AQA Qualifications

GCSE

MATHEMATICS

Unit 3 43603H

Mark scheme

43603H

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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

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.

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.
Mdep	A method mark dependent on a previous method mark being awarded.
Bdep	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…	Allow 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

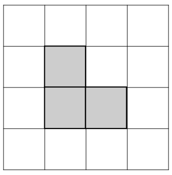
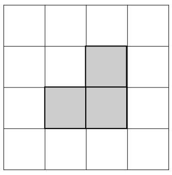
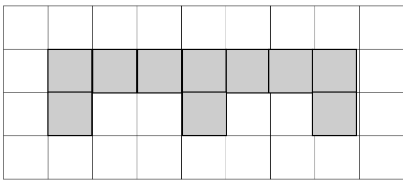
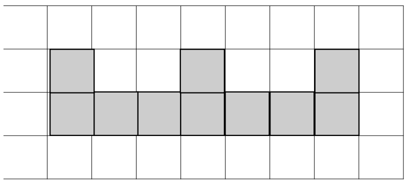
Erased or crossed out work that is still legible should be marked.

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	 	B2	Drawings can be anywhere on the grids B1 for shapes reversed or B1 for one correct
	 or 	B1	Drawings can be anywhere on the grid May be upside down
2	$2 \times \pi \times 3$ or 6π	M1	oe
	18.(…) and yes	A1	
3	Equilateral	B1	
	Valid reason	B1	eg $6x + 4$ is the same as $2(3x + 2)$ or $6x + 4 = 2(3x + 2)$ or $AB = AC = BC$ or three sides equal or all sides equal

4	Reflection	B1	Accept Reflect or Reflected
	$x = 5$	B1	

5(a)	$x + y = 180$	B1	oe $y = 180 - x$ or $x = 180 - y$ or $2x + 2y = 360$

5(b)	$y = 1.5x$	B1	oe $2y = 3x$ or $y = \frac{3}{2}x$ or $x = \frac{2}{3}y$ or $\frac{x}{y} = \frac{2}{3}$ or $\frac{y}{x} = \frac{3}{2}$

5(c)	x + their $1.5x$ or $2.5x$ or y + their $\frac{2}{3}y$ or $\frac{5}{3}y$ or $180 \div 5$ or 36	M1	
	their $2.5x = 180$ or their $\frac{5}{3}y = 180$ or $180 \div 2.5$ or 36×2 or 72 or $180 \div \frac{5}{3}$ or 36×3 or 108	M1dep	oe
	(x =) 72 and (y =) 108	A1ft	ft their (b)

6	$\frac{5}{6} \times 8 \times 1.5 \times 3$ or $8 \times 1.5 \times 2.5$ or 30 or $\frac{5}{6} \times 1000$ or 833.(...)	M1	oe $36 \div 6 \times 5$
	their 30×1000 or 30 000 or $1000 \div 20$ or 50 or $\frac{5}{6} \times 1000 \div 20$ or 41.6(6..).	M1	oe $36 \div 6 \times 5 \times 1000$
	their $30\,000 \div 20$ $(\div 60)$ or 30×50 $(\div 60)$ or 1500 $(\div 60)$ or $\frac{5}{6} \times 1000 \div 20 \times 36$ $(\div 60)$	M1dep	
	25	A1	
	Showing understanding of a volume divided by flow rate or a capacity divided by flow rate	Q1	Strand (iii) Award if a volume or a capacity divided by 20

7(a)	180	B1	

7(b)	045	B1	Condone 45

8	$5^2 + 9^2$ or $25 + 81$ or 106	M1	$\tan^{-1}\left(\frac{5}{9}\right)$ = 29.05...and sin (29.05..) = $\frac{5}{x}$ or $\tan^{-1}\left(\frac{5}{9}\right)$ = 29.05...and cos (29.05..) = $\frac{9}{x}$ or $\tan^{-1}\left(\frac{9}{5}\right)$ = 60.95...and cos (60.94..) = $\frac{5}{x}$ or $\tan^{-1}\left(\frac{9}{5}\right)$ = 60.95...and sin (60.94..) = $\frac{9}{x}$
	$\sqrt{5^2+9^2}$ or $\sqrt{25+81}$ or $\sqrt{106}$	M1dep	$\frac{5}{\sin(29.05...)}$ or $\frac{9}{\cos(29.05...)}$ or $\frac{5}{\cos(60.94...)}$ or $\frac{9}{\sin(60.94...)}$
	10.29 …	A1	Allow 10 or 10.2 if correct working shown
	10.3	B1ft	ft their 2 d.p. answer

9(a)	10×10 or 100	M1	4×10 or 40
	$\frac{1}{2} \times 3 \times 3$ or 4.5 or 3×3 or 9	M1	4×3 or 12 or $\frac{1}{2} \times 3 \times 3$ or 4.5 oe
	$\frac{1}{2} \times 3 \times 3 \times 4$ or 4.5×4 or 9×2 or 18	M1dep	$\frac{1}{2} \times (10 + 4) \times 3$ or 21 or $12 + 4.5 + 4.5$ or 21 oe dependent on 2^{nd} M1
	$100 - 18 = 82$	A1	$40 + 21 + 21 = 82$ oe

9(b)	82% of £750 seen or implied or (£) 615	M1	
	their 615×0.9 or 553.5	M1	oe multiplier 1.9 seen
	their $615 + 553.5$ or their 615×1.9	M1	
	1168.50 or 1169 or 1170	A1	1168.5 implies M3A0 SC2 (£) 1425 SC1 (£) 675

10	Fully correct locus	B3	B2 for two correct straight lines or two correct semi-circles or one correct straight line and one correct semicircle B1 for one correct straight line or one correct semicircle B1 for correct shape but incorrect size

11(a)	Equation	B1	

11(b)	Formula	B1	

11(c)	Identity	B1	

11(d)	Expression	B1	

12(a)	(0, 6, 10)	B1	

12(b)	(4, 6, 0)	B1	

12(c)	Two from 4 × 6 or 24 4 × 10 or 40 6 × 10 or 60	M1	
	(4 × 6 + 4 × 10 + 6 × 10) × 2 or (24 + 40 + 60) × 2	M1dep	oe
	248	A1	

13	**Alternative Method 1**		
	$4(3x - 2) = 10$ or $8x - y = 10$	B1	
	$12x - 8$ seen (= their 10)	M1	$3x - 2 = 2.5$ oe
	$12x$ = their 8 + their 10 or $12x = 18$	M1	$3x = 4.5$
	$x = 1.5$	A1	oe
	$8 \times$ their $x - y$ = their 10 or $12 - y$ = their 10 or $y = 8 \times$ their x – their 10	M1	
	$y = 2$	A1ft	SC3 for $x = 9$ and $y = -28$ SC2 for $x = 9$
	Alternative Method 2		
	$4(3x - 2)(8x - y) = 100$	B1	oe
	$4(3x - 2) = 8x - y$ or $-y = 4(3x - 2) - 8x$	M1	oe
	$4(3x - 2)(8x - (4(3x - 2) - 8x)) = 100$ or $144x^2 - 192x - 36 = 0$ or $12x^2 - 16x - 3 = 0$ or $(2x - 3)(6x + 1) = 0$	M1	oe
	$x = 1.5$	A1	
	$8 \times$ their $x - y$ = their 10 or $12 - y$ = their 10 or $y = 8 \times$ their x – their 10	M1	
	$y = 2$	A1ft	

14	tan chosen	M1	100 = 116 + 16 – 2 × $\sqrt{116}$ × 4 cos x $\frac{\sin x}{10} = \frac{\sin 90}{\sqrt{116}}$ oe
	tan x = $\frac{10}{4}$ tan x = 2.5	M1dep	oe If hypotenuse used sin x = $\frac{10}{\sqrt{116}}$ or cos x = $\frac{4}{\sqrt{116}}$ or cos x = $\frac{116+16-100}{2\times\sqrt{116}\times 4}$ sin x = 0.928… or 0.93 or cos x = 0.37…
	[68, 68.2]	A1	

15(a)	*OCA* = 36 or *ACB* = 90 or *COA* = 108 or *COB* = 72 or *OBC* = 54 or 90 – 36 or (180 – 72) ÷ 2	M1	oe May be on diagram
	54	A1	

15(b)	(Triangle) *RDC* is isosceles or *RC* and *RD* are equal tangents	B1	May be implied from 90 and 45 in triangle *RDC*
	Angle *RDC* = y or Angle *RCD* = y	B1	
	Angle *RDC* or Angle *RCD* is 45 and alternate segment (theorem) stated	Q1	Strand (ii) Complete reasons with both B marks scored

16(a)	$\dfrac{11^2+12^2-15^2}{2\times11\times12}$	M1	$15^2 = 11^2 + 12^2 - 2 \times 11 \times 12 \cos x$ oe
	$\dfrac{40}{264}$ or $\dfrac{5}{33}$ or 0.15…	A1	oe
	81 or 81.28(…) or 81.29 or 81.3	A1	SC1 for 52.25(...) or 52 or 52.3 or 52.26 or 46.45(...) or 46 or 46.5 or 46.46

16(b)	$\dfrac{BC}{\sin 35} = \dfrac{8}{\sin 74}$	M1	oe
	$\dfrac{8\sin 35}{\sin 74}$	M1dep	
	4.77(…) or 4.8	A1	Accept 5 with some correct working shown

17	$\dfrac{--12\pm\sqrt{(-12)^2-4\times3\times-5}}{2\times3}$ or $\dfrac{12\pm\sqrt{144+60}}{6}$	M1	Allow one error
	$\dfrac{--12\pm\sqrt{(-12)^2-4\times3\times-5}}{2\times3}$ or $\dfrac{12\pm\sqrt{144+60}}{6}$	A1	oe
	4.38 and –0.38	A1	SC2 for 4.38 or –0.38

18	**Alternative Method 1**		
	States that total angle for arcs is 180°	Q1	Strand (i) Accept “half a circle” or “semi-circle”
	$\pi \times 8^2 \div 2$ or [100, 101]	M1	oe
	$\pi \times 8^2 \div 2 + 64 + 64$ or [100, 101] + 64 + 64	M1dep	
	[228, 229] or 230	A1	Accept $32\pi + 128$ SC1 for $\pi \times 8^2$ or [200, 202] and 64 or 128 seen
	Alternative Method 2		
	States that total angle for arcs is 180°	Q1	Strand (i) Accept “half a circle” or “semi-circle”
	$\frac{\theta}{360} \times \pi \times 8^2$ and $\frac{180-\theta}{360} \times \pi \times 8^2$	M1	oe $\theta < 180$
	$\frac{\theta}{360} \times \pi \times 8^2 + \frac{180-\theta}{360} \times \pi \times 8^2 + 64 + 64$	M1dep	
	[228, 229] or 230	A1	Accept $32\pi + 128$ SC1 for $\pi \times 8^2$ or [200, 202] and 64 or 128 seen

19	3 and 7.5 seen or 4 : 1 or 1 : 4 seen or implied	B1	
	$\pi \times 6 \times 15$ or 90π or [282, 283] or $\pi \times 3 \times 7.5$ or 22.5π or [70, 71]	M1	oe
	$\pi \times 6 \times 15 - \pi \times 3 \times 7.5$ or $90\pi - 22.5\pi$ or $\pi \times 6 \times 15 \times \frac{3}{4}$	M1dep	oe
	[211.8, 212.2] or 67.5π or $\frac{135}{2}\pi$	A1	Ignore fw

20(a)	Correct sketch	B2	B1 for one correct step

20(b)	Correct sketch	B2	B1 for one correct step