AQA

GCSE

Mathematics

93701H Applications of Mathematics
Unit 1: Higher Tier
Mark scheme

93701H

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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.
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.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the candidate intended it to be a decimal point.

Q	Answer	Mark	Comments
1(a)	18	B1	
1(b)	52 – 28 + 6 or 52 – 22	M1	
	30	A1	
	Additional Guidance		
	If answer does not appear in 1b check table. 30 in Leeds gains M1A1 Calculations can be done in any order or in steps. eg 52 + 6 = 58, 58 – 28 M1 eg 52 + 6 = 56, 56 – 28 gains M1 Answer 30 with no working gains M1A1		
2	**Alternative method 1**		
	3500 × 1.65 or 5775 or 3500 × 0.65 or 2275	M1	
	their 5775 – (3500 + 750) or (their 2275 + 3500) – (3500 + 750) or their 2275 – 750	M1	oe eg 5775 – 4250
	1525	A1	
	Additional Guidance		
	To award the 2nd M1 it must be clear that they have attempted to find either 65% or 165% of 3500 If they work with 165% they must subtract both 3500 and 750 If they work with 65% they must only subtract 750 Penalise further working as incorrect method. eg 0.65 × 3500 = 2275 M1 2275 – 750 = 1525 3500 + 1525 = 5025 M0A0		

Q	Answer	Mark	Comments
3	7, 7, 7, 9, (10)	B2	B1 for finding the mean of any five integers between 7 and 10 inclusive or B1 for finding the median of any five integers between 7 and 10 inclusive or B1 7 (median) and 8 × 5 = 40 or 8 (median) and 9 × 5 = 45
	Additional Guidance		
	The median can be shown by listing their 5 numbers in order and either circling the middle number or crossing off 2 either side to leave the middle number. All numbers used must be integers.		

Q	Answer	Mark	Comments
4	87 in women 40 to 59	B1	
	Under 25 22 men and 11 women	B1	
	Column total values correct 25 to 39 110 **and** 40 to 59 187 **and** 60 or over 250	B1	
	Women's row totals 230	B1ft	Total of the 4 values for women
	350 in men's row total box **and** values total to 350	B1ft	Total of their 4 values
	Additional Guidance		

	Under 25	25 to 39	40 to 59	60 or over	Total
M	22	75	100	153	350
W	11	(35)	87	97	(230)
T	(33)	110	187	250	(580)

Q	Answer	Mark	Comments
5	**Alternative Method 1**		
	$\frac{2}{3} - \frac{1}{2}$ or $\frac{1}{6}$	M1	oe
	their $\frac{1}{6}$ is 5 or 6 × 5 or 5 ÷ their $\frac{1}{6}$	M1dep	
	30	A1	
	Alternative Method 2		
	0.66(…) – 0.5 or 0.16(…) or 66% – 50% or 16.(…)%	M1	
	5 ÷ their 0.16(…) or 5 ÷ their 16.(..) (× 100) or 100 ÷ their 16.(..) × 5	M1dep	
	30	A1	
	Alternative Method 3		
	Trial and improvement First trial using both fractions $\frac{2}{3}$ and $\frac{1}{2}$ of any distance greater than 5km	M1	
	finds the difference between their two values	M1dep	(Trying to get a difference of 5)
	30	A1	

Q	Answer	Mark	Comments
5 (cont)	**Alternative Method 4**		
	$\frac{1}{2}x + 5 = \frac{2}{3}x$	M1	
	$1.5x + 15 = 2x$ or $0.5x = 15$ or $3x + 30 = 4x$ or $\frac{1}{6}x = 5$	M1dep	
	30	A1	
	Additional Guidance		
	For Alt 2 allow use of 0.66 or better for $\frac{2}{3}$ for both method marks but must be 30 for (use of 0.66 or 66% gives an answer of 31.25)		
6(a)	0.3 × 30	M1	
	9	A1	SC1 $\frac{9}{30}$
	Additional Guidance		
	Beware of 9 from incorrect method eg 10 × 0.4 + 10 × 0.25 + 10 × 0.3 = 4 + 2.5 +3 = 9.5 answer 9 M0A0 Do not award M1 for 0.3 × 30 if it is added to other values		

Q	Answer	Mark	Comments
6(b)	64	B2	B1 0.32 selected SC1 0.31 × 200 = 62
	Additional Guidance		
	0.32 selected must be the only rel.freq. they use eg 0.32 × 4 = 1.28 B1 eg 0.4 + 0.25 +0.3 +0.35 +0.32 B0 Beware use of average relative frequency 1.62 ÷ 5 × 200 = 64.8 which they may round to 64 gains B0		
7(a)	C	B1	Circled or indicated
	Additional Guidance		
7(b)	A	B1	Circled or indicated
	Additional Guidance		

Q	Answer	Mark	Comments
8	**Alternative method 1**		
	1.03 seen	M1	
	1750×1.03^4	M1	
	1969.64	A1	Must be correct money notation (2dp) Allow 1970 from correct method
	Alternative method 2		
	1750 + (1750 × 0.03) or 1802.5(0)	M1	Year 1 total Equivalent to using 1.03 once
	[1856.57,1856.58] **and** [1912.26,1912.28] or 52.5(0) (+)54.08(+) 55.7(0) (+)57.37	M1	Year 2 and year 3 totals or Calculating interest for each of the 4 years 1750 + 52.5(0) +54.08 + 55.70 +57.37 implies M2
	[1969.62, 1969.65]	A1	Must be correct money notation (2dp) Allow 1970 from correct method
	Additional Guidance		
	Calculating amounts each year gains a method mark for a complete year 1 total. The 2nd method mark is only awarded if the interest is found for the next 2 years Use of simple interest will only gain credit if the first year interest is added on to the investment to give 1802.5(0)		

Q	Answer	Mark	Comments
9(a)	$158 < h \leqslant 164$ or $164 \geq h > 158$	Q2	Q1 for $158 \leqslant h \leqslant 164$ or for $158 < h < 164$ or $158 < h$ and $h \leqslant 164$
	Additional Guidance		
	Allow all reversed eg $164 \geq h \geq 158$ Q1 Allow any other letter for h Ignore units		
9(b)	$x + 3$ or $x - 2$ seen	B1	
	x + their $(x + 3)$ + their $(x - 2) = 43$	M1	oe must be linear expressions with 3 terms in x
	$3x = 42$ $3x + 1 = 43$	M1	Simplifying their linear equation to $ax = b$ or by collecting like terms on the left
	Sita 14, Teri 17 and Helen 12	A1	
	Logical algebraic argument with key steps shown including final answers	Q1	QWC strand (iii) Must gain both method marks and give a solution SC3 for 14,17 and 12 from T & I or numerical method
	Additional Guidance		
	The B1 for a correct expression cannot be awarded with SC3 Omitting Sita gives the following their $(x + 3)$ + their $(x - 2) = 43$ $2x = 42$ $x = 21$ Answers 21, 24 and 19 B1M0M1A0Q0 Example of incorrect expression used Uses $3x$ for Teri $x + 3x + x - 2 = 43$ $5x - 2 = 43$ $5x = 45$ Answer 9,27,7 or 9,12,7 B1M1M1A0Q1		

Q	Answer	Mark	Comments
10(a)	Median line drawn at 38	B1	±½ square
	Quartiles drawn at 33.5 and 42 and box drawn.	B1	±½ square
	Whiskers drawn from the box to 26 and 54	B1	±½ square
	Additional Guidance		
	For whiskers, lines on ends do not need to be drawn The box can be any height Some students may also draw a box plot when answering 10b. Ignore this box plot when marking 10a		

Q	Answer	Mark	Comments
10(b)	**Alternative method 1**		
	States their 2015 median and makes a comparison in context eg The median was 38 in 2015 so the 2015 times were quicker (on average) (due to lower median) eg the median in 2015 was one minute less than 2014 so 2015 times were quicker		
	Works out both IQR's and compares consistency 2014 interquartile range = 13 2015 interquartile range = their upper quartile – their lower quartile **and** 2015 times are more consistent (due to lower IQR)	B2 ft	oe ft 10(a) B1 states their 2015 median (with no comparison or incorrect comparison) or B1 incorrect reading of their median with correct comparison eg plots the median at 38 but reads as 36 and states that the times in 2015 were faster
	Alternative method 2 (adds a boxplot for 2014)	B2ft	ft their boxplot oe B1 correct IQR's ft their box plot or B1 incorrect readings used for 2015 IQR with correct comparison -must use correct method for 2014 IQR ie. 13 seen or 45 – 32
	Boxplot drawn for 2014 and median indicated as higher in 2014 or lower in 2015 and 2015 times were quicker (on average) (due to lower median)		
	Both quartiles marked on the boxplot for 2014 and states box smaller/narrower in 2015 2015 times are more consistent (due to lower IQR)	B2ft	ft their 10a boxplot oe

Q	Answer	Mark	Comments
10(b)	**Additional Guidance**		
		B2 ft	ft their 10(a) boxplot oe
	Incorrect reading of scale must not be use of another value. Eg 42 is not an incorrect reading of the median Correct readings from correct boxplot gives IQR of 8.5 Incorrect method for 2014 IQR means B0 for the IQR part		
11(a)	(56 + 62 + 44) ÷ 3 or 162 ÷ 3	M1	
	54	A1	
	Additional Guidance		
	56 + 62 + 44 ÷ 3 with incorrect answer is M0		
11(b)	57 × 3 or 171	M1	
	their 171 – (44 + 59)	M1	Allow their 171 – (48 + 59)
	68	A1	
	Additional Guidance		
	Check table for answer if no answer given in 11b Using 48 instead of 44 can gain M1M1A0 (answer 64)		

Q	Answer	Mark	Comments
12(a)	8.43×10^8	B2	B1 for 843 000 000 or B1 for 8.4×10^8 SC1 1.09×10^7
	Additional Guidance		
	SC is for using number of visitors		
12(b)	$8.5 \times 10^7 \div 1.4 \times 10^6$ or $1.9 \times 10^8 \div 1.5 \times 10^6$	M1	
	60.7(14...) **and** [126.66,126.7]	A2	A1 for one correct Allow 61 and 126 or 127 from correct method
	63.(33) **and** 60.(71) **and** Yes or [2.08,2.1] **and** Yes or 60.(71) **and** 65.95 or 66 **and** Yes or 121.(43) or 121.(42) **and** 126.(66) **and** Yes	Q1ft	QWC strand (iii) for correct conclusion for their values if M1 gained Allow 122 from 61 used
	Additional Guidance		
	Allow rounding to nearest integer for all comparisons except the division leading to 2.08 Yes can be implied eg 63 >60		

Q	Answer	Mark	Comments
13	**Alternative Method 1**		
	$t = \frac{4}{7}c$ or $10c + 6t = 20.68$	M1	
	$10c + 6 \times \frac{4}{7}c = 20.68$	M1	
	$\frac{94}{7}c = 20.68$	M1	oe
	their $20.68 \times \frac{7}{94}$ or 1.54	M1	oe
	(t =) £0.88 or 88p	A1	0.88 with no units is M4 A0
	Alternative Method 2		
	$t = \frac{4}{7}c$ or $10c + 6t = 20.68$	M1	
	$c = \frac{7}{4}t$	M1	
	$10 \times \frac{7}{4}t + 6t = 20.68$	M1	
	$\frac{94}{4}t = 20.68$	M1	
	(t =) £0.88 or 88p	A1	0.88 or 88 with no units is M4 A0
	Alternative Method 3		
	$\frac{4}{7} \times 6$ or $\frac{24}{7}$	M1	
	$10 + \frac{24}{7}$ or $\frac{94}{7}$	M1	oe
	20.68 ÷ 94 (× 7) or 20.68 ÷ 94 (× 4)	M1	
	0.22 (× 4) or 1.54 (÷ 4)	M1	
	£0.88 or 88p	A1	0.88 or 88 with no units is M4 A0

Q	Answer	Mark	Comments
13 (cont)	**Alternative Method 4**		
	$t = \frac{4}{7}c$ or $7t = 4c$ or $4c - 7t = 0$ or $10c + 6t = 20.68$	M1	
	$20c + 12t = 41.36$ **and** $20c - 35t = 0$	M1	oe equating coefficients
	$47t = 41.36$	M1	subtracting
	$t = \frac{41.36}{47}$	M1	
	(t =) £0.88 or 88p	A1	0.88 or 88 with no units is M4 A0
	Alternative Method 5		
	Chooses 2 values where tea is exactly $\frac{4}{7}$ the cost of coffee	M1	Any two monetary values eg coffee 70p and tea 40p Must be whole numbers
	Tries their two values in $10c + 6t$ and compares with 20.68	M1	eg $10 \times 0.7 + 6 \times 0.4 = 9.40$ too small
	Tries a pair of monetary values which give an answer between £18 and £23	M1	Implies previous M2 Cost of tea must be a multiple of 4 Cost of coffee must be a multiple of 7 and t should be $\frac{4}{7}$ of c Possible combinations are Coffee (£)1.40 tea 80p total (£)18.80 Coffee (£)1.47 tea 84p total (£)19.74 *Coffee (£)1.54 tea 88p total (£) 20.68 Coffee (£) 1.61 tea 92p total (£) 21.62 Coffee (£) 1.68 tea 96p total (£) 22.56
	Tries £1.54 and 88p eg $10 \times 1.54 + 6 \times 0.88 = 20.68$	M1	

Q	Answer	Mark	Comments
13 (cont)	(t =) £0.88 or 88p	A1	0.88 or 88 with no units is M4 A0
	Additional Guidance		
	Accept any letters for t and c Trying c = 1.54 and t = 88 at any point and then selecting this as their answer gains all 5 marks All attempts must give correct monetary costs for tea and coffee. For example coffee costs £1 gives tea costs 57.14pence M0 Allow working in pence throughout eg 2068 but final answer must have correct units		

Q	Answer	Mark	Comments
14	**Alternative Method 1**		
	1067.5	B1	Condone 1067.499999
	179.5	B1	Condone 179.499999
	their 1067.5 + their 179.5	M1	their upper bounds must be >1065 and >179
	1247 **and** No	A1	
	Alternative Method 2		
	1067.5	B1	Condone 1067.499999
	1245 – their 1067.5	M1	their 1067.5 must be their upper bound. It cannot be 1065
	177.5	A1	
	No 178.5 is the lightest Kate can be or No 179 is greater than 178 to nearest pound	B1ft	ft their upper bound if M1 scored
	Additional Guidance		
	Examples of ft eg 1 uses 1069.5 →answer of 179.1 conclusion No as Kate could be 179.5 eg 2 Uses 1065.5 → answer 179.5 conclusion Yes as max Kate can be is 179.5		
15(a)	3.6 or 0.4 seen	M1	Implied by one correct height
	bars drawn height 3.6 for 80 – 85 **and** 0.4 for 85 – 100	A1	
	Additional Guidance		
	One bar at correct height and width implies M1 A0		

Q	Answer	Mark	Comments
15(b)	Supermarket: $\frac{2}{10} \times 30 + 18 + 6$ or $2 \times 3 + 18 + 6$ or $6 + 18 + 6$	M1	
	30	A1	
	Street stall: (2×3.5) or (5×4) or (15×0.6) or 7 or 20 or 9	M1	oe eg works in cm^2 1 cm^2 = 2.5 Values may be written on the bars
	$(2 \times 3.5) + (5 \times 4) + (15 \times 0.6)$ or $7 + 20 + 9$ or 36	M1	14 .4 × 2.5 or 36
	6	A1	
	Additional Guidance		
	For the 2nd histogram allow use of any equivalent divisions eg cm^2, line of 5		

16(a)	s = the number of boxes of Supreme d = the number of boxes of Dazzle	B1	Allow 'amount' for 'number'
	Additional Guidance		

16(b)	$d + s \leqslant 20$	B1	oe
	Additional Guidance		

Q	Answer	Mark	Comments
16(c)	$d + s = 20$ drawn **and** $d = 2s$ drawn and Correct region shown by shading	B3	B2 $d + s = 20$ drawn **and** $d = 2s$ drawn with no shading or incorrect shading B1 $d + s = 20$ drawn or $d = 2s$ drawn
	Additional Guidance		
	May shade the region or the outside of the region		
16(d)	Trial of any integer point in the region close to the intersection with correct profit for d and s	M1	Must have a clear enclosed region (0,20) →£16 (6,13) →£17 (6,14) → £17.8(0)
	$s = 6$, $d = 14$, profit = £17.80	A2	A1 for $s = 6$, $d = 14$ Correct money notation
	Additional Guidance		
	Must have drawn 2 lines on the graph and used shading to indicate their region Condone 6.60 and 11.20 on answer lines for 6 and 14 if 6 and 14 seen in working Answers of 6, 14 and 17.8 is M1A1A0		

Q	Answer	Mark	Comments
17	**Alternative Method 1**		
	(125000 at 0%) 125000 × 1.02 or 127500	M1	
	315500 – (their 127500 + 125000)	M1	oe eg 315500 – 250000 – 2500
	(£) 63000	A1	
	their 63000 ÷ 1.05 or 60000	M1	
	125000 + 125000 + their 60000 or 315 500 – (their 3000 + their 2500)	M1dep	their 3000 is their 63000 – their 60000 and their 2500 is 2% of 125000
	(£) 310000	A1	
	Alternative Method 2		
	x + (0.02 × 125000) or 0.05(x – 250000)	M1	
	x + (0.02 × 125000) + 0.05 (x – 250000) (= 315500)	M1	implies first M1
	x + 2500 + 0.05x –12500 = 315500	M1	implies previous M2
	1.05x = 325500	M1	
	x = 325500 ÷ 1.05	M1dep	
	(£) 310000	A1	
	Additional Guidance		
	Common incorrect method 315500 – 250000 = 65500 125000 × 0.02 = 2500 65500 × 0.05 = 3275 315500 – (3275 +2500) = 309725 M0M0A0M0M0A0		