GCSE

Mathematics

43603H Unit 3: Higher

Mark scheme

4360
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Version/Stage: 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.

Q	Answer	Mark	Comments
1	19.9(0) × 1.5 ÷ 2 or 14.92(5) or 14.93 or 19.9(0) × 1.5 or 29.85	M1	
	$\dfrac{15}{100}$ × 18 or 2.7(0) or $\dfrac{15}{100}$ × 18 × 2 or 5.4(0)	M1	0.85 seen
	18 – their 2.7(0) or 0.85 × 18 or 15.3(0) or 36 – their 5.4(0) or 0.85 × 18 × 2 or 30.6(0)	M1dep	dependent on 2nd M1 oe or 0.85 × 36
	15.3(0) and 14.93 or 30.6(0) and 29.85	A1	
	A and 14.92(5) or 14.93 and 15.3(0) or A and 29.85 and 30.6(0)	Q1ft	Strand (iii) Correct comparison made for the same number of shirts with M3 scored

Additional Guidance	
A and 29.85 and 33.3(0) – discount of 15% on one shirt only	M1M1M1A0Q1ft

Q	Answer	Mark	Comments
2(a)	$P = 2(l + w)$	B1	

Q	Answer	Mark	Comments
2(b)	$A = d^2$	B1	

Q	Answer	Mark	Comments
2(c)	$S = 2(xy + xz + yz)$	B1	

Q	Answer	Mark	Comments
2(d)	$150 \div 6$ or 25	M1	
	$\sqrt{\text{their } 25}$ or 5	M1dep	
	their 5^3	M1dep	oe
	125	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
3(a)	$\pi \times 2.5^2$	M1	oe
	19.6(…)	A1	
	20	B1ft	ft their 2 sf or more answer
	Additional Guidance		
	20.0		B0

Q	Answer	Mark	Comments
3(b)	$\pi \times 16$ or 50.(…)	M1	oe
	$\pi \times \dfrac{16}{2}$ or $\pi \times 8$ or 25.(…)	M1dep	oe
	41.(…)	A1	Accept 16 + 8π Accept 40 if working shown
	Additional Guidance		

Q	Answer	Mark	Comments
4(a)	Rotation	B1	
	90$^{°}$ clockwise or 270° anti-clockwise	B1	
	(–1, 0)	B1	
	Additional Guidance		
	More than one transformation		B0
	Accept ¼ turn clockwise for 90° clockwise		

Q	Answer	Mark	Comments
4(b)		B2	B1 for translation 1 unit right or for translation 5 units down SC1 for *P* translated $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$
	Additional Guidance		

Q	Answer	Mark	Comments
	Correctly evaluated trial less than 4	M1	eg 2 → –12
	Obtains $3 \leq x \leq 4$ or better	M1dep	3 → –3 3.1 → –1.209 3.2 → 0.768 3.3 → 2.937 3.4 → 5.304 3.5 → 7.875 3.6 → 10.656 3.7 → 13.653 3.8 → 16.872 3.9 → 20.319
5	Obtains $3.4 \leq x \leq 3.5$ or two correct trials [3.35, 3.45] which bracket 6	A1	3.35 → 4.095375 3.45 → 6.563625 3.44 → 6.307584 3.43 → 6.053607 3.42 → 5.801688
	Tests 3.45 and concludes 3.4 or two correct trials [3.35, 3.45] which bracket 6 and 3.4 for final answer	Q1	Strand (ii) Using 2 dp to ensure 1 dp

Additional Guidance	
3.4 without working shown	M0M0A0Q0
3.4 without final trial	M1M1A1Q0
Allow rounded or truncated values	

	Alternative method 1		
	4.5 litres = 1 gallon seen or implied	B1	
	27 ÷ their 4.5 or 6	M1	
	their 6 × 36 or 216	M1dep	
	216 and yes	A1	
	Alternative method 2		
	4.5 litres = 1 gallon seen or implied	B1	
	36 ÷ their 4.5 or 8 or 210 ÷ 27 or 7.7(…)	M1	
	their 8 × 27 or 216 or 36 ÷ their 4.5 or 8 and 210 ÷ 27 or 7.7(…)	M1dep	
	216 and yes or 7.7(…) and 8 and yes	A1	
6	**Alternative method 3**		
	4.5 litres = 1 gallon seen or implied	B1	
	210 ÷ 36 or $5.8\dot{3}$	M1	
	their $5.8\dot{3}$ × their 4.5 or 26.25	M1dep	
	26.25 and yes	A1	
	Alternative method 4		
	4.5 litres = 1 gallon seen or implied	B1	
	27 ÷ their 4.5 or 6 or 210 ÷ 36 or $5.8\dot{3}$	M1	
	27 ÷ their 4.5 or 6 and 210 ÷ 36 or $5.8\dot{3}$	M1dep	
	6 and $5.8\dot{3}$ and yes	A1	
	Additional Guidance		
	Must clearly state their conversion		

Q	Answer		Mark	Comments
7	**Alternative method 1**			
	$y - x = 60$	$4y - 4x = 240$	M1	oe
	$y + 4x = 120$	$y + 4x = 120$	M1	oe Equating coefficients
	$5x = 60$	$5y = 360$	M1dep	oe Eliminating a variable
	$x = 12$ or $y = 72$		A1	One solution
	$x = 12$ and $y = 72$		A1	Both solutions
	Alternative method 2			
	$y - x = 60$	$2y - 2x = 120$ or $3y - 3x = 180$	M1	oe
	$y + 1.5x = 90$ or $\frac{2}{3}y + x = 60$	$y - x + y + 4x$ $= 60 + 120$ or $2y + 3x = 180$	M1	oe Equating coefficients
	$2.5x = 30$ $\quad \frac{5}{3}y = 120$ or $5y = 360$		M1dep	oe Eliminating a variable
	$x = 12$ or $y = 72$		A1	One solution
	$x = 12$ and $y = 72$		A1	Both solutions

Q	Answer		Mark	Comments
7	**Alternative method 3**			
	$y + 4x = 120$	$y + 4x = 120$	M1	
	$y + 1.5x = 90$	$\frac{8}{3}y + 4x = 240$	M1	oe Equating coefficients
	$2.5x = 30$	$\frac{5}{3}y = 120$	M1dep	oe Eliminating a variable
	$x = 12$ or $y = 72$		A1	One solution
	$x = 12$ and $y = 72$		A1	Both solutions
	Additional Guidance			

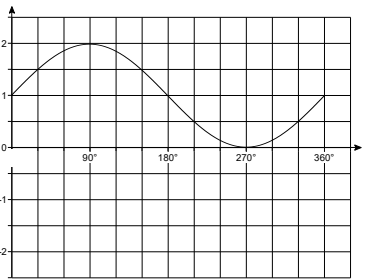| Q	Answer	Mark	Comments
8	**Alternative method 1**		
	$\dfrac{x}{x + 5} = \dfrac{6}{10}$	M1	oe Setting up a correct equation
	$10 \times x = 6 \times (x + 5)$	M1dep	oe Eliminating fractions
	$10x - 6x = 30$ or $4x = 30$	M1dep	oe Collecting terms
	7.5	A1	
	Alternative method 2		
	$\dfrac{x + 5}{10} = \dfrac{5}{4}$ or $\dfrac{x}{6} = \dfrac{5}{4}$	M1	oe Setting up a correct equation
	$4(x + 5) = 50$ or $4x + 20 = 50$	M1dep	oe Eliminating fractions
	$4x = 50 - 20$ or $4x = 30$	M1dep	oe Collecting terms
	7.5	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
9	$\frac{2}{7}$ seen or $\frac{21 \times 5}{7}$ or 15	M1	$\frac{7}{5}y$ = 21 or y = 15 (when y is length *EB*)
	$\frac{2}{7}$ × 21 or 21 – 15 or 6	M1dep	
	$\tan x = \frac{\text{their } 6}{21}$ or 0.2857(…)	M1	oe
	15.9(…) or 16	A1ft	SC2 21.8 SC1 8.4
	Additional Guidance		
	For misreading *AE* = $\frac{2}{5}$ *AB*, $\tan x = \frac{8.4}{21}$ gives $\tan x$ = 0.4 and x = 21.8		

10a	$\frac{3}{5}$	B1	

10b	60°	B1	

11a	*EOG* = 100	M1	
	40	A1	
	Additional Guidance		

11b	112	B1	
	Opposite angles of a cyclic quadrilateral add up to 180	B1dep	Must have 112
	Additional Guidance		
	Cyclic and opposite must be seen		
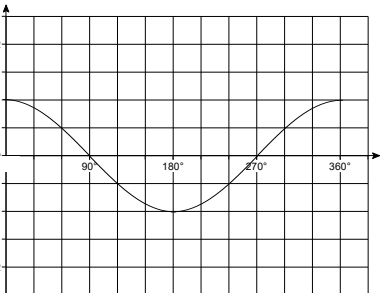
Q	Answer	Mark	Comments

11c

37	B1	
Alternate segment (theorem)	B1dep	Must have 37
Additional Guidance		

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$\dfrac{y}{\sin 73} = \dfrac{23}{\sin 40}$	M1	oe $\dfrac{y}{0.956...} = \dfrac{23}{0.642...}$
$\dfrac{23 \sin 73}{\sin 40}$	M1dep	oe $\dfrac{23 \times 0.956...}{0.642...}$
34.(2…)	A1	
Additional Guidance		
For the method marks accept rounded or truncated values		

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½ × 8.4 × 12 × sin 49	M1	$\sin 49 = \dfrac{h}{8.4}$ and h = 8.4 sin 49 or h = 6.3395(…)
38.(…)	A1	
Additional Guidance		

Q	Answer	Mark	Comments
14	$\dfrac{-3 \pm\sqrt{3^2-(4 \times 2 \times \text{-}6)}}{2 \times 2}$	M1	Allow one error
	$\dfrac{-3 \pm\sqrt{3^2-(4 \times 2 \times \text{-}6)}}{2 \times 2}$ or $\dfrac{-3 \pm\sqrt{9 + 48}}{2 \times 2}$ or $\dfrac{-3 \pm\sqrt{57}}{4}$	A1	Fully correct oe
	$- 2.64$ and 1.14	A1	SC2 for one answer ie $-2.6(\dots)$ or $1.1(\dots)$
	Additional Guidance		

Q	Answer	Mark	Comments
15	$(x + 2)(6x - 1) = 28$	M1	
	$6x^2 - x + 12x - 2 = 28$	M1dep	Allow one error
	$6x^2 +11x - 30\ (= 0)$	M1dep	Collect terms to one side, ft their four terms
	$(3x + 10)(2x - 3)\ (=0)$	A1	
	$(x = -\dfrac{10}{3}$ and$)\ \ x = 1.5$	B1ft	oe ft their two brackets
	$2(6 \times 1.5 - 1 + 1.5 + 2)$ or $14 \times 1.5 + 2$	M1	$2(6x - 1 + x + 2)$ or $14x + 2$
	23 (and $x = -\dfrac{10}{3}$ discarded)	A1	May be implied
	Additional Guidance		

Q	Answer	Mark	Comments
16	$55^2 = 32^2 + 40^2 - (2 \times 32 \times 40 \times \cos x)$	M1	oe
	$\dfrac{32^2 + 40^2 - 55^2}{2 \times 32 \times 40}$ or –0.156… or –0.16	M1dep	
	99.(…)	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
17(a)	Fully correct graph	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
17(b)	Fully correct graph	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
18	$6\mathbf{b} - 2\mathbf{a}$	M1	$2\mathbf{a} - 6\mathbf{b}$
	$2\mathbf{a} + \dfrac{1}{2}(6\mathbf{b} - 2\mathbf{a})$	M1dep	oe $6\mathbf{b} - \dfrac{1}{2}(6\mathbf{b} - 2\mathbf{a})$
	$2\mathbf{a} + 3\mathbf{b} - \mathbf{a}$	M1dep	$6\mathbf{b} + \mathbf{a} - 3\mathbf{b}$
	$\mathbf{a} + 3\mathbf{b}$	A1	$3\mathbf{b} + \mathbf{a}$
	Additional Guidance		

Q	Answer	Mark	Comments
19	$\dfrac{1}{3} \times \pi \times 9^2 \times 16$ or $432\,\pi$	M1	oe [1356, 1357.4]
	$(\dfrac{1}{2} \times)\ \dfrac{4}{3} \times \pi \times 9^3$ or $486\,\pi$ or $972\,\pi$	M1	oe [1526, 1527.1] or [3052, 3054.1]
	[1356, 1357.4] and [1526, 1527.1] or 432π and 486π	A1	
	[2882, 2884.5] or 2900 or 918π	A1	
	Additional Guidance		
	2900 with or without working		4 marks