AQA Qualifications

GCSE
MATHEMATICS

Unit 3 43603H
Mark Scheme

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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.
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 …	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	Correct enlargement or $\frac{1}{2} \times 3 \times 2$ or Area factor 9 or 9 and 6 seen	B1	Seen or implied oe
	$\frac{1}{2} \times 9 \times 6$ or $\frac{1}{2} \times 3 \times 2 \times 3^2$	M1	oe
	27	A1ft	ft their triangle
2(a)	1, 0, 4	B2	B1 for 2 correct
2(b)	their 5 points plotted correctly	M1	$\pm\frac{1}{2}$ square
	Fully correct smooth curve	A1	$\pm\frac{1}{2}$ square
2(c)	Translation of their graph 3 units in negative y direction or fully correct graph	B2ft	$\pm\frac{1}{2}$ square B1 for their translated 5 points plotted (–2, 1) etc B1 for clear intention to translate 3 units in negative y direction
3	180 – 107 or 73 or 107 – 90 or 17	M1	oe
	180 – their 73 – their 73 or 17×2	M1dep	oe (90 – their 73) $\times$ 2
	34	A1	

Q	Answer	Mark	Comments
4	$x + 35 + x - 23 = 180$	M1	oe $2x + 12 = 180$
	$2x = 180 - 12$ or $2x = 168$	M1dep	$(180 - 12) \div 2$ or 84 Terms collected
	119	A1	
	$x = 84$ and an algebraic equation with both method marks awarded for correct algebra	Q1	Strand (ii)
5	$2\frac{4}{7} + 5\frac{3}{5} + 2\frac{4}{7} + 5\frac{3}{5}$	M1	oe $\frac{572}{35}$ or 16.3
	$16\frac{12}{35}$	A1	
6	8 × 500 000 or 4 000 000	M1	1 km = 1000 m **and** 1 m = 100 cm seen or 1 km = 100 000 cm seen or implied
	8 × 500 000 ÷ 100 or 8 × 500 000 ÷ 1000 or 8 × 500 000 ÷ 100 000	M1dep	oe
	40	A1	
	Alternative method		
	or 500 000 ÷ 1000 or 500 or 500 000 ÷ 100 or 5000 or 8 ÷ 100 or 0.08 or 8 ÷ 1000 or 0.008	M1	1 km = 1000 m **and** 1 m = 100 cm seen or 1 km = 100 000 cm seen or implied
	or 500 000 ÷ 100 000 or 5 or 500 000 ÷ 1000 × 8 or 4000 or 500 000 ÷ 100 × 8 or 40 000 or 500 000 ÷ 100 ÷ 1000 or 8 ÷ 100 000 or 0.000 08	M1dep	
	40	A1	

Q	Answer	Mark	Comments
7(a)	$\frac{1}{2} \times (280 + 198) \times 86$ or $198 \times 86 + \frac{1}{2} \times (280 - 198) \times 86$ or $280 \times 86 - \frac{1}{2} \times (280 - 198) \times 86$	M1	oe
	20 554	A1	
7(b)	their 20 554 ÷ 4047 or 5.08 or 5.07... or 5.1	M1	4047 ÷ 7 = 578.(14…)
	their 5.08 × 7	M1dep	their 20 554 ÷ their 578.(14…)
	35.5… or 35.56 or 35.7	A1	
	35	Q1ft	Rounding down

Q	Answer	Mark	Comments
8	$2 \times \pi \times 7$ or [43.9, 44]	M1	oe 14π
	$2 \times \pi \times 7 \div 4$ or [10.9, 11] or $2 \times \pi \times 7 \times 3$ or [131.9, 132]	M1dep	oe $7\pi / 2$ oe 42π
	$2 \times \pi \times 7 \div 4 \times 3$ or [32.9, 33]	M1dep	oe $21\pi / 2$
	[46.9, 47]	A1	$10.5\pi + 14$ oe SC2 for [23.4, 23.5] or [30.4, 30.5] SC1 for [16.4, 16.5]

Q	Answer	Mark	Comments
9	Trial such that root < trial ≤ 4	M1	eg $3^3 + 3 = 30$ (too big) Obtains $2 < x \le 4$ or better
	Improved correct trial	M1	2 < trial < 1st trial or 2 < trial < root eg $2.5^3 + 2.5 = 18.125$ (too small)
	Obtains $2.8 < x < 2.9$ or better or obtains $2.75 < x < 2.85$ or better	A1	2.6 ⇒ 20.(176) or 20.2 2.7 ⇒ 22.(383) or 22.4 2.8 ⇒ 24.(752) or 24.8 2.9 ⇒ 27.(289) or 27.3 2.75 ⇒ 23.5(468…)
	Tests 2.85 (or 2.82, 2.83 or 2.84) and concludes 2.8	Q1	2.85 ⇒ 25.9(99…) or 26 2.84 ⇒ 25.7(46…) 2.83 ⇒ 25.4(95…) or 25.5 2.82 ⇒ 25.2(45…) Using 2 dp to ensure 1 dp Strand (ii) Note: 2.81 ⇒ 24.998…

10	$\pi \times 4 \times 4 \times 9$ or 144π	M1	[452, 453] or 450
	$\pi \times 10 \times 10 \times 36$ or 3600π	M1	[11 300, 11 320]
	$3600\pi \div 144\pi$	M1dep	[11 300, 11 320] ÷ [452, 453] or 450
	25	A1	Condone [24.9, 25.1] SC2 for [24.9, 25.1] using incorrect formulae
	Alternative method		
	Ratio (SF) of radii = 2.5	M1	
	Ratio (SF) of height = 4	M1	
	$2.5 \times 2.5 \times 4$	M1dep	
	25	A1	Condone [24.9, 25.1] SC2 for [24.9, 25.1] using incorrect formulae

Q	Answer	Mark	Comments
11(a)	180 – 90 – 74 or 90 – 74	M1	
	16	A1	
11(b)	8.7 and tangents from the same point (are equal)	B1	oe
11(c)	tan 74 $= \frac{8.7}{r}$ or tan 16 $= \frac{r}{8.7}$	M1	$\frac{8.7}{\sin 74} = \frac{r}{\sin 16}$
	$\frac{8.7}{\tan 74}$ or 8.7 tan 16	M1dep	$\frac{8.7 \sin 16}{\tan 74}$
	2.49(…) or 2.5	A1ft	ft from part (a)

Q	Answer	Mark	Comments
12(a)	$5x \times 5x \times 5x$ or $125x^3$ or $5x \times 2x \times x$ or $10x^3$	M1	oe $(5x)^3$
	$5x \times 5x \times 5x - 5x \times 2x \times x$	M1dep	
	$125x^3 - 10x^3$	A1	SC1 for 125 and 10 seen
12(b)	115×3.5^3	M1	$(5 \times 3.5)^3 - 10 \times 3.5^3$
	4930(.625) or 4931	A1	

Q	Answer	Mark	Comments
13	Fully correct construction with circle in tolerance and all arcs shown	B4	B3 Fully correct except using one pair of arcs and midpoint to construct perpendiculars B3 Perpendiculars fully correct with arcs intersecting in two places and no circle or circle out of tolerance B2 Using one pair of arcs and midpoint to construct perpendiculars, no circle or circle out of tolerance B2 No arcs, two perpendiculars correct and circle in tolerance B2 One perpendicular fully correct with arcs intersecting in two places B1 No arcs, two perpendiculars correct and no circle or circle out of tolerance
14	$(2x + 1)^2$ or $(2x - 1)^2$	M1	oe 8, 15, 17 seen
	$4x^2 + 2x + 2x + 1$ or $4x^2 + 4x + 1$	A1	
	$4x^2 - 2x - 2x + 1$ or $4x^2 - 4x + 1$	A1	$2x + 1 = 17$ or $2x - 1 = 15$
	$(2x + 1)^2 = (2x - 1)^2 + 8^2$ or their $(2x + 1)^2 =$ their $(2x - 1)^2 + 8^2$ or $4x^2 + 2x + 2x + 1$ $= 4x^2 - 2x - 2x + 1 + 64$ or $8x = 64$	M1	oe $2x = 16$
	8	A1	Do not accept 8 without working

Q	Answer	Mark	Comments
15(a)	$y \alpha \frac{1}{x}$ or $y = \frac{k}{x}$	M1	oe 5 × 9 or 45 seen
	$5 = \frac{k}{9}$ or k = 45	M1dep	oe
	$y = \frac{45}{x}$	A1	oe
15(b)	their 45 ÷ 15	M1	
	3	A1ft	ft on inverse proportion

16	9.5 ÷ 2 (= 4.75) or 19 × 2 (= 38) or 9.5 ÷ 19 (= 0.5)	M1	
	57 ÷ 3 (= 19) or 19 × 3 (= 57) or 57 ÷ 19 (= 3)	M1	
	76 ÷ 4 (= 19) or 19 × 4 (= 76) or 76 ÷ 19 (= 4)	M1	
	A with full verification	A1	eg A and 4.75 (19 and 19) Checking density or A and 38 (57 and 76) Checking masses or A and 0.5 (3 and 4) Checking volumes

Q	Answer	Mark	Comments
17(a)	$\dfrac{9^2+5^2-11^2}{2\times9\times5}$ $(=\cos x)$	M1	$11^2=9^2+5^2-2\times9\times5\cos x$
	$-0.16(6\ldots)$ or -0.17 or $-\dfrac{15}{90}$ or $-\dfrac{1}{6}$	A1	Can be implied from answers of 99.(....) with 1st M1 awarded
	[99.59, 100]	A1	
17(b)	$\dfrac{1}{2}\times9\times5\times\sin$ (their 99.6)	M1	
	$\dfrac{1}{2}\times9\times5\times\sin$ (their 99.6) $\times 4$	M1dep	oe $\dfrac{1}{2}\times9\times5\times\sin$ (their 99.6) $\times 2$ $+\ \dfrac{1}{2}\times9\times5\times\sin$ (180 – their 99.6) $\times 2$
	[88.6, 89]	A1ft	
18	$\dfrac{240}{x-12}$ or $\dfrac{240}{x}$	M1	$x-12=\dfrac{240}{t+1}$ or $x=\dfrac{240}{t}$
	$\dfrac{240}{x-12}$ and $\dfrac{240}{x}$	M1dep	$x-12=\dfrac{240}{t+1}$ and $x=\dfrac{240}{t}$
	$\dfrac{240}{x-12}-\dfrac{240}{x}=1$	M1dep	$\dfrac{240}{t}-12=\dfrac{240}{t+1}$
	$240x-240(x-12)=x(x-12)$ or $2880=x^2-12x$ or $x^2-12x-2880=0$	M1dep	$240(t+1)-12t(t+1)=240t$ or $t^2+t-20=0$ oe
	$(x+48)(x-60)$ or correct use of formula $\dfrac{-12\pm\sqrt{12^2-4(1)(-2880)}}{2(1)}$ or $(x-6)^2-36-2880=0$	M1	$(t+5)(t-4)$ or correct use of formula $\dfrac{-1\pm\sqrt{1^2-4(1)(-20)}}{2(1)}$
	60	A1	SC2 for 60 from trial and error

SP/12/13