GCSE
MATHEMATICS
8300/3F

Foundation Tier

Paper 3 Calculator

Shadow paper based on June 2023 paper

Mark scheme

June 2023

Version: 1.0

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 Examiner.

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.

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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. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values a $\leqslant$ value < b
3.14 …	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
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 student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

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

Questions which do not ask students to show working

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

Misread or miscopy

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

Further work

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

Choice

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

Work not replaced

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

Work replaced

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

Premature approximation

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

Continental notation

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

Q	Answer	Mark	Comments
1(a)	7	B1	

Q	Answer	Mark	Comments
1(b)	27	B1	

Q	Answer	Mark	Comments
1(c)	63	B1	

Q	Answer	Mark	Comments
2(a)	13	B1	

Q	Answer	Mark	Comments
2(b)	1 2 5 7 13 13 18 20 or 1 2 5 7 13 or 20 18 13 13 7 or 7 and 13 or $20 \div 2$ or $\frac{8+1}{2}$th or 4.5th value	M1	full list of numbers in either order allow one missing, extra or transcription error in an otherwise full list of numbers list of first or last five numbers in either order allow only a transcription error in a list of the first or last five numbers oe works out the position of the median in the list
	10	A1	
	Additional Guidance		
	Ordered list in the stem of the question can be assumed to be for part (b) unless contradicted by the working seen in the working space		
	Numbers in a list may be seen crossed out in an attempt to find the median		
	Answer 10 from any or no list		M1A1
	Puts list in order then finds the mean		M1A0

Q	Answer	Mark	Comments
2(c)	19	B1	

Q	Answer	Mark	Comments
3(a)	C	B1	
	B and E	B1	either order

Q	Answer	Mark	Comments
3(b)	Colour spinner with all sections labelled red, blue, green or yellow with at least one of each and shape spinner with all sections labelled square, circle or triangle with at least one of each	B2	B1 one spinner with all sections labelled red, blue, green or yellow with at least one of each or one spinner with all sections labelled square, circle or triangle with at least one of each
	Additional Guidance		
	Allow any unambiguous labelling eg R for Red		
	Allow any unambiguous splitting into sections eg unruled		
	Shape spinner under Colour heading and/or Colour spinner under Shape heading can score a maximum of B1		
	Sections do not have to be equal		
	Ignore any probabilities given on the spinners		

Q	Answer	Mark	Comments
4	10.5 × 100 or 1050 or 80 ÷ 100 or 0.8 or 3 × 80 ÷ 100 or 2.4	M1	oe 970 implies 1050 9.7 implies 0.8
	their 1050 – 3 × 80 or their 1050 – 240 or 810 or 10.5 – 3 × their 0.8 or 10.5 – their 2.4 or 8.1	M1dep	oe eg 1050 – 80 – 80 – 80 oe eg 10.5 – their 0.8 – their 0.8 – their 0.8
	810 cm or 8.1 m	A1	oe

Additional Guidance	
Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts	
8 m 10 cm on answer line	M1M1A1
Units may be seen in working but must be seen with the correct value eg 810 on answer line with 810 cm seen in working	M1M1A1
10.5 – 3 × 80 = 810 centimetres or 8.1 metres	M1M1A1
10.5 – 3 × 80 = 810 or 8.1	M1M1A0
Do not ignore further incorrect conversion after correct answer seen eg 810 cm = 81 m	M1M1A0

Q	Answer	Mark	Comments
5(a)	16	B1	implied by 76 or 316
	(3rd term =) 76	B1ft	ft (their 16 + 3) × 4
	Additional Guidance		
	16 76 on answer line		B1B1
	16 and/or 76 seen but not final term eg Answer 316		B1B0
	Answer only 316		B1B0

Q	Answer	Mark	Comments
5(b)	30 × 5 or 150	M1	
	195	A1	SC1 105 or 375
	Additional Guidance		
	195, 30, … on answer line		M1A1
	195, 30, … in working with answer line blank		M1A1
	195, 30, … in working with 84 on answer line		M1A0
	195 – 45 ÷ 5 = 30 without answer 195 (embedded answer)		M1A0

Q	Answer	Mark	Comments
6(a)	3	B1	

Q	Answer	Mark	Comments
6(b)	12	B1	

Q	Answer	Mark	Comments
6(c)	$15 + 6$ or 21 or 8.48	M1	may be implied by a journey (lines or curves) ending at 8.48 on the graph
	Straight line from (8.27, 3) to (8.48, 0)	A1	$\pm\frac{1}{2}$ small square ignore any other working lines on the graph
	Additional Guidance		
	Fully correct graph		M1A1
	Accept unruled line if intention clear		

Q	Answer	Mark	Comments
7	24 × 10.4(0) or 249.60	M1	oe
	10 – 6 + 8 – 2 or 4 + 6 or 10 or (10 – 6) × 15.6(0) or 4 × 15.6(0) or 62.4(0) or (8 – 2) × 15.6(0) or 6 × 15.6(0) or 93.6(0)	M1	oe
	their 10 × 15.6(0) or their 62.4(0) + their 93.6(0) or 156	M1dep	oe dep on 2nd M their 62.4(0) and their 93.6(0) must both be from correct methods
	405.60	A1	405.6 is A0 SC2 421.2(0) or 436.8(0)

Q	Answer	Mark	Comments
8	**Alternative method 1**		
	40 + 40 + 35 or 115	M1	
	1000 ÷ 10 or 100 or 1000 ÷ 8 or 125	M1	oe eg $\frac{1}{10} \times 1000$
	100 and 115 and 125	A1	
	Alternative method 2		
	40 + 40 + 35 or 115 or 1 ÷ 10 or 0.1 or 1 ÷ 8 or 0.125	M1	oe do not accept $\frac{1}{10}$ or $\frac{1}{8}$
	their 115 ÷ 1000 or 0.115 or their 115 × 10 or 1150 or their 115 × 8 or 920	M1dep	oe eg $\frac{115}{1000}$ 0.92 implies 920 1.15 implies 1150
	0.115 and 0.1 and 0.125 or 920 and 1150 and 1000 or 0.92 and 1.15 and 1	A1	oe decimals, percentages or fractions with a common denominator

Mark scheme and Additional Guidance continue on the next page

8 cont	**Alternative method 3**		
	40 ÷ 1000 or 0.04 or 35 ÷ 1000 or 0.035 or 1 ÷ 10 or 0.1 or 1 ÷ 8 or 0.125	M1	oe do not accept $\frac{1}{5}$ or $\frac{1}{4}$
	their 0.04 + their 0.04 + their 0.035 or 0.115	M1dep	oe their 0.04 and their 0.035 must all be from correct methods
	0.1 and 0.115 and 0.125	A1	oe decimals, percentages or fractions with a common denominator
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
9	Always true Sometimes true Sometimes true	B3	B1 for each
	Additional Guidance		
	Allow any unambiguous indication eg if a cross is the only indication in a row, take that as the answer		
	A row with a tick and some crosses, mark the tick		
	A row with more than one tick is B0 for that row		

Q	Answer	Mark	Comments
10(a)	m^8	B1	
	Additional Guidance		
	Accept $1m^8$		

Q	Answer	Mark	Comments
10(b)	$6h + 14g$	B2	either order B1 $6h$ or $14g$
	Additional Guidance		
	Further incorrect work after a B2 response is B1 eg $6h + 14g = 20gh$		B1
	Further incorrect work after a B1 response is B1 eg $8h + 14g = 22gh$		B1
	$h6 + 14g$ or $6h + g14$		B1
	$h6$ or $g14$		B1

Q	Answer	Mark	Comments
11	180 ÷ 15 (= 12) and 12 × 4 = 48 or 180 ÷ 15 (= 12) and 11 × 12 (= 132) and 48 + 132 = 180 or 12 × 4 (= 48) and 12 × 11 (= 132) and 48 + 132 = 180 or 48 ÷ 4 (= 12) and 12 × 15 = 180 or 4 : 11 = 48 : 132 and 48 + 132 = 180 or 180 – 48 (= 132) and 48 : 132 = 4 : 11	B2	oe B1 180 ÷ 15 or 48 ÷ 4 or 12 oe or $\frac{4}{15}$ $\frac{11}{15}$ or 180 – 48 or 132 oe

Additional Guidance

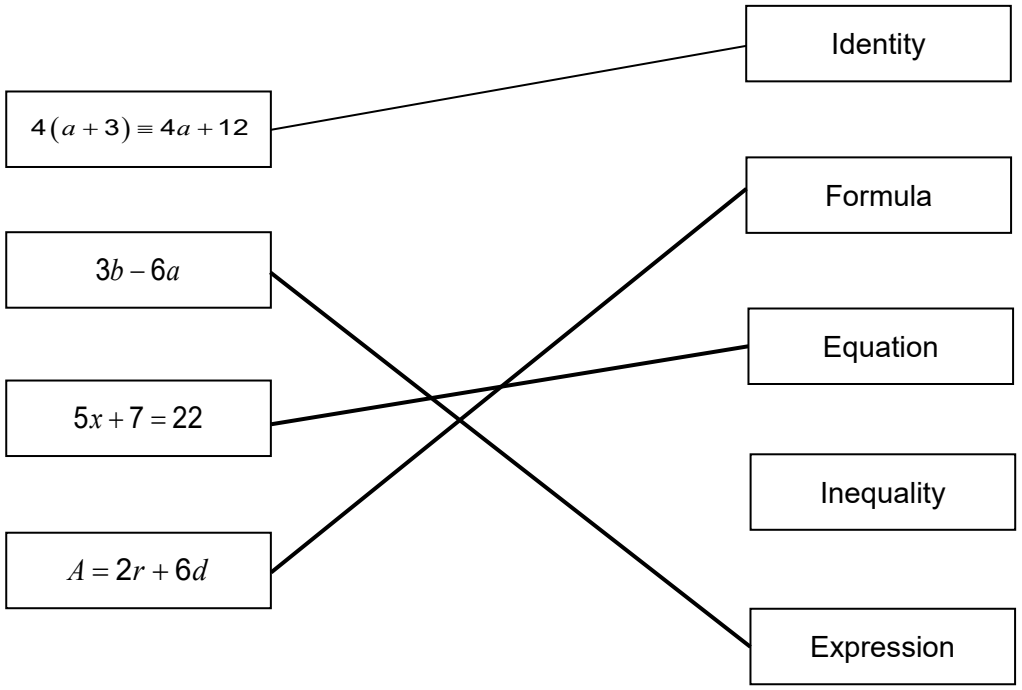
48 and 132 shown on the diagram is not oe for 48 + 132 = 180	
180 ÷ 15 × 4 = 48	B2
180 ÷ 15 and 12 × 4 and 4 : 11 = 48 : 132	B2
180 ÷ 15 = 12 and 4 : 11 = 48 : 132 (12 × 4 or 12 × 11 missing)	B1
48 : 132 and 48 + 132 = 180 (4 : 11 = 48 : 132 missing)	B1
180 ÷ 15 = 12 and 48 + 132 = 180 (12 × 4 or 12 × 11 missing)	B1
48 ÷ 4 = 12 and 180 – 48 = 132 (12 × 4 or 12 × 11 missing)	B1
48 ÷ 4 and 12 × 11 and 48 : 132 = 4 : 11 (48 + 132 = 180 missing)	B1
48 + 132 = 180	B1

Q	Answer	Mark	Comments
12(a)	Pair of numbers satisfying all criteria	B2	B1 pair of numbers satisfying two criteria eg $a = 20 \quad b = 10$ or $a = 6 \quad b = -4$
	Additional Guidance		
	a and b can be decimals eg $a = 11.2 \quad b = 1.2$		B2
	Correct integer values $a = 12 \quad b = 2$ $a = 11 \quad b = 1$ $a = 10 \quad b = 0$ $a = 9 \quad b = -1$ $a = 8 \quad b = -2$		B2

Q	Answer	Mark	Comments
12(b)	Pair of numbers satisfying all criteria	B2	eg $w = 4.6 \quad x = 1.9$ B1 pair of numbers satisfying two criteria eg $w = 4.5 \quad x = 2$ or $w = 5 \quad x = 1.5$ SC1 pair of numbers with a sum of 6.5 satisfying neither inequality
	Additional Guidance		
	$w = 1.9 \quad x = 4.6$ $w = 1.8 \quad x = 4.7$ etc		SC1

Q	Answer	Mark	Comments
13	Yes ticked and appropriate working to show *AB* and *CD* are parallel	B2	B1 any correct angle on the diagram eg 38 opposite the 38 given eg 38 written next to the 142 given or any correct angle evaluation seen in working eg 180 – 38 = 142
	Additional Guidance		
	Angles must be shown on diagram or clearly identified to score B2 eg Yes and 38 opposite the given 38 and corresponding angle at top shown as 38 and 38 + 142 = 180		
	Ignore any incorrect or irrelevant terminology alongside correct working		
	"Yes" may be implied		
	Condone an incorrect angle if not subsequently used		
	Crossed out angles on diagram may be used to support working		

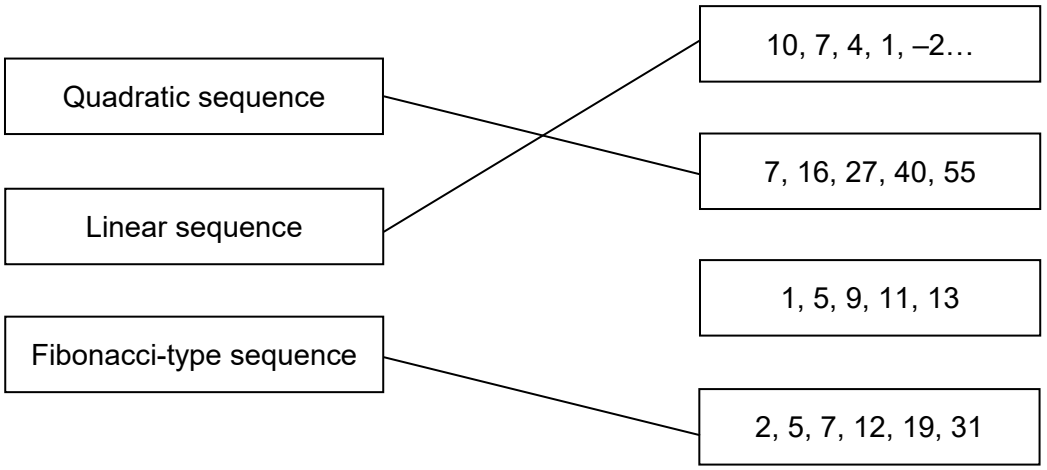
Q	Answer	Mark	Comments
14	All 3 correct matches	B3	B1 for each correct match
	Additional Guidance		
	Mark intention		
	Matching to more than one box on the right is choice for that match		



Q	Answer	Mark	Comments
15	650 ÷ 2 or 325	M1	oe eg 2 × 325
	3 × their 325 or 975	M1dep	oe 650 × $\frac{3}{2}$ is M2
	1975 – their 975 or 1000 or (1975 – their 975) ÷ 4	M1dep	oe dep on M2
	250	A1	
	Additional Guidance		
	Up to M3 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
16	13.6 × 10 ÷ 2 or 68	M1	oe
	their 68 ÷ 27.2	M1dep	
	2.5	A1	SC1 5
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	2.5 × 27.2 = 68, 68 on answer line		M1M1A0

Q	Answer	Mark	Comments
17	2 correct matches	B2	B1 for 1 correct match
	Additional Guidance		
	Mark intention		
	Matching to more than one box on the right is choice for that match		



Q	Answer	Mark	Comments	
18	$1 + 0.02$ or 1.02 or $0.02 \times 357\ 000$ or 7140 or $364\ 140$	M1	oe eg $1 + \frac{2}{100}$ $357\ 860$ implies M1	
	Full method for exactly 6 compounded percentage calculations with their multiplier	M1	oe eg $357\ 000 \times$ their 1.02^6	
	[402 000, 403 000] with M2 awarded	A1		
	Additional Guidance			
	402039.(98…) or 402040 with M2 awarded			M1M1A1
	Answer 399 840 from 7140×6			M1M0A0
	Answer 399 840 without either 42 840 shown or M2 awarded			M0M0A0
	Intermediate values for separate calculations are 364 140, 371 442.(…), 378 851.(…), 386 428.(…), 394 156.(…)			

Q	Answer	Mark	Comments
19	No ticked and correct reason or correct evaluation of the surface areas for any numerical or algebraic values or correct ratio of the surface areas	B2	eg 40 faces are hidden B1 No ticked
	Additional Guidance		
	Ignore irrelevant reasons or evaluations alongside a correct reason or evaluation, unless contradictory		
	"No" may be implied by a correct reason		
	Accept reasoning that uses A as a cube		
	No ticked and A has 6, B has 32 (condone sides for faces) A has 3, B has 16 A has 6 sides, on B each cube only has 3 or 2 Ratio is 3 : 16 (accept equivalent ratios) The inside is missing (or covered) When they are put together you lose two faces Some of the faces are covered You cannot see some sides because they are stacked together		 B2 B2 B2 B2 B2 B2 B2 B2
	Yes ticked or Cannot tell ticked		B0

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="3">20(a)</td><td>12 and –3 in the correct positions</td><td>B2</td><td>B1 12 or –3 in the correct position</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="3">
<table>
<tr><td>x</td><td>–3</td><td>–2</td><td>–1</td><td>0</td><td>1</td></tr>
<tr><td>y</td><td>21</td><td>12</td><td>5</td><td>0</td><td>–3</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Mark</th><th>Comments</th></tr>
<tr><td rowspan="6">20(b)</td><td>Plots at least three points correctly</td><td>M1</td><td>correct or ft their table in (a)
$\pm\frac{1}{2}$ small square
points may be implied by graph passing through them</td></tr>
<tr><td>Correct graph drawn through the five correct points</td><td>A1</td><td>$\pm\frac{1}{2}$ small square
smooth (quadratic) curve</td></tr>
<tr><td colspan="3">Additional Guidance</td></tr>
<tr><td colspan="2">Correct graph drawn without plotting the correct points</td><td>M1A1</td></tr>
<tr><td colspan="2">Ignore any extra points plotted</td><td></td></tr>
<tr><td colspan="2">Ignore any part of graph drawn for $x < -3$ or $x > 1$</td><td></td></tr>
<tr><td colspan="2">Ruled straight lines</td><td>A0</td></tr>
</table>

Q	Answer	Mark	Comments
21	**Alternative method 1**		
	5625 ÷ (2 + 7) or 5625 ÷ 9 or 625	M1	oe
	their 625 × 7 or 4375 or their 625 × 2 or 1250 or their 625 ÷ 5 or 125	M1dep	oe $5625 \times \frac{7}{9}$ is M2 $5625 \times \frac{2}{9}$ is M2 5625 ÷ 45 is M2
	their 4375 ÷ 5 or (5625 – their 1250) ÷ 5 or their 125 × 7 or 875	M1dep	oe dep on M2
	875 and Yes	A1	accept 875 > 870
	Alternative method 2		
	870 × 5 or 4350	M1	
	5625 ÷ (2 + 7) or 5625 ÷ 9 or 625	M1	oe
	their 625 × 7 or 4375 or their 625 × 2 or 1250	M1dep	oe dep on 2nd M $5625 \times \frac{7}{9}$ is M2 $5625 \times \frac{2}{9}$ is M2
	4350 and 4375 and Yes	A1	

Additional Guidance continue on the next page

21 cont	**Additional Guidance**	
	Up to M3 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts	
	Yes may be implied eg They receive 5 more than 870	M3A1
	Condone £875.00p and Yes	M3A1

Q	Answer	Mark	Comments
22	$100 - 60$ or 40 or $360 - 60 - 120 - 100$ or 80	M1	oe implied by 1 degree = 0.3 people or 10 degrees = 3 people or 12 customers = 40 degrees
	$\frac{12}{40} \times 360$ or 108 or $\frac{12}{40} \times 60$ or 18 or $\frac{12}{40} \times 120$ or 36 or $\frac{12}{40} \times$ their 80 or 8×3 or 12×2 or $\frac{12}{40} \times (60 + 120 + 100)$ or 84	M1dep	
	24	A1	
	Additional Guidance		
	Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		

Q	Answer	Mark	Comments
23	**Alternative method 1 – using sine of an angle**		
	sin chosen or used	M1	
	$\sin 35 = \frac{14}{x}$ or $x = \frac{14}{\sin 35}$ or $x \times \sin 35 = 14$	M1dep	oe
	[24.4, 25]	A1	
	Alternative method 2 – using cosine of an angle		
	cos chosen or used	M1	
	$\cos 55 = \frac{14}{x}$ or $x = \frac{14}{\cos 55}$ or $x \times \cos 55 = 14$	M1dep	oe
	[24.4, 25]	A1	
	Alternative method 3 – finding adjacent first		
	$\frac{14}{\tan 35}$ or $14 \times \tan 55$ or 19.9(...) or 20	M1	oe
	$\sqrt{(\text{their } 19.9(...))^2 + 14^2}$ or $\sqrt{592.(...)}$ or their 19.9(…) ÷ cos 35 or their 19.9(…) ÷ sin 55	M1dep	oe
	[24.4, 25]	A1	
	Additional Guidance		
	Do not accept scale drawing		
	$\frac{\sin 35}{15} = \frac{\sin 90}{x}$		M1

Q	Answer	Mark	Comments
24(a)	4 or 5	M1	May be implied by 2^3 or 8
	4 and 5 and $\frac{2}{40}$ or $\frac{1}{20}$ or 0.05	A1	May be implied by 2^3 or 8
	Additional Guidance		
	Do not allow exact calculations for M1A1 Eg 9.1039… = 9 and 5.49 = 5 and $\frac{2}{45}$	M1A0	

Q	Answer	Mark	Comments
24(b)	Valid explanation	B1	eg the numbers on the bottom have been rounded down so that means it will make a larger number when it is divided into the top
	Additional Guidance		
	Ignore irrelevant reasons alongside a correct reason, unless contradictory		
	Ignore a calculation using exact values alongside a correct reason eg 0.05 is greater than 0.040 (…) with **valid** explanation	B1	
	0.05 is greater than 0.040 (…)	B0	
	The denominator is larger in the unrounded version	B1	
	The denominator is smaller in the estimation.	B1	
	2 is divided by more (with answer less)	B1	
	Estimating rounds the numbers down which makes the denominator less	B1	
	Estimating rounds the numbers down which makes it less	B0	

Q	Answer	Mark	Comments
25(a)	$(x + 7)(x – 3)$	B2	either order B1 $(x + a)(x + b)$ where $ab = –21$ or $a + b = 4$
	Additional Guidance		
	Accept $1x$ for x throughout		
	$(7 + x) \times (x – 3)$		B2
	Condone missing final bracket eg $(7 + x)(–3 + x$		B2
	Ignore any attempt to solve $(x + 7)(x – 3) = 0$ eg $(x + 7)(x – 3)$ followed by $x = –7$, $x = 3$		B2

Q	Answer	Mark	Comments
25(b)	$(y =)$ 2 $(y =)$ 9	B1	either order
	Additional Guidance		
	Accept any letter eg $x = 2$ $x = 9$		B1
	2 and 9 on the answer line		B1
	2 and 9 written separately in the stem unless contradicted by answer line		B1
	2 and 9 written with $(2 – 2)(9 – 9)$ unless contradicted by answer line		B1
	$(2 – 2)(9 – 9)$ on answer line		B0
	$(2 – 2)(9 – 9)$ even if 2 and 9 circled or indicated as the embedded values		B0