\sin^{-1}$ (4 ÷ 13.6) **or** $\cos^{-1}$(13 ÷ 13.6) [17, 17.103]		B1 M2 A1
	cos A = $\frac{13^2 + 13.6^2 - 4^2}{2 \times 13 \times 13.6}$ 17.1		B1 M2 A1
	$AB^2 = 12^2 + 5^2 = 17^2$ AB = 17 $\tan^{-1}$(4 ÷ 17) 13.2		B0 M1 M1dep A1ft

Q	Answer	Mark	Comments
24(a)	$\frac{3}{ML} = \frac{x}{2.5}$	B1	
24(b)	$\frac{ML}{1.2} = \frac{4}{x}$ or $\frac{4}{ML} = \frac{x}{1.2}$	M1	oe, eg $ML : x = 4 : 1.2$
	$\frac{4.8}{x} = \frac{2.5x}{3}$ or $\frac{3ML}{2.5} = \frac{4.8}{ML}$	M1dep	oe, eg $3 \times 4.8 = 2.5x^2$ $14.4 = 2.5x^2$ $3ML^2 = 2.5 \times 4.8$ $3ML^2 = 12$ or $QB = 4.8$ or $TB = 1.5$
	$x^2 = \frac{3 \times 4.8}{2.5}$ or $ML = 2$	A1	oe
	2.4	A1	
	No progress can be made unless the first line of the scheme is achieved (unless $QB = 4.8$ or $TB = 1.5$ shown which is 2 marks). After that it is not always easy to follow working as fractions as part of fractions appear and numerators/denominators end up in the wrong place after the student attempts to simplify.		
	The following are usually a sign that the algebra has gone wrong. $4x$, $3x$, $1.2ML$, $4.5ML$, $2.5ML$ or $ML = 1.2$		