



GCSE

Mathematics

Higher Tier Unit 3 Geometry and Algebra
Mark scheme

43603H

November 2015

Version 1.1 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 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...	Accept 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.

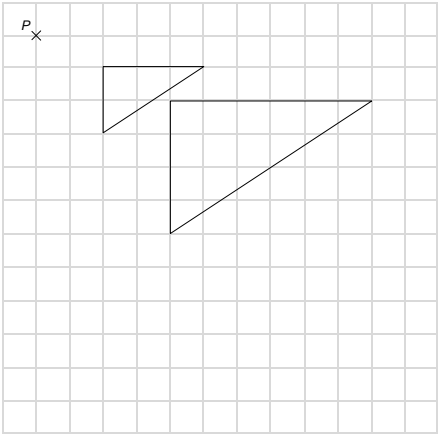
Work replaced

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	Alternative method 1		
	10×12 or 120 or $\frac{1}{2} \times 10 \times (18 - 12)$ or 30	M1	oe
	10×12 or 120 and $\frac{1}{2} \times 10 \times (18 - 12)$ or 30	M1	oe
	150	A1	
	Alternative method 2		
	10×18 or 180 or $\frac{1}{2} \times 5 \times (18 - 12)$ or 15 or $\frac{1}{2} \times 5 \times (18 - 12) \times 2$ or 30	M1	oe
	10×18 or 180 and $\frac{1}{2} \times 5 \times (18 - 12) \times 2$ or 30	M1	oe
	150	A1	
	Alternative method 3		
	$\frac{1}{2}(12 + 18) \times 5$	M1	oe
	$\frac{1}{2}(12 + 18) \times 5 \times 2$ or 75	M1	oe
	150	A1	

Q	Answer	Mark	Comments
2(a)	<p>Fully correct enlargement in correct position</p> 	B3	<p>B2 for enlargement SF2, wrong position or for 3 correct vertices plotted but no triangle drawn</p> <p>B1 for any other enlargement not SF1 or for 2 correct vertices plotted</p>
	Additional Guidance		
	Mark intention		

Q	Answer	Mark	Comments
2(b)	Alternative method 1		
	Rotation	B1	
	Origin or (0, 0) or O	B1	oe
	180 (clockwise) or 180 (anticlockwise) or -180	B1	oe
	Alternative method 2		
	Enlargement and SF -1	B2	
	Origin or (0, 0) or O	B1	oe
	Additional Guidance		
	Rotation, (0, 0), 90 then 90	B1B1B0	
	Accept 180C for 180 (clockwise)	B1	
	Accept ½ turn for 180	B1	
	Accept $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ for origin	B1	
	Enlargement (0, 0)	B0B1	
	Allow rotate, rotating, rotational (symmetry)	B1	
	Mixed transformations, eg translation of 180 reflection (0, 0)	B0B0B1 B0B1B0	
Do not accept turn for rotation	B0		
Double transformations eg Rotate, translate	B0B0B0		

Q	Answer	Mark	Comments	
3	12.5×17.6 or 220	M1		
	$\frac{7(14 + \text{their } 220)}{3}$	M1		
	546 or 546.00	Q1ft	Strand(i) ft their answer in correct money notation	
4	1 gallon = 4.5 litres stated or implied	B1	eg their $144 \div 4.5$	
	$40 \times 40 \times 90$ or 144 000	M1		
	their 144 000 \div 1000 or 144	M1dep		
	32	A1		
	Additional Guidance			
	Note: use of 1 litre = 1.75 pints implies answer 31.5			B1M1M1A1
5(a)	Alternate	B1		
5(b)	$12x - 60 (= 2x + 100)$	B1	Expanding brackets	
	$3(4x - 20) = 2x + 100$ or $12x - \text{their } 60 = 2x + 100$	M1		
	$12x - 2x = 100 + \text{their } 60$ or $10x = 160$	M1dep	oe Collecting terms	
	16	A1ft	ft their expansion	

Q	Answer	Mark	Comments	
6 alt 1	Alternative method 1			
	$\frac{1500}{600}$ or 2.5 or $\frac{600}{1500}$ or 0.4	M1	oe	
	3.3×2.5 or 8.25	M1	$9.6 \div 2.5$ or 3.84	$\frac{15}{100} \times 9.6$ or 1.44 or 0.85 seen
	$\frac{15}{100} \times 9.6$ or 1.44 or 0.85 seen	M1	$\frac{15}{100} \times 3.84$ or 0.576 or 0.85 seen	9.6 – their 1.44 or 0.85×9.6 or 8.16
	9.6 – their 1.44 or 8.16 or 0.0064×0.85	M1dep	$3.84 - 0.576$ or 0.85×3.84	their $8.16 \div 2.5$
	8.25 and 8.16	A1	3.26 or 3.264 or 3.27	
	1500 g pack identified	Q1ft	Strand(iii) correct conclusion for their values provided method marks have been awarded	

Q	Answer	Mark	Comments	
6 alt 2	Alternative method 2			
	3.3 ÷ 600 or 0.0055 (price per 1g)	M1	3.3 ÷ 6 or 0.55 (price per 100g)	
	9.6 ÷ 1500 or 0.0064	M1	9.6 ÷ 15 or 0.64	$9.6 \times \frac{15}{100}$ or 1.44 or 0.85 seen
	$\frac{15}{100} \times 0.0064$ or 0.00096 or 0.85 seen	M1dep	$\frac{15}{100} \times 0.64$ or 0.096 or 0.85 seen	9.6 – 1.44 or 0.85 × 1.44 or 8.16
	their 0.0064 – their 0.00096 or 0.85 × 0.0064 or 0.0054(4)	M1dep	their 0.64 – their 0.096 or 0.85 × their 0.64 or 0.544	8.16 ÷ 15 or 0.544
	0.0055 and 0.00544	A1	0.55 and 0.544	
	1500 g pack identified	Q1ft	Strand(iii) correct conclusion for their values provided method marks have been awarded	

Q	Answer	Mark	Comments	
6 alt 3	Alternative method 3			
	3.3 ÷ 600 or 0.0055 (price per 1 g)	M1		
	$\frac{15}{100} \times 9.6$ or 1.44 or 0.85 seen	M1	9.6 ÷ 2.5 or 3.84	$\frac{15}{100} \times 9.6$ or 1.44 or 0.85 seen
	9.6 – their 1.44 or 0.85 × 9.6 or 8.16	M1	$\frac{15}{100} \times 3.84$ or 0.85 seen or 0.576	9.6 – their 1.44 or 0.85 × 9.6 or 8.16
	their 8.16 ÷ 1500 or 0.00544	M1dep	3.84 – 0.576 or 0.85 × 3.84	their 8.16 ÷ 2.5
	0.0055 and 0.00544	A1	3.26 or 3.27	
	1500 g pack identified	Q1ft	Strand(iii) correct conclusion for their values provided method marks have been awarded	

Q	Answer	Mark	Comments
6 alt 4	Alternative method 4		
	600 ÷ 3.3 or 181.8...	M1	3.30 × 5 or 16.50
	$\frac{15}{100} \times 9.6$ or 1.44 or 0.85 seen	M1	$\frac{15}{100} \times 9.6$ or 1.44 or 0.85 seen
	9.6 – their 1.44 or 0.85 × 9.6 or 8.16	M1	9.6 – their 1.44 or 0.85 × 9.6 or 8.16
	1500 ÷ their 8.16 or 183.8...	M1	their 8.16 × 2 or 16.32
	181.8... and 183.8 ...	A1	16.32 and 1650
	1500 g pack identified	Q1ft	Strand(iii) correct conclusion for their values provided method marks have been awarded

Q	Answer	Mark	Comments
7	Alternative method 1		
	7 or 28 seen	B1	
	$2\pi r = 28$ or $\pi d = 28$	M1	oe
	$r = \frac{28}{2\pi}$ or $d = \frac{28}{\pi}$ or 8.9...	M1	oe
	4.45(...) or 4.46	A1	
	4.5	B1ft	ft rounding their answer to 1 decimal place
	Alternative method 2		
	7 or 28 seen	B1	
	Correct trial using radius = 4	M1	$2 \times \pi \times 4 = [25.12, 25.14]$
	Correct trial using radius = 5	M1	$2 \times \pi \times 5 = = 31.4...$
	4.45(...) or 4.46	A1	
	4.5	B1ft	ft rounding their answer to 1 decimal place
	Additional guidance		
	Accept 3.14 or better for pi for method marks		
	Answer 8.9 from $28 \div \pi$		B1M1M1A0 B1ft

Q	Answer	Mark	Comments
8(a)	- 6, 3 and - 1	B2	B1 for 1 or 2 correct
8(b)	their 6 or 7 points plotted	M1	$\pm \frac{1}{2}$ square tolerance
	Fully correct smooth curve	A1	$\pm \frac{1}{2}$ square tolerance
8(c)	Two correct readings from their graph at $y = - 1.5$	B2ft	B1 for each $\pm \frac{1}{2}$ square tolerance
	Additional Guidance		
	Accept the answers given in coordinates provided correct for their curve Answers must come from their graph		
9	$\frac{w}{\sin 65} = \frac{18}{\sin 40}$ or $\frac{w}{\sin 65} = 28$	M1	
	$\frac{18}{\sin 40} \times \sin 65$ or $28 \sin 65$	M1	
	25.37(...) or 25.4 or 25.38 or 25	A1	
10(a)	90 seen or implied	B1	
	$90 \div 6$ or 15 or $90 \div 6 \times 5$ or 75	M1	oe
	30	A1	
	Additional Guidance		
	30 without working		B1M1A1

Q	Answer	Mark	Comments
10(b)	Angle $LMN = 80$ or angle $MLP = 58$	M1	May be on diagram
	180 – 80 – 58	M1	oe
	42	A1	
11	$\frac{12}{3}$ or 4 or $\frac{3}{12}$ or $\frac{1}{4}$	B1	oe
	$\frac{2x-3}{5x} = \frac{3}{12}$	M1	oe
	12(2x – 3) = 3 × 5x or 24x – 36 = 15x or 9x = 36 or 4(2x – 3) = 5x or 8x – 12 = 5x or 3x = 12	M1	oe
	$x = 4$	A1	
	$(5 \times \text{their } 4)^2 - 12^2$ or 256	M1	$\frac{1}{2} \times 4 \times 3$ or 6
	$\sqrt{(5 \times \text{their } 4)^2 - 12^2}$ or 16	M1	$\frac{1}{2} \times 16 \times 12$ or 6×4^2
	96	A1	

Q	Answer	Mark	Comments
12	$\frac{-3 \pm \sqrt{3^2 - (4 \times 5 \times -4)}}{2 \times 5}$	M1	Allow one error
	$\frac{-3 \pm \sqrt{3^2 - (4 \times 5 \times -4)}}{2 \times 5}$ or $\frac{-3 \pm \sqrt{9 + 80}}{10}$	A1	Fully correct oe
	-1.24 and 0.64	A1	SC2 for either – 1.24 or 0.64
	Additional Guidance		
	-1.24 (...) or 0.64 (...)	M1A1A0	
13	$\frac{4}{3} \times \pi \times 3^3$ or [113, 113.2] or	M1	
	85 ÷ their [113, 113.2] or 85 ÷ 36π	M1	
	0.75... or 0.8	A1	

Q	Answer	Mark	Comments
14	$\sin 30 = \frac{6}{l}$	M1	
	$\frac{6}{\sin 30}$ or 12	M1dep	
	$\cos x = \frac{8}{\text{their } 12}$ or 0.66... or 0.67 or $\cos x = \frac{8 \times \sin 30}{6}$	M1dep	$\cos^{-1} \frac{2}{3}$ oe
	48.(...)	A1	
15(a)	$\cos x = \frac{8^2 + 9^2 - 15^2}{2 \times 8 \times 9}$	B1	
15(b)	$\cos x = \frac{15^2 - 8^2 - 9^2}{2 \times 8 \times 9}$ implies $x = 56.2...$ or 56.3 $\cos x = \frac{8^2 + 9^2 - 15^2}{15 \times 8 \times 9}$ implies $x = 94.2...$ $\cos x = \frac{8^2 + 9^2 - 15^2}{2 \times 8 \times 9}$ implies $x = 123.7...$ $\cos x = \frac{15^2 - 8^2 + 9^2}{15 \times 8 \times 9}$ implies $x = 77...$	B1ft	ft their answer in part (a) Accept rounding or truncation of their answers

Q	Answer	Mark	Comments
16(a)	$\vec{AB} = -6\mathbf{a} + 4\mathbf{b}$ or $\vec{AM} = -3\mathbf{a} + 2\mathbf{b}$ or $\vec{MB} = -3\mathbf{a} + 2\mathbf{b}$	M1	Need not be simplified oe
	$\mathbf{a} + \frac{1}{2}(4\mathbf{b} - \mathbf{a} - 5\mathbf{a})$ $= \mathbf{a} + \frac{1}{2}(4\mathbf{b} - 6\mathbf{a})$ $= \mathbf{a} + 2\mathbf{b} - 3\mathbf{a}$ $= 2\mathbf{b} - 2\mathbf{a}$ or $-5\mathbf{a} + 4\mathbf{b} + \frac{1}{2}(\mathbf{a} + 5\mathbf{a} - 4\mathbf{b})$ $= -5\mathbf{a} + 4\mathbf{b} + \frac{1}{2}(6\mathbf{a} - 4\mathbf{b})$ $= -5\mathbf{a} + 4\mathbf{b} + 3\mathbf{a} - 2\mathbf{b}$ $= 2\mathbf{b} - 2\mathbf{a}$	A1	oe
16(b)	$NC = 5(\mathbf{b} - \mathbf{a})$ or $5\mathbf{b} - 5\mathbf{a}$	M1	
	2 : 5	A1	5 : 2 implies M1
17	$\frac{40}{360} \times \pi \times 18^2$ or 113.(...)	M1	oe
	$\frac{1}{2} \times 18^2 \times \sin 40$ or 104.(...)	M1	oe
	8.9... or 9	A1	

Q	Answer	Mark	Comments
18	$\frac{15}{x} + \frac{6}{x+4} = 1$	M1	
	15(x + 4) or 6x	M1dep	
	$15(x + 4) + 6x = x(x + 4)$	M1dep	
	$x^2 - 17x - 60 = 0$	A1	
	$(x + a)(x + b)$	M1	Where $ab = -60$ or $a + b = -17$ If quadratic formula used allow one error
	$(x + 3)(x - 20)$ or $x = -3$ and $x = 20$	A1	
	20	A1ft	ft solution of their quadratic