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General Certificate of Secondary Education
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Mathematics 43603H

Unit 3 Higher tier

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

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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.

Unit 3 Higher Tier

Q	Answer	Mark	Comments
1a	Correct translation drawn	B1	
1b	$\begin{pmatrix} 5 \\ -6 \end{pmatrix}$ or 5 (squares) right and 6 (squares) down	B2	B1 for one part correct
2	$3x$ or $2x$ seen for missing sides	B1	May be on diagram or in working
	$4x + 4x + 2x + 3x + 2x + x$ (= 56)	M1	oe $16x$ implies B1M1
	their $16x = 56$	M1	
	3.5 or $\frac{7}{2}$ or $3\frac{1}{2}$	A1ft	SC2 for $\frac{56}{11}$ or 5.09... or 5.1 SC2 for $\frac{56}{13}$ or 4.3... SC2 for 4 SC applies if method marks not awarded.
3	$2 \times \pi \times 4.2$ or $2 \times 3.14(\ldots) \times 4.2$	M1	
	[26.3, 26.4]	A1	
	26.4	B1ft	ft their 2 d.p. or more answer SC1 for 55.4
4	*ACB* = 48 or *BAC* = 180 − 100 − 48 (= 32)	M1	May be on diagram
	180 − 32 or 100 + 48	M1dep	
	148	A1	

Q	Answer	Mark	Comments
5	7	B1	Any order
	$3x - 7 = 11$	M1	
	6	A1	
	$3x - 7 = x + 4$	M1	
	5.5 or $\frac{11}{2}$ or $5\frac{1}{2}$	A1	

Q	Answer	Mark	Comments
6	0.2×40 or $\frac{20}{100} \times 40$ or 8 or $\frac{80}{100} \times 40$	M1	oe 40 ÷ 50 (= 0.8) and 0.8×0.2 or 0.8×0.8
	32	A1	0.16
	50 ÷ their 32 or 80 ÷ 55 1.5(6...) or 1.4(5...) or their 32 ÷ 50 or 55 ÷ 80 or 0.64 or 0.68(75) or 0.69	M1	oe 0.8 − 0.16 or 0.64 or 50 ÷ 40 = 1.25 and 1.25 ÷ 0.8
	50 ÷ their 32 and 80 ÷ 55 or their 32 ÷ 50 and 55 ÷ 80 or their 32 ÷ 50 × 80 or 55 ÷ 80 × 50	M1dep	Attempt to match equal quantities or equal prices 0.8 − 0.16 and 55 ÷ 80 1.25 ÷ 0.8 and 80 ÷ 55
	1.5(6...) and 1.4(5...) 0.64 and 0.68(75) or 0.69 51(.2) 34(.375)	A1	ml per £ £ per ml 80 ml of small bottle 50 ml of large bottle
	Correct conclusion (Small bottle (50 ml) if correct)	Q1ft	Strand (iii) ft from their working Dependent on 2nd and 3rd method marks

Q	Answer	Mark	Comments
Alt6	0.2×40 or $\frac{20}{100} \times 40$ or 8 or $\frac{80}{100} \times 40$	M1	oe 40×8 (= 320) and 320×0.2 or 320×0.8
	32	A1	64
	their 32×8 or 55×5 or 256 or 275	M1	oe 320 − 64 or 256
	their 32×8 and 55×5	M1dep	Attempt to match equal quantities or equal prices
	256 and 275	A1	
	Correct conclusion	Q1ft	Strand (iii) ft from their working Dependent on 2nd and 3rd method marks
7a	250 000 ÷ 100 or 2500 or 250 000 ÷ 1000 or 250	M1	100×1000 or 100 000
	250 000 ÷ 100 ÷ 1000	M1dep	250 000 ÷ their 100 000
	2.5	A1	
7b	5.5 seen	B1	
	5.5×4 or their min $\times 4$	M1	Do not accept 6×4 $5.5 < \text{min} < 6$
	22	A1ft	SC2 for 26
8	$13^2 + 6.5^2$ or 169 + 42.25	M1	211.25 or 211.3
	$\sqrt{13^2 + 6.5^2}$	M1dep	oe
	14.5(34…)	A1	Accept 15 with working

Q	Answer	Mark	Comments
9	Other angle of 70 seen or $B = 90$	M1	Angles seen on diagram must be in the correct place
	$180 - 90 - 70$ or 20 seen or $DBC = 40$	M1	
	$90 - 20 - 20$ or $180 - 90 - 40$	M1dep	oe dependent on both previous M marks
	50	A1	
10	Correctly evaluated trial such that root < trial ≤ 6	M1	e.g. $6^3 - 20 \times 6 = 96$ Too big Obtains $5 < x < 6$ or better (need not be stated)
	Improved trial	M1	$5 <$ Trial $< 1^{st}$ trial e.g. $5.5^3 - 3 \times 5.5 = 56.(375)$ or 56.4 Too small 5.1 → 30.(6…) or 30.7 5.2 → 36.(6…) 5.3 → 42.(8…) or 42.9 5.4 → 49.(4…) or 46.5 5.5 → 56.(3…) or 56.4
	Obtains $5.5 \leq x \leq 5.6$ or better or Two correct trials [5.55, 5.65] which bracket 60	A1	5.6 → 63.(6…) 5.7 → 71.(1…) or 71.2 5.8 → 79.(1…) 5.9 → 87.(3…) or 87.4 5.55 → 59.(95) 5.56 → 60.(6...) or 60.7
	Tests 5.55 and concludes 5.6 or Two correct trials [5.55, 5.65] which bracket 60 and 5.6 for final answer	A1	Using 2 dp to ensure 1 dp Strand (ii)

Q	Answer	Mark	Comments
11a	70	B1	
11b	4y + y = 180 or 5y = 180 or 180 ÷ 5	M1	oe
	36	A1	
12	tan 35 = $\frac{x}{40}$	M1	oe $\frac{40}{\sin 55} = \frac{x}{\sin 35}$
	40 tan 35 or 28	M1dep	oe $\frac{40 \sin 35}{\sin 55}$
	their 28.(…) + 1.8	M1dep	
	29.8…	A1	
	29.8 or 30	B1ft	ft is for any answer given to 2 s.f. or 3 s.f. if no evidence of incorrect rounding.

Q	Answer	Mark	Comments
13	15 ÷ 10 (= 1.5) or 10 ÷ 15 (= $\frac{2}{3}$) or ($\frac{w}{15}$ =) $\frac{3}{10}$ or ($\frac{15}{w}$ =) $\frac{10}{3}$ or ($\frac{w}{3}$ =) $\frac{15}{10}$	M1	oe Accept ratios e.g. 3 : 10
	3 × their 1.5 or 3 ÷ their $\frac{2}{3}$ or 15 × $\frac{3}{10}$ or 3 × $\frac{15}{10}$	M1dep	oe 1.5^2 or $(\frac{2}{3})^2$ seen
	4.5	A1	1.5^2 and 30 seen or $(\frac{2}{3})^2$ and 30 seen
	15 × 4.5	M1	1.5^2 × 30 or 30 ÷ $(\frac{2}{3})^2$
	67.5	A1	oe
14	π × 90 × 90 × 200	M1	[5 080 000 ,5 120 000]
	π × 90 × 90 × 200 ÷ 4 or π × 90 × 90 × 200 ÷ 1000	M1dep	[5080, 5120] [1 270 000, 1 280 000]
	π × 90 × 90 × 200 ÷ 4 ÷ 1000	M1dep	405π implies M3
	[1270, 1280] or 1300	A1	SC2 for [317.5, 318.5] or 320
15	43	B1	
	Alternate segment (theorem)	Q1	Strand (i) Do not accept Alternate Dependent on B1

Q	Answer	Mark	Comments
16	$(x=)\ \frac{-5 \pm \sqrt{5^2 - 4(6)(-3)}}{2 \times 6}$	M1	Allow one error
	$(x=)\ \frac{-5 \pm \sqrt{5^2 - 4(6)(-3)}}{2 \times 6}$ $\frac{-5 \pm \sqrt{25+72}}{12}$	A1	$\frac{-5 \pm \sqrt{97}}{12}$
	0.40 and -1.24	A1	
17	3×180 or 540 seen or Exterior angle = 360 ÷ 5 or 72	M1	Must be convinced that 360 ÷ 5 is for the exterior angle May be on diagram
	(Interior angle =) 108	A1	Must be convinced that 108 is for the interior angle May be on diagram
	108 – 72 or acute angle in rhombus = 72 or acute angle in rhombus = 180 – their obtuse interior angle	M1	May be on diagram 180 – 72 – 72 or (180 – 108) ÷ 2
	36	A1ft	ft for obtuse interior angles only

Q	Answer	Mark	Comments
18a	$y = kx$ $y = kx^2$ $y = \frac{k}{x}$ $y = \frac{k}{x^2}$	B2	B1 for 2 or 3 correct Ignore incorrect
18b	$8 = \frac{k}{3}$	M1	oe
	$8 \times 3 \div 5$	M1	oe
	4.8	A1	oe eg $\frac{24}{5}$ or $4\frac{4}{5}$ SC1 for $\frac{40}{3}$ (13.3...)oe SC1 for $\frac{40}{9}$ (4.4...) oe SC1 for $\frac{72}{25}$ (2.88 or 2.9) oe

Q	Answer	Mark	Comments
19a	$4 \times \pi \times (3x)^2$	M1	oe
	$36\pi x^2$	A1	Accept π in any position
19b	$\pi \times 3x \times l$ = their $36\pi x^2$	M1	oe
	$(l =)\ 12x$	A1ft	ft their k πx^2
20a	**–a** + **b** or **b** – **a**	B1	
20b	(Vector *AC* =) 2.5(**–a** + **b**) or (vector *BC* =) 1.5(**–a** + **b**)	M1	oe ft from their (a) provided it is a vector of the form *m***a** + *n***b**
	a + 2.5(**–a** + **b**) or **b** + 1.5(**–a** + **b**)	M1dep	oe
	–1.5**a** + 2.5**b**	A1ft	oe Answer must be simplified