GCSE

Mathematics

Unit 3 43603H

Mark scheme

43603H
June 2015

Version 1: 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.

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.
Q	Marks awarded for Quality of Written Communication
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

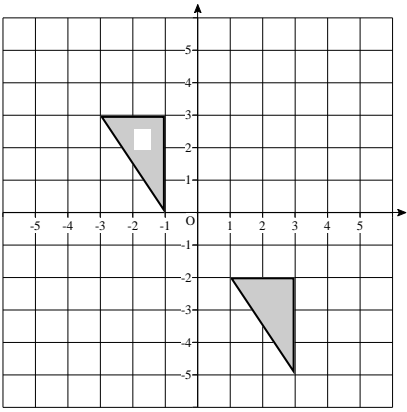Erased or crossed out work that is still legible should be marked.
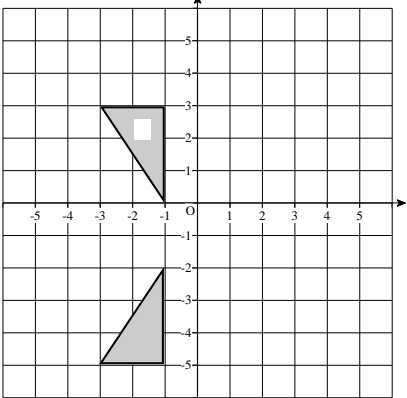
Work replaced

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	$\dfrac{150}{500}$ $(\times\ 100)$	M1	oe
	30	A1	

2(a)	Correct translation 	B2	B1 for translation 4 right or 5 down or for 3 correct points without the triangle

2(b)	Correct reflection 	B2	B1 for reflection in $y = c$ or in $x = -1$ or for 3 correct points without the triangle

Q	Answer	Mark	Comments
3	$\dfrac{30}{100}$ × 68 or 20.4 or 20 or $\dfrac{70}{100}$ × 68 or 47.6 or 48	M1	oe
	0.75 × 55 or 41(.25) or 41.3	M1	oe
	15 000 ÷ 47.6 or 315.(…) or 15 000 ÷ 48 or [312, 316]	M1dep	oe Dependent on 1st M1
	12 000 ÷ 41(.25) or 12 000 ÷ 41.3 or [290, 293]	M1dep	oe Dependent on 2nd M1
	[312, 316] and [290, 293] and A	Q1	
	Additional Guidance		
	68 – 20.4 = 45.6, 15 000 ÷ 45.6 = 329 and 291 seen		M1M1M1M1 Q0

| 4(a) | π × 0.7 <br> or 2 × π × 0.35 <br> or 2.19 | M1 | |
| | [2.198, 2.2] | A1 | Accept 0.7 π |

Q	Answer	Mark	Comments
4(b)	Consistent units seen or implied	B1	eg 1600 or [0.002 198, 0.002 2] seen
	their 1600 ÷ their [2.198, 2.2]	M1	oe Units need not be consistent
	727.(…)	A1	
	727	Q1ft	Strand (i) Rounding down their answer
	Additional Guidance		
	160 ÷ 0.7π = 72.8 so 72		B0M1A0Q1ft

Q	Answer	Mark	Comments
5(a)	4x – 5 = 15	M1	4 × 5 – 5 = 15 or 4 × 5 = 20
	4x = 15 + 5 or 4x = 20	M1dep	oe
	5	Q1	Strand (ii) SC2 Answer 5 without algebra shown

Q	Answer	Mark	Comments
5(b)	5y – 7 = y + 3	M1	
	5y – y = 3 + 7 or 4y = 10	M1	oe
	(y =) 2.5	A1	
	their 2.5 + 3 or 5 × their 2.5 – 7 or 5.5 or 5.5 × 15	M1	oe ft their y if clearly shown
	82.5	A1	
	Additional Guidance		
	4 × 2.5 = 10, 2.5 + 3 embedded value for y		M1M1A1M1A0

Q	Answer	Mark	Comments
6(a)	Never true	B1	
6(b)	Always true	B1	

Q	Answer	Mark	Comments	
7	$9^2 + 16^2$ or 81 + 256 or 337	M1		
	$\sqrt{9^2 + 16^2}$ or $\sqrt{81+256}$ or $\sqrt{337}$	M1dep		
	18.35… or 18.36	A1		
	18.4	B1ft	ft their answer to 2 dp or better	
	Additional Guidance			
	18.4 on its own			M1M1A1B1
	18.40			M1M1A1B0
	18.3			M1M1A0B0

Q	Answer	Mark	Comments
	Alternative method 1		
	$\tan 25$ $(= \dfrac{x}{30})$	M1	
	30 tan 25 or [13.9, 14]	M1	
	30 tan 25 ÷ 3 × 5 or [4.6, 4.7] × 5 or their height ÷ 3 × 5	M1	
	[23.3, 23.4]	A1	Accept 23
	Alternative method 2		
	$\dfrac{30}{\sin 65} = \dfrac{b}{\sin 25}$	M1	
	$\dfrac{30 \sin 25}{\sin 65}$ or [13.9, 14]	M1	
8	$\dfrac{30 \sin 25}{\sin 65} \div 3 \times 5$ or [4.6, 4.7] × 5 or their height ÷ 3 × 5	M1	
	[23.3, 23.4]	A1	Accept 23
	Alternative method 3		
	30 ÷ 3 × 5 or 50	M1	
	$\tan 25$ $(= \dfrac{x}{50})$	M1	
	50 tan 25	M1	
	[23.3, 23.4]	A1	Accept 23
	Additional Guidance		
	50 tan 25 or $\dfrac{50 \sin 25}{\sin 65}$		M1M1M1A0

Q	Answer	Mark	Comments
9(a)	$(180 - 38) \div 2$	M1	
	71	A1	May be on diagram if no contradiction

Q	Answer	Mark	Comments
9(b)	ODE = 90 seen or implied or CDO = 25 or COD = 130	B1	May be on diagram
	DOE = 50 or CDE = 115 or 140 seen	M1	May be on diagram
	40	A1	

Additional Guidance	
40 with no working seen	B1M1A1
115 is B1M1 unless from clearly incorrect working eg 115 leading to an answer of 65 is M1 only	

10	**Alternative method 1**		
	0.8 × 0.48 × 20 or 7.68	M1	Units need not be consistent here
	0.5 × 0.35 × 20 or 3.5	M1	Units need not be consistent here
	7.68 – 3.5 or 4.18	M1	
	(4.18 × 7.9 =) [33.0, 33.2]	A1	
	Alternative method 2		
	80 × 48 × 2000 or 7 680 000	M1	Units need not be consistent here
	50 × 35 × 2000 or 3 500 000	M1	Units need not be consistent here
	(7 680 000 – 3 500 000) ÷ 1 000 000 or 4.18	M1	
	(4.18 × 7.9 =) [33.0, 33.2]	A1	
	Alternative method 3		
	0.8 × 0.48 or 0.384 and 0.50 × 0.35 or 0.175	M1	oe
	0.8 × 0.48 – 0.50 × 0.35 or 0.209	M1dep	oe
	their 0.209 × 20 or 4.18	M1	Units must be consistent here
	(4.18 × 7.9 =) [33.0, 33.2]	A1	
	Alternative method 4		
	80 × 48 or 3840 and 50 × 35 or 1750	M1	oe
	80 × 48 – 50 × 35 or 2090	M1dep	oe
	their 2090 ÷ 1000 × 20 or 4.18	M1	Units must be consistent here
	(4.18 × 7.9 =) [33.0, 33.2]	A1	

Q	Answer	Mark	Comments
11(a)	1 0 4 in correct positions	B2	B1 for 2 correct

11(b)	6 or 7 of their points plotted correctly	M1	$\pm \dfrac{1}{2}$ square
	Fully correct smooth curve	A1	$\pm \dfrac{1}{2}$ square
	Additional Guidance		
	Curve should not curve back in from outside $x = 0$ or $x = 6$		
	Curve should not have vertical end of more than 2 small squares		

11(c)	3	B1ft	ft their graph or correct

12(a)	SAS or Side, Angle, Side or two sides and the included angle	B1	oe
	Additional Guidance		
	2 sides and included angle		B1
	2 sides and angle		B0

12(b)	RHS or Right angle, Hypotenuse, Side	B1	oe eg RSH

Q	Answer	Mark	Comments
13(a)	C	B1	

Q	Answer	Mark	Comments
13(b)	$y \, \alpha \, \sqrt{x}$ or $y = k\sqrt{x}$	B1	oe or $cy = \sqrt{x}$
	$36 = k\sqrt{100}$ or $k = 3.6$ or $y = 3.6\sqrt{x}$	M1	oe $36c = \sqrt{100}$ or $c = \dfrac{5}{18}$ or $0.277\ldots$ or $\dfrac{5}{18}y = \sqrt{x}$
	$3.6 \times \sqrt{250}$ or $56.9(\ldots)$	M1	oe $\sqrt{250} \div \dfrac{5}{18}$
	57	A1	

Q	Answer	Mark	Comments
14	½ × 5x × 3x × sin 30 or Height $= 3x \times \sin 30$ or Height $= 1.5x$	M1	oe Height may be on the diagram
	½ × 5x × 3x × sin 30 = 45 or $3.75 x^2 = 45$	M1	oe
	$x^2 = 45 \div 3.75$ or $x^2 = 12$	M1	oe
	$3.46(4\ldots)$ or 3.5 or $\sqrt{12}$ or $2\sqrt{3}$	A1	
	Additional Guidance		
	Ignore further working if $\sqrt{12}$ is followed by an attempt to simplify the surd		

Q	Answer	Mark	Comments
15	180 – 112 – 46 or 22	M1	May be seen on the diagram
	$\dfrac{15}{\sin 112} = \dfrac{x}{\sin \text{ their } 22}$	M1	oe
	$\dfrac{15 \sin \text{ their } 22}{\sin 112}$	M1	
	6.06… or 6.1 or 6	A1	

Q	Answer	Mark	Comments
16	$\dfrac{-8 \pm \sqrt{8^2 - 4 \times 5 \times 2}}{2 \times 5}$ or $\dfrac{-8 \pm \sqrt{24}}{10}$	M1	Allow one error
	$\dfrac{-8 \pm \sqrt{8^2 - 4 \times 5 \times 2}}{2 \times 5}$ or $\dfrac{-8 \pm \sqrt{24}}{10}$	A1	oe
	–0.3 and –1.3	A1	SC2 for –0.3 or –1.3

Q	Answer	Mark	Comments
17(a)	$a + \dfrac{1}{2} b$	B1	oe

Q	Answer	Mark	Comments
17(b)	$\overrightarrow{QS} = -a + b$ or $\overrightarrow{SQ} = a - b$	M1	oe
	$\overrightarrow{QN} = -\dfrac{1}{3} a + \dfrac{1}{3} b$ or $\overrightarrow{SN} = \dfrac{2}{3} a - \dfrac{2}{3} b$	M1dep	oe
	$\overrightarrow{PN} = \dfrac{2}{3} a + \dfrac{1}{3} b$ or $\overrightarrow{NM} = \dfrac{1}{3} a + \dfrac{1}{6} b$	A1	oe
	Valid reason	Q1	Strand (ii) eg *PN* is a multiple of *PM* *PN* is a multiple of *NM* $\overrightarrow{PN} = \dfrac{1}{3}(2a + b)$ and $\overrightarrow{PM} = \dfrac{1}{2}(2a + b)$ $\overrightarrow{PN} = \dfrac{2}{3}(a + \dfrac{1}{2}b)$ and $\dfrac{2}{3}\overrightarrow{PM}$

Q	Answer	Mark	Comments
18	$4 \times \pi \times 6^2$ or 144π or $452.(\ldots)$	M1	oe
	$2 \times \pi \times 9^2$ or 162π or [508, 509]	M1	oe
	$\pi \times 9^2$ or 81π or $254.(\ldots)$ or $3 \times \pi \times 9^2$ or 243π or $763.(\ldots)$	M1	oe
	$144\pi : 243\pi$	M1	oe eg $452.(\ldots) : 763.(\ldots)$ $4 \times 6 \times 6 : 3 \times 9 \times 9$
	$16 : 27$	A1	
	Additional Guidance		
	243π alone implies		M0 M1 M1 M0 A0

Q	Answer	Mark	Comments
19	$\dfrac{1}{3} \times \pi \times 1.5^2 \times 4$ or 3π	M1	
	$\dfrac{1}{3} \times \pi \times 1.5^2 \times 4 \div 0.2$ or 15π	M1dep	oe
	[47, 47.2] or 48	A1	