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GCSE

# Mathematics

Paper 2 43652H

Mark scheme

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43652H

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Version 1 Final

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from [aqa.org.uk](http://aqa.org.uk)

## Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

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.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
<b>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between $a$ and $b$ inclusive.
<b>[a, b)</b>	Accept values $a \leq \text{value} < b$
<b>3.14...</b>	Accept answers which begin 3.14 e.g. 3.14, 3.142, 3.1416
<b>Q</b>	Marks awarded for quality of written communication
<b>Use of brackets</b>	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

**Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

**Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

**Questions which ask candidates to show working**

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

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

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

**Misread or miscopy**

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

**Further work**

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

**Choice**

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

**Work not replaced**

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

**Work replaced**

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

**Premature approximation**

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

Q	Answer	Mark	Comments
1(a)	$6x - 3 + 2x - 6$ or $8x$ or $-9$	M1	Allow one error
	$8x - 9$	A1	Do not ignore fw
	<b>Additional Guidance</b>		
	$8x + - 9$ 4 correct terms seen $8x - 9$ , followed by an equation solved or unsolved eg $8x - 9 = -x$ or $8x - 9 = 0, 8x = 9, x = \frac{9}{8}$	M1A0  M1 M1A0	
1(b)	$\frac{3}{2} < n \leq 5$ or 2, 3, 4 or 2, 4, 5 or 2, 3, 5 or 3, 4, 5 or 1, 2, 3, 4, 5 or 2, 3, 4, 5, 6	M1	
	2, 3, 4, 5	A1	SC1 for 4, 5, 6, 7, 8, 9 and 10
	<b>Additional Guidance</b>		
	4, 5, 6 Embedded answers are ambiguous so M0	M0 M0	

Q	Answer	Mark	Comments
1(c)	$12x - 20$	B1	oe $\frac{22}{4}$ or 5.5 or $3x - 5 = \frac{22}{4}$ or $x - \frac{5}{3} = \frac{22}{12}$
	$12x = 22 + 20$ or <i>their</i> $12x = 22 + \text{their } 20$	M1	oe $3x = \text{their } \frac{22}{4} + 5$ or $x = \frac{22}{12} + \frac{5}{3}$
	$\frac{42}{12}$ or $\frac{7}{2}$ or 3.5	A1ft	oe ignore fw On ft accept answers to 1dp or better
	<b>Additional Guidance</b>		
	$12x - 5 = 22, 12x = 22 + 5, x = \frac{27}{12}$ $12x - 20 = 22, 12x = 22 + 20, x = \frac{44}{12}$ $7x - 9 = 22, 7x = 22 + 9, x = \frac{31}{7}$ $12x - 20 = 22, 12x = 44, x = \frac{44}{12}$ T&I scores 3 or 0	B0M1A1ft B1M1A0 B0M1A1ft B1M0A0	

Q	Answer	Mark	Comments
2(a)	360 ÷ 8 or 135 seen	M1	oe 180 - [ [ (8 - 2) × 180 ] ÷ 8 ]
	45	A1	
	<b>Additional Guidance</b>		
	90 ÷ 2 = 45 is a valid method using symmetry		
2(b)	Angle <i>ABD</i> is 90 or angle <i>ADB</i> = <i>w</i> seen or implied or angle <i>ADB</i> = angle <i>CBD</i> seen or implied or angle <i>BCD</i> is 65 or angle <i>ABC</i> is 180 – 65 or 115 or angle <i>ADC</i> is 180 – 65 or 115 or 155 seen	M1	oe (360 – 65 – 65 – 90 – 90) or 50 May be on diagram
	180 – 65 – 90 or 180 – 155 or 115 – 90 or angle <i>ADB</i> is 25	M1dep	oe (360 – 65 – 65 – 90 – 90) ÷ 2 or 50 ÷ 2 or 90 – 65
	25	A1	
	<b>Additional Guidance</b>		
	For the first M1 angles must be clearly identified either in the diagram or in the working Use of the right angle symbol is acceptable for 90 May extend side to obtain a valid angle Working space takes precedence over diagram		

Q	Answer	Mark	Comments	
<b>3</b>	850 × 1.18 or 1003	M1	oe (990 + 15) ÷ 1.18 or 990 ÷ 1.18 or 838.9(...)	
	1003 and 1005 or 2	A1	851.(...) or 852 or 1.(...)	
	Laura and 1003 and 1005 or Laura and 2 or UK and 1003 and 1005 or UK and 2 or Laura and 851.(...) or 852 or Laura and 1.(...) or UK and 851.(...) or 852 or UK and 1.(...)	Q1ft	Strand (iii) decision to match <i>their</i> calculation ft <i>their</i> comparison of values with M1 scored, both values must be in the same currency	
	<b>Additional Guidance</b>			
	Accept name, country or price (eg the (£)850 saddle) for final answer 990 ÷ 1.18 = 838.(...), Steve (or Holland) 990 ÷ 1.18 = 838.(...), 15 ÷ 1.18 = 12.(...), 838 + 12 = 850, they both cost the same Laura with no valid working For the Q mark, follow through <i>their</i> comparison of values with M1 scored, but both values must be in the same currency and one of the values used in the comparison must be from the M1 that was awarded	M1A0Q1ft M1A0Q1ft M0A0Q0		



Q	Answer	Mark	Comments
4(a)	– 4 and 2	B2	B1 for each value in correct place in table
	<b>Additional Guidance</b>		
	– 4 when $x = -2$ and 2 when $x = 1$		
4(b)	6 or 7 of <i>their</i> points plotted correctly	M1	tolerance $\pm \frac{1}{2}$ square
	Fully correct smooth curve	A1	tolerance $\pm \frac{1}{2}$ square
	<b>Additional Guidance</b>		
	Two curves drawn: Mark the better curve		
4(c)	$y = -3$ correctly drawn	B1	Any length $> 2$ cm tolerance $\pm \frac{1}{2}$ square
4(d)	–1.8 and 2.8	B1ft	ft <i>their</i> graph or correct tolerance $\pm \frac{1}{2}$ square
	<b>Additional Guidance</b>		
	If quadratic formula used, answers are –1.79 and 2.79		
	Do not accept embedded answers or coordinates		
	Must have two answers for ft		
If 3 or more answers on ft treat as choice			

Q	Answer	Mark	Comments
5	$\frac{150}{800} (\times 100)$ or $\frac{150}{650+150} (\times 100)$ or 0.1875	M1	oe
	18.75 or 18.8 or 19	A1	oe SC1 for 81.25 or 81 or 81.3
	<b>Additional Guidance</b>		
	$\frac{800}{150}$ 19 with no working 19 is incorrect only if clearly from wrong working Build up methods score 0 or 2		M0  M1A1

Q	Answer	Mark	Comments
6(a)	720 ÷ 6 or 120	M1	720 ÷ 6 × 5 or 600
	600 and 120	A1	
	<b>Additional Guidance</b>		
	120 and 600 (order reversed)	M1A0	
6(b)	135 + 70 + 35 or 240	M1	
	<i>their</i> 240 ÷ 6 or 40	M1dep	
	2 × <i>their</i> 40 or 80	M1dep	
	10	A1	ignore fw
	<b>Additional Guidance</b>		
	Gemma 10, Beth 5, answer 15 scores full marks	M1M1M1A1	
	(120 and) 80 and 40 may be written next to the 3 : 2 : 1 in the question	M1M1M1A0	
<b>Beware of 10 from incorrect working</b> eg 135 ÷ 3 = 45, 70 ÷ 2 = 35, 35 ÷ 1 = 35, answer 10 scores 0	M0M0M0A0		

Q	Answer	Mark	Comments	
7(a)	$\frac{1}{3}$ or $\frac{2}{6}$ or 0.33(...) or $72 \div 6$ or 12 or $72 \div 6 \times 2$	M1	oe	
	24	A1	oe	
	<b>Additional Guidance</b>			
	24 out of 72			M1A1
	$\frac{24}{72}$			M1A0
2 out of 6 or 1 out of 3			M0	
7(b)	250 – 25 – 53 – 62 or 110	M1	$(25 + 53 + 62) \div 250$ or $\frac{140}{250}$ or 0.56	
	<i>their</i> $110 \div 2$ or 55	M1dep	1 – <i>their</i> $\frac{140}{250}$ or $1 - 0.56$ or 0.44	
	$\frac{55}{250}$ or 0.22 or 22%	A1	ignore fw oe $\frac{11}{50}$	
	<b>Additional Guidance</b>			
	$\frac{55}{250}$ followed by error eg = 0.2			M1M1A1
	55 in table			M1M1A0
Do not allow misreads for 250				

Q	Answer	Mark	Comments	
<b>8</b>	(Diameter or side of square =) $\sqrt{36}$ or 6 or (radius =) 3	M1	6 × 6 (= 36)	
	$\pi \times 6$ or $2 \times \pi \times 3$	M1dep		
	[18.8, 18.9] or $6\pi$	A1	Accept 19 with working shown	
	<b>Additional Guidance</b>			
	Accept [3.14, 3.142] for $\pi$ Ignore further working after $6\pi$ , that is if they incorrectly work $6\pi$ out award full marks Do not accept $\pi 6$ for the A mark 6 or 3 may be on diagram but must be correct, eg radius must be 3, not 6			

Q	Answer	Mark	Comments
9	$2x + 2x - 10 + x + 25 + 2x + 30$ or $ax + 45$ or $7x + b$	M1	Allow one error in <i>their</i> 7 terms oe $25 + 30 - 10$ or 45
	$2x + 2x - 10 + x + 25 + 2x + 30 = 360$ or $7x + 45$ or <i>their</i> $ax + 45 = 360$ or <i>their</i> $7x + b = 360$	M1dep	oe $360 - \textit{their} 45$ or 315
	$7x + 45 = 360$	M1dep	oe <i>their</i> $315 \div 7$
	45	A1	
9	<b>Additional Guidance</b>		
	$x = 45$ with no working		M3A1
	$45 + 315 = 360, \frac{315}{7} = 45$		M3A1
	$2x = 90, x = 45$ (no incorrect working seen)		M3A1
	$360 - 45 = 215, \frac{215}{7} = 30.714$		M3A0
	$45 + 215 = 360, \frac{215}{7} = 30.714$		M3A0
	Embedded answer		M3A0
	Beware of $25 + 30 - 10 = 45$		M1

Q	Answer	Mark	Comments
10(a)	$30y + 120w$ or $30(y + 4w)$	B2	oe B1 for $30y$ or $120w$ or $0.3y + 1.2w$ Do not ignore fw for B2 SC1 for $30p + 120c$
	<b>Additional Guidance</b>		
	$30yp + 120wp$		B2
	$30p + 120w$		B1
	$30y = 120w$		B1
	$0.3y + 120w$		B1
	$30y + 1.20w$		B1
	$30y + w120$		B1
	$30y + 120w = 150yw$		B1
	$30w + 120y$		B0
	$30a + 120b$		B0
	$y30 + w120$		B0
	$30p + 120p$		B0
	$30py + 120pw$		B0
	Use of letters other than $y$ or $w$ is B0		
	Ignore $p$ as units		

Q	Answer	Mark	Comments	
10(b)	<b>Alternative method 1</b>			
	$2p + r = 265$ or $p + 5r = 200$ or $3p + 6r = 465$	M1	May work in pence or pounds	
	$(2p + r = 265)$ $2p + 10r = 400$	$10p + 5r = 1325$ $(p + 5r = 200)$	M1	Equating coefficients oe
	$9r = 135$ or $r = 15$	$9p = 1125$ or $p = 125$	A1	Eliminating a variable oe
	Pen = (£)1.25 and Ruler = £0.15	A1	Condone 15p on answer line	
	<b>Alternative method 2</b>			
	$2p + r = 265$ or $p + 5r = 200$ or $3p + 6r = 465$	M1	May work in pence or pounds	
	$r = 265 - 2p$ or $r = \frac{200 - p}{5}$	$p = 200 - 5r$ or $p = \frac{265 - r}{2}$	M1	Making $p$ or $r$ the subject oe
	$9p = 1125$ or $p = 125$	$9r = 135$ or $r = 15$	A1	Eliminating a variable oe
	Pen = (£)1.25 and Ruler = £0.15	A1	Condone 15p on answer line	
	<b>Additional Guidance</b>			
	Accept: £0.15p or 125p with £ sign crossed out			
	Do not accept: 0.15p with £ sign crossed out or £125p			
	Answers reversed		M1M1A1	
2 × pens + 1 ruler = 265 with no further working		M0		
T&I scores 0 or 4				
Use any two different letters, eg $x$ and $y$ , $p$ and $r$				
Letters not words required for the first M mark, but can be recovered by showing correct working for following M mark(s)				



Q	Answer	Mark	Comments	
11	Use of tan	M1	$\sqrt{40^2 + 55^2}$ and use of sin, cos, sine rule or cosine rule	
	$\tan^{-1}\left(\frac{55}{40}\right)$ or $\tan^{-1}\left(\frac{40}{55}\right)$ or $\tan A = \left(\frac{55}{40}\right)$ or $\tan B = \left(\frac{40}{55}\right)$	M1	oe eg $\sin^{-1}\left(\frac{55}{\sqrt{40^2 + 55^2}}\right)$	
	53.9(...) or 54 or 54.0 or 36.(...) or 36.0	A1		
	143.9(...) or 144	A1	SC3 for 324 or 323.9...	
	<b>Additional Guidance</b>			
	Scale drawing can score 0, 3 or 4 but must be accurate			
	$\tan = \frac{55}{40}$ or $\tan = \frac{40}{55}$			M1M1
$\tan \frac{55}{40}$ or $\tan \frac{40}{55}$ or $\tan A = \left(\frac{40}{55}\right)$ or $\tan B = \left(\frac{55}{40}\right)$ recovered			M1M1	
$\tan \frac{55}{40}$ or $\tan \frac{40}{55}$ or $\tan A = \left(\frac{40}{55}\right)$ or $\tan B = \left(\frac{55}{40}\right)$ not recovered			M1M0	

Q	Answer	Mark	Comments
12(a)	Four correct cumulative frequencies	B1	23, 48, 87 and 100
	Five correct heights plotted	B1	(..., 12), (... , 23), (... , 48), (... , 87) and (... , 100)
	Five points plotted at correct upper boundaries	B1	(15, ...), (20, ...), (40, ...), (55, ...) and (70, ...) Must be an increasing function
	Straight lines or smooth curve going through the five points	B1ft	ft <i>their</i> 5 plotted points. Must be an increasing function
	<b>Additional Guidance</b>		
	Ignore anything to the left of <i>their</i> (15, 12) Ignore anything to the right of <i>their</i> (70, 100), must be an increasing function tolerance $\pm \frac{1}{2}$ square		
	Accept histograms / bars for heights plotted but upper boundary points must be identified either by plots or curve / polygon		

Q	Answer	Mark	Comments
12(b)	<i>their</i> LQ plotted and <i>their</i> median plotted and <i>their</i> UQ plotted	B2ft	ft <i>their</i> cf graph provided increasing function tolerance $\pm \frac{1}{2}$ square ( $\pm 1$ ) B1ft for 2 correctly plotted
	Box plot with 8 and 69 correct	B1	Correct diagrammatic representation
	<b>Additional Guidance</b>		
	Allow values plotted as points for B2ft		
13	Arc drawn from intersection of wall and fence cutting wall and fence or Arc drawn from D radius hedge length	M1	
	Complete angle bisector with all construction arcs	A1	
	Point marked in correct place, with all arcs for both constructions shown	A1	May be indicated by intersection of angle bisector and arc SC1 Point marked in correct place but no arcs
	<b>Additional Guidance</b>		
	Tree need not be labelled		
14(a)	108	B1	
	Opposite angle of a cyclic quadrilateral (add up to 180)	Q1	Strand (i) Must have 108
	<b>Additional Guidance</b>		
	Must see “opposite” and “cyclic” (oe eg quadrilateral in a circle)		

Q	Answer	Mark	Comments
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14(b)	125	B1	
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15(a)	$2x^2 - 6x + x - 3$	M1	Must be 4 terms Allow one error May be in a grid
	$2x^2 - 5x - 3$	A1	Do not ignore fw
	<b>Additional Guidance</b>		
	$2x^2 - 5x + 3$		M1A0
	$2x^2 - 5x + - 3$		M1A0
	$2x^2 - 4x - 3$		M0A0
	For method mark the four terms may be eg in a grid with correct negative signs		

15(b)	$(y - 4)(y + 6)$	B2	B1 for $(y + a)(y + b)$ such that $ab = -24$ or $a + b = 2$  or B1 for $y(y + 6) - 4(y + 6)$ or $y(y - 4) + 6(y - 4)$
	<b>Additional Guidance</b>		
	$(y + 4)(y - 6)$		B1
	$(y - 12)(y + 2)$		B1
	$(y + 13)(y - 11)$		B1
	$y(y + 6)$		B0
Condone use of $x$ or another letter			

Q	Answer	Mark	Comments
<b>15(c)</b>	$32x^5y^{15}$	B2	B1 for two terms correct in a product
	<b>Additional Guidance</b>		
	Penalise multiplication signs for B2		
	+ sign(s) in answer scores B0		
	Mark final answer		
	$32 \times x^5 \times y^{15}$		B1
	$32 \times 5x^5 \times y^{15}$		B1
	$32x^5y^8$		B1
	$32xy^{15}$		B1
	$32 + x^5 + y^{15}$		B0

Q	Answer	Mark	Comments
<b>16</b>	$75 \div 50$ or $\frac{3}{2}$ or 1.5 seen or implied or $50 \div 75$ or $\frac{2}{3}$ seen or implied	M1	oe
	$(75 \div 50)^2$ or $\left(\frac{3}{2}\right)^2$ or $1.5^2$ or 2.25 or $\frac{9}{4}$ or $(50 \div 75)^2$ or $\left(\frac{2}{3}\right)^2$ or $\frac{4}{9}$	M1dep	oe
	$6000 \times 2.25$ or 13 500 or $80 \times 6000$	M1	oe
	<i>their</i> $13\,500 \div 10\,000$ or $80 \div 10\,000$ or <i>their</i> $13\,500 \div 10\,000 \times 80$ or $80 \times 6000 \div 10\,000$ or $6000 \div 10\,000 \times 2.25$	M1dep	oe Dependent on previous M1
	108	A1	Digits 108 seen M1M1M1M1A0
	<b>Additional Guidance</b>		
$6000 \times \frac{3}{2} \times 80$ $720\,000$ implies $\frac{3}{2}$ and $6000 \times 80$ from $(6000 \times \frac{3}{2} \times 80)$  $9000$ implies $\frac{3}{2}$ Ignore assumptions about the shape			M1M0M1  M1M0M1  M1

Q	Answer	Mark	Comments
17	49 (%) seen or implied	B1	
	their $3.22 (\times 10^7) \div 51 (= 1\%)$ or their $3.22 (\times 10^7) \div 51 \times 2 (= 2\%)$ or their $3.22 (\times 10^7) \times \frac{66}{360}$	M1	oe [631 372, 631 373] 1 262 745 5 903 333
	their $3.22 (\times 10^7) \div 51 \times 49$ or their $3.22 (\times 10^7) - \frac{3.22 \times 2}{51}$ or their $3.22 (\times 10^7) \times \frac{66}{360} \div 51$	M1dep	oe [30 937 254, 30 937 255] [115 751, 115 752]
	their $3.22 (\times 10^7) \div 51 \times 49 \times \frac{66}{360}$ or $(\text{their } 3.22 - \frac{3.22 \times 2}{51}) \times \frac{66}{360}$	M1dep	oe
	5 671 830 or [5 500 000, 5 700 000]	A1	oe
	$5.67 \times 10^6$ or $6 \times 10^6$ or $[5.5 \times 10^6, 5.7 \times 10^6]$	B1ft	ft <i>their</i> answer which may be rounded and given in standard form
	<b>Additional Guidance</b>		
	$\times 10^7$ not required for method marks		
Accept decimals to 2 dp or better			

Q	Answer	Mark	Comments
18(a)	$0.\dot{5}3846\dot{1}$ or $0.\overline{538461}$	B1	
	<b>Additional Guidance</b>		
	Mark final answer		
18(b)	$\frac{37}{90}$	B1	
19	$5 \times 6$ or 30 or $20 \times 2$ or 40  or 1 (cm) square = 10 students or 1 (small) square = 0.4 students	M1	$10 \times 8$ or 80 or $5 \times 12$ or 60 or $10 \times 6$ or 60
	$5 \times 6 + 20 \times 2$ or $7 \times 10$ or $0.4 \times 175$ or 70 or $(10 \times 8) + (5 \times 12) + (10 \times 6)$ or 200	M1dep	$270 - (10 \times 8) - (5 \times 12) - (10 \times 6)$ or 70
	$\frac{\textit{their } 70}{270} \times 100$  $\frac{\textit{their } 200}{270} \times 100$	M1	oe or $\frac{30}{100} \times 270$ or 81
	25.9(...) (%) or 26 (%) 200 and 74(.1...)	A1	70 and 81 or 200 and 189
	No and 25.9(...) or No and 26 or No and 200 and 74(.1...) or No and 70 and 81 or No and 200 and 189	Q1ft	Strand (iii) ft <i>their</i> 25.9% provided all method marks have been awarded ft <i>their</i> 81 provided all method marks have been awarded



Q	Answer	Mark	Comments
20	$\frac{x-1}{(x-2)(x-1)} - \frac{x-2}{(x-2)(x-1)}$ or $x - 1 - (x - 2)$ or $2(x - 2) (x - 1)$ or $x^2 - 2x - x + 2$	M1	oe
	their $[x - 1 - (x - 2)] = 2(x - 1) (x - 2)$ or $x - 1 - x + 2$ or $2(x^2 - 2x - x + 2)$	M1dep	oe
	$2x^2 - 6x + 3 (= 0)$	A1	oe Must be three terms
	$\frac{-6 \pm \sqrt{(-6)^2 - (4 \times 2 \times 3)}}{2 \times 2}$ or $\frac{6 \pm \sqrt{12}}{4}$	M1	oe Allow one error, ft <i>their</i> quadratic
	$\frac{-6 \pm \sqrt{(-6)^2 - (4 \times 2 \times 3)}}{2 \times 2}$ or $\frac{6 \pm \sqrt{12}}{4}$	A1ft	ft <i>their</i> quadratic, fully correct oe 2.366(...) and 0.633(...)
	2.37 and 0.63	A1ft	SC2 for one correct answer to 2 dp SC1 for one correct answer to 3 dp or more
	<b>Additional Guidance</b>		
T&I with two correct answers to 2 dp scores full marks			
T&I with two correct answers to 3 dp or more loses final A mark			
ft is from <i>their</i> quadratic (must have three terms)			
One error is an incorrect substitution in one position or a short divisor line			
A negative discriminant can score M1A1ftA0ft for an attempt at a solution			

Q	Answer	Mark	Comments
21	285 or $284.\dot{9}$ or 275 or 12.5 or 13.5 or $13.4\dot{9}$ or 18.5 or $18.4\dot{9}$ or 17.5	B1	
	their 285 as part of trapezium equation or $\left(\frac{\text{their } 12.5 + \text{their } 17.5}{2}\right)h$	M1	oe their 285 = (280, 290] their 12.5 = [12.5, 13) their 17.5 = [17.5, 18)
	$285 = \left(\frac{12.5 + 17.5}{2}\right)h$	A1	oe fully correct
	19 with no incorrect bounds used	A1	

Q	Answer	Mark	Comments
<b>22</b>	<b>Alternative method 1</b> red		
	42 seen or used or probability (red and red) = $\frac{42}{90}$ or $\frac{r}{10} \times \frac{r-1}{9}$ or $1 - \left(\frac{r}{10} \times \frac{r-1}{9}\right)$	B1	oe $\frac{7}{15}$ or 0.46 or 0.466... or 0.47 or 46% or 46.6... or 47%
	$\frac{7}{10} \times \frac{6}{9}$ or $42 = 7 \times 6$ or $\left(\frac{r}{10} \times \frac{r-1}{9}\right) = \frac{42}{90}$ or $1 - \left(\frac{r}{10} \times \frac{r-1}{9}\right) = \frac{48}{90}$ or $r(r-1) = 42$ or $r^2 - r = 42$	M1	oe
	7 red	A1	
	<b>Alternative method 2</b> blue		
	$\frac{b}{10} \times \frac{b-1}{9} + 2 \times \frac{b}{10} \times \frac{10-b}{9}$	B1	oe
	$\frac{b}{10} \times \frac{b-1}{9} + 2 \times \frac{b}{10} \times \frac{10-b}{9} = \frac{48}{90}$ or $b^2 - 19b = -48$ or $b^2 - 19b + 48 = 0$ or $b = 3$	M1	oe
	7 red	A1	
	<b>Additional Guidance</b>		
	7 with no working scores full marks		

Q	Answer	Mark	Comments
<b>23</b>	$4^2 + 4^2$ or $16 + 16$ or $32$ or $2^2 + 2^2$ or $4 + 4$ or $8$	M1	oe
	$\sqrt{32}$ or $4\sqrt{2}$ or $\sqrt{8}$ or $2\sqrt{2}$	M1	Allow use of decimals to 2 dp or better
	$\cos x = \frac{\sqrt{8}}{6}$ or $0.47\dots$	M1	oe $\cos x = \frac{6^2 + 32 - 6^2}{2 \times 6 \times \sqrt{32}}$
	$[61.8, 61.9]$ or $62$	A1	