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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 students' 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 students' 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 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.

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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
1	$\pi \times 3.5 \times 3.5$ or $3.14\ldots \times 3.5 \times 3.5$ or $\pi \times 3.5^2$ or $3.14\ldots \times 3.5^2$	M1	oe
	38.4(8…) or 38.4(6...)	A1	$\frac{49}{4}\pi$ or 12.25π or 12.3π
	38.5	B1 ft	ft their answer of 2 d.p. or more
2	$x + 2x + 90 + 138$ or states angles in quadrilateral = 360	M1	oe Attempts to subtract from 360
	$x + 2x + 90 + 138 = 360$ or $360 - 90 - 138$ or 132 seen	M1dep	oe
	$x + 2x = 360 - 90 - 138$ or $3x$ = their 132 or their 132 ÷ 3	M1dep	oe
	44	A1	
3a	Correct reflection (1, –3), (1, –5), (5, –3)	B2	B1 for triangle reflected in line $x = -1$ B1 for triangle reflected in line $y = c$ B1 for correct points without the triangle drawn
3b	Rotation	B1	
	90(°) clockwise	B1	oe 270(°) anticlockwise Accept $\frac{1}{4}$ turn clockwise
	Origin, *O* or (0, 0)	B1	Oe

Q	Answer	Mark	Comments
4	7.6×2.4	M1	
	18.24 or 18.2	A1	
	18	B1 ft	ft their area provided at least 1 d.p. shown
	$30 + 10 \times$ their 18	M1	Oe
	210	A1 ft	ft their area 212.40 or 212 implies M1A1B0M1A1ft 212.4 implies M1A1B0M1A0

Q	Answer	Mark	Comments
5a	2.2	B1	
5b	1000 grams = 1 kg seen or implied	M1	1 ÷ 2.2 (= 0.45 kg) (= 1 pound)
	(1 pound =) 1000 ÷ 2.2 (= 454 … grams) or 1 ÷ 2.2 × 1000 [454, 455] or 450	M1	(1 gram =) 2.2 ÷ 1000 (= 0.0022 pound) 1 ÷ 2.2 × 0.5 (= 0.227 … grams) [0.227, 0.2275] or 0.225 or 0.230
	($\frac{1}{2}$ pound =) 1000 ÷ 2.2 ÷ 2 (= 227.2 … grams) [227, 227.5] or 225 or 230	M1	100 grams = 2.2 ÷ 1000 × 100 (= 0.22 pounds) or 200 grams = 2.2 ÷ 1000 × 200 (= 0.44 pounds) or 250 grams = 2.2 ÷ 1000 × 250 (= 0.55 pounds) or 500 grams = 2.2 ÷ 1000 × 500 (= 1.1 pounds)
	[227, 227.5] or 225 or 230 and 250 g stated	A1	0.55 (pounds) and 250 g stated 0.44 (pounds) and 250 g stated SC3 for e.g. 0.227 and 250 g stated
Alt 5b **Using 2**	1000 grams = 1 kg seen or implied	M1	May be implied from working 1 ÷ 2 (= 0.5 kg) (= 1 pound)
	(1 pound =) 1000 ÷ 2 (= 500 grams) or 1 ÷ 2 × 1000 (= 500 grams)	M1	(1 gram =) 2 ÷ 1000 (= 0.002 pound) 1 ÷ 2 × 0.5 (= 0.25 grams)
	($\frac{1}{2}$ pound =) 1000 ÷ 2 ÷ 2 (= 250 grams)	M1	100 grams = 2 ÷ 1000 × 100 (= 0.2 pounds) or 200 grams = 2 ÷ 1000 × 200 (= 0.4 pounds) or 250 grams = 2 ÷ 1000 × 250 (= 0.5 pounds) or 500 grams = 2 ÷ 1000 × 500 (= 1 pound)
	250 g stated	A1	SC3 for e.g. 0.25 and 250 g stated

Q	Answer	Mark	Comments
Alt 5b Using 1.6	1000 grams = 1 kg seen or implied	M1	1 ÷ 1.6 (= 0.625 kg) (= 1 pound)
	(1 pound =) 1000 ÷ 1.6 (= 625 grams) or 1 ÷ 1.6 × 1000	M1	(1 gram =) 1.6 ÷ 1000 (= 0.0016 pound) 1 ÷ 1.6 × 0.5 (= 0.3125… grams) [0.3125, 0.313]
	($\frac{1}{2}$ pound =) 1000 ÷ 1.6 ÷ 2 (= 312.5 grams) [312.5, 313]	M1	100 grams = 1.6 ÷ 1000 × 100 (= 0.16 pounds) or 200 grams = 1.6 ÷ 1000 × 200 (= 0.32 pounds) or 250 grams = 1.6 ÷ 1000 × 250 (= 0.4 pounds) or 500 grams = 1.6 ÷ 1000 × 500 (= 0.8 pounds)
	[312.5, 313] and 250 g stated	A1ft	0.4 (pounds) and 250 g stated SC3 for e.g. 0.3125 and 250 g stated
Alt 5b Using 2.5	1000 grams = 1 kg seen or implied	M1	1 ÷ 2.5 (= 0.4kg) (= 1 pound)
	(1 pound =) 1000 ÷ 2.5 (= 400 grams) or 1 ÷ 2.5 × 1000	M1	(1 gram =) 2.5 ÷ 1000 (= 0.0025 pound) 1 ÷ 2.5 × 0.5 (= 0.2 grams)
	($\frac{1}{2}$ pound =) 1000 ÷ 2.5 ÷ 2 (= 200 grams)	M1	100 grams = 2.5 ÷ 1000 × 100 (= 0.25 pounds) or 200 grams = 2.5 ÷ 1000 × 200 (= 0.5 pounds) or 250 grams = 2.5 ÷ 1000 × 250 (= 0.625 pounds) or 500 grams = 2.5 ÷ 1000 × 500 (= 1.25 pounds)
	200 and 250 g stated	A1ft	0.625 (pounds) and 250 g stated SC3 for 0.2 and 250 g stated

Q	Answer	Mark	Comments
Alt 5b Using 4.5	1000 grams = 1 kg seen or implied	M1	1 ÷ 4.5 (= 0.222 ...kg) (= 1 pound)
	(1 pound =) 1000 ÷ 4.5 (= 222(.22…) grams or 220 grams) or 1 ÷ 4.5 × 1000	M1	(1 gram =) 4.5 ÷ 1000 (= 0.0045 pound) 1 ÷ 4.5 × 0.5 (= 0.111 ... grams)
	($\frac{1}{2}$ pound =) 1000 ÷ 4.5 ÷ 2 (= 111.(11…) grams or 110 grams)	M1	100 grams = 4.5 ÷ 1000 × 100 (= 0.45 pounds) or 200 grams = 4.5 ÷ 1000 × 200 (= 0.9 pounds) or 250 grams = 4.5 ÷ 1000 × 250 (= 1.125 pounds) or 500 grams = 4.5 ÷ 1000 × 500 (= 2.25 pounds)
	111 or 110and 100 g stated	A1ft	0.45 (pounds) and 100 g stated SC3 for e.g. 0.111 and 100 g stated
6	$2x - 4 = x + 5$	B1	(P =) $2(2x - 4) + 2(x + 5)$ or $6x + 2$ oe
	$2x - x = 5 + 4$	M1	$6x + 2 = 4(x + 5)$ or $6x + 2 = 4(2x - 4)$
	$x = 9$ or side = 14	A1	
	(Perimeter =) 4 × their 14 or 9 × 6 + 2	M1	Do not ft 4 × their x
	56	Q1	Strand (iii) Shows $x = 9$ (and each side is 14 (cm)) and perimeter is 56 (cm) 56 without working implies B1M1A1M1

Q	Answer	Mark	Comments
7a	–2, –3, –2	B2	B1 For 1 or 2 correct
7b	Their 5 points plotted	M1	Allow one error $\pm \frac{1}{2}$ square
	Fully correct with a smooth curve	A1	$\pm \frac{1}{2}$ square
7c	Correct reading at $y = 0.5$	B1 ft	ft their curve $\pm \frac{1}{2}$ square
	Second correct reading at $y = 0.5$	B1ft	ft their curve $\pm \frac{1}{2}$ square Award SC1 for [1.8, 1.9] and [–1.9, –1.8] only if graph is missing.

Q	Answer	Mark	Comments
8a	2 or 2.0	B1	
8b	Circular arc drawn centre post	M1	
	Fully correct arc radius 5 cm	A1	± 2 mm tolerance
8c	2 cm = 1 metre or 1 cm = 0.5 metre	M1	Any equivalent scale Condone 1 square = 0.5 metre
	1 cm = 50 cm or 2 cm = 100 cm or 2 : 100	M1	Any order Common units
	1 : 50	A1	50 : 1 implies M1M1A0
9	Fully correct at (3, 6), (5, 7), (5, 5), (7, 6)	B2	B1 for correct size B1 for at least two correct points as vertices
10a	tan chosen	M1	$\frac{h}{\sin 35} = \frac{1.2}{\sin 55}$
	tan 35 = $\frac{h}{1.2}$ or 1.2 tan 35	M1dep	$\frac{1.2 \sin 35}{\sin 55}$
	0.84…	A1	Allow 0.8 if working shown
10b	2 × their 0.84… or 2.4 tan 35	M1	oe
	1.68… or 1.7	A1ft	Answer on ft may be rounded

Q	Answer	Mark	Comments
11	90 seen or implied	M1	90 may be on diagram or may implied by use of Pythagoras or trigonometry
	$8.3^2 + 5.2^2$	M1	sin 32.(067…) or cos 57.(9326…) = $\frac{5.2}{OB}$ or cos 32.(067…) or sin 57.(9326…) = $\frac{8.3}{OB}$
	$\sqrt{8.3^2 + 5.2^2}$	M1 dep	$\frac{5.2}{\sin 32.(067\ldots)}$ or $\frac{5.2}{\cos 57.(9326\ldots)}$ or $\frac{8.3}{\cos 32.(067\ldots)}$ or $\frac{8.3}{\sin 57.(9326\ldots)}$
	9.79… or 9.8	A1	Accept 10 if working seen
12	$\frac{3x}{x} = \frac{36}{x+4}$	M1	oe Scale factor 3 or $\frac{1}{3}$ seen or implied
	$3x(x + 4) = 36x$	M1	oe 36 ÷ 3 (= 12)
	$3(x + 4) = 36$ or $3x^2 + 12x = 36x$	M1	oe their 12 – 4
	$3x + 12 = 36$ or $x + 4 = 12$ or $x = 8$ or $3x^2 – 24x = 0$ or $3x^2 = 24x$	M1	$(x =)$ 8 or their 8 × 3
	$(3x =)$ 24	A1	24

Q	Answer	Mark	Comments
13	$\frac{1}{2} \times 12 \times 14 \times \sin 52$	M1	oe $h = 12 \sin 52$ (= 9.456...) and $\frac{1}{2} \times 14 \times h$
	[66, 66.3]	A1	
	cm^2	B1	
14	$\frac{-1 \pm \sqrt{1^2 - 4(3)(-5)}}{2(3)}$	M1	Allow one error
	$\frac{-1 \pm \sqrt{1^2 - 4(3)(-5)}}{2(3)}$ or $\frac{-1 \pm \sqrt{61}}{6}$	A1	oe
	1.14 and –1.47	A1	SC2 for 1.14 or –1.47 SC1 for 1.135... or . –1.468...
15a	$y \propto x$ or $y = kx$ or $cy = x$	M1	oe 28 ÷ 7 or 4 seen 7 ÷ 28 or 0.25 seen
	$28 = k \times 7$ or $k = 4$ $c \times 28 = 7$ or $c = 0.25$	M1	oe
	$y = 4x$	A1	oe Accept $y = kx$ and $k = 4$
15b	4×12 or their 4×12	M1	Must be direct proportion
	48	A1ft	

Q	Answer	Mark	Comments
16a	70	B1	May be on diagram
	(Opposite angles of) cyclic quadrilateral (add up to 180°)	Q1	Dependent on 70 In a quadrilateral in a circle the opposite angles add up to 180°
16b	One correct angle	M1	*DAE* = 70 or *BAD* = 25 or *DBC* = 70 Angles can ft from their 70 in (a)
	Two correct angles	M1	*DAE* = 70 or *BAD* = 25 or *DBC* = 70 *or ADE* = 40
	Three correct angles	M1	*DAE* = 70 or *BAD* = 25 or *DBC* = 70 *or ADE* = 40 or *BDC = 95* or *BAE* = 95
	15	A1	
17a	5**a** + 3**b** + 6**a** – **7**b	M1	
	11**a** – 4**b**	A1	
17b	22	B1 ft	ft their 11 × 8 ÷ their 4 Accept 22**a** (– 8**b)**
18	20 or 30 seen	B1	
	90 + 35 or 125 seen	B1	20 sin 35 and 20 cos 35 10 sin 35 and 10 cos 35
	$20^2 + 30^2 - (2 \times 20 \times 30 \times \cos 125)$ or $10^2 + 15^2 - (2 \times 10 \times 15 \times \cos 125)$	M1	$(30 + 20 \sin 35)^2 + (20 \cos 35)^2$ or $(15 + 10 \sin 35)^2 + (10 \cos 35)^2$
	1988(.29…) or 1990	A1ft	497(.07…) or 500 22.29(5…) or 22.3 or 22.5 ft their 90 + 35
	44.5… or 44.6 or 45	A1	