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.

Q	Answer	Mark	Comments
1(a)	**Alternative method 1**		
	0.15 × 275 or 41.25	M1	oe
	275 – their 41.25	M1dep	
	233.75	A1	
	Additional guidance		**Mark**
	For a build up method the complete build up must be seen for M1 Condone 233.75 seen in working followed by 41.25 on answer line		M2 A1
	Alternative method 2		
	0.85 seen	M1	
	0.85 × 275	M1dep	
	233.75	A1	
1(b)	0.35	B1	
2(a)	1.44	B1	
	Additional guidance		
	Allow £1.44p		
2(b)	268 ÷ 134 or 2	M1	£2 per 1% of CPI
	their 2 × 107	M1 dep	
	214	A1	
3	A - 2 B - 3 C - 1	B2	B1 for one correct match
	Additional guidance		
	Do not condone letters used for 1, 2, and 3		

Q	Answer	Mark	Comments
4	**Alternative method 1**		
	$\frac{54}{75}$ (× 100) or $\frac{45}{60}$ (× 100)	M1	oe
	72(%) **and** 75(%) or (Paper 1 75% of 75 =) 56.25 or (Paper 2 72% of 60 =) 43.2	A1	
	(Paper) 2	Q1ft	ft their percentages or decimals if M1 gained and at least one value is correct
	Alternative method 2		
	Changes to decimals or equivalent fractions 0.72 **or** 0.75 or $\frac{216}{300}$ or $\frac{225}{300}$	M1	oe
	Changes to decimals or equivalent fractions 0.72 **and** 0.75 or $\frac{216}{300}$ and $\frac{225}{300}$	A1	Allow any equivalent fractions
	(Paper) 2	Q1ft	ft their percentages or decimals if M1 gained and at least one value is correct

Q	Answer	Mark	Comments

4 (cont.)	Additional guidance	Mark
	For Q1 their values must be compared in the same format with at least one correct. Any equivalent fractions are acceptable eg $\frac{432}{600}$ and $\frac{450}{600}$ and Paper 2	M1A1Q1

5(a)	It is cheaper/quicker (than testing the population) Too expensive to test them all or too time consuming to test them all	B1	oe
	Additional guidance		**Mark**
	Accept any equivalent comment that recognises a sample is better than a Population If referring to too long or too expensive they must state 'to test the population' Because it would take too long and would be too expensive Because testing the population would take too long		B0 B1
5(b)	Sample size is too small	B1	
	Only one day/ time of day or only test one week or not random	B1	
	Additional guidance		**Mark**
	Both comments may be seen and marked under criticism 1 or 2		

Q	Answer	Mark	Comments
6	**Women rail** 112 ÷ 4 or 28	B1	
	0.3 × 200 or 60	M1	oe
	their 60 ÷ 4	M1 dep	May be implied by 45 or 15 seen
	Road (Women 45) (men) 15	A1	
	200 – 112 – 37 – their 15 or 36	M1	or 200 – their 60 – 37 – their 39 (women air)
	64	A1ft	Ft their 36 + their 28 or ft their 60 and their 39 used
	Additional guidance		**Mark**
	Work may be seen in a two way table or in the space or working lines		

Q	Answer	Mark	Comments
7(a)	midpoints used correctly	B1	condone one error
	(12.5 × 17) + (17.5 × 46) + (22.5 × 22) + (27.5 × 10) + (32.5 × 5) or 212.5 + 805 + 495 + 275 + 162.5 or 1950	M1	Attempt at ∑fx using values on or between class boundaries
	their 1950 ÷ 100	M1	
	19.5	A1	SC2 17 or 22
	Additional guidance		**Mark**
	For 2nd method mark allow their 100 if totalling ∑f clearly seen 17 and 22 come from use of lower and upper class boundaries		
7(b)	Yes because the average speed was less than 20 or Yes as 63 cars/ about 2/3 of cars/most cars/over half the cars drive at or below 20 or No, as 37 cars break the speed limit	B1ft	Ft their answer to part (a) oe

Q	Answer	Mark	Comments
8	2(x +12) or 2x + 24 seen	B1	
	x + their (x + 12) + their 2(x + 12) = 204	M1	Setting up their equation. Must include 3 terms in x
	4 x = 168 or $x = \frac{\text{their } 168}{4}$	M1	Rearranging to a single term Ft their collection of like terms.
	42	A1	
	Organised algebraic response	Q1	Must gain 2nd and 3rd method marks. QWC strand ii SC3 42 from a numerical/T&I approach. SC3 56 from an algebraic approach
	Additional guidance		
	$4x + 36 = 204$ is B1M1 The Q mark is for an algebraic method leading to their solution **Example** Condone one arithmetical slip for the second Method mark-eg 204 – 36 = 176 Adding 36 instead of subtracting 36 is not an arithmetical error – it is incorrect method **Example** $4x + 36 = 204$ 204 – 36 = 168 168 ÷ 4 = 42 B1 (implied) M1M1A1Q1 **Special cases** If SC3 is awarded for 42 for T & I. do not award the B1 even if correct expressions seen for Phil. Omission of Ben or incorrect use of brackets (for Phil) may lead to the equation $3x + 36 = 204$ Solved correctly gives an answer of 56 for SC3		

Q	Answer	Mark	Comments
9(a)	(0), 5, 18, 38, 63, 78, 90	B1	Correct cf values – may be implied by correct heights on graph
	Plotting at upper class boundaries	B1	Must be an increasing graph
	3 or 4 of their cf heights correct	B1 ft	ft first B1. Must be an increasing graph
	All their heights correct and points joined with a smooth curve or straight lines starting at (40, 0)	B1	Must be an increasing graph Ignore any additional graph underneath.
9(b)	median = '73'	B1	Ft their increasing graph
	Their upper quartile – their lower quartile	M1	Ft their increasing graph with at least one value correct for their graph
	'21'	A1 ft	Ft their increasing graph
9(c)	Correct comment using the median eg he is not correct as the median/average mass of his apples is lower than Lucy's	B1 ft	Ft their median
	Correct comment using the IQR eg his apples vary more in mass than Lucy's apples	B1 ft	Ft their IQR
10(a)	x is the number of 10p coins and y is the number of 20p coins	B1	
10(b)	$x + y = 35$ or $y + x = 35$	B1	
10(c)	$x + 2y = 56$ and $x + y = 35$ or $10x + 20y = 560$ and $10x + 10y = 350$	M1	oe equating coefficients of x or y Allow one error in totals
	$y = 21$	A1	
	$x = 14$	A1	SC1 for x=14 and y=21 using T &I or with no working.

Q	Answer	Mark	Comments
11	9.5 or 10.5 or 47.5 or 52.5	B1	
	10.5 and 52.5	B1	
	their 52.5 × their 10.5	M1	Multiplying their upper bounds. Their upper bounds cannot be 50 and/or 10
	551.25(tonnes)	A1ft	ft if they multiply their upper bounds
	Additional guidance		**Mark**
	eg, 55 × 10.5 = 577.5		**B1B0M1 A1ft**
12	**Alternative method 1**		
	12 000 linked to 1.3% or 16 000 linked to 1.4%	B1	Implied by use of digits 13 or 14 eg 12000 x 1.3
	12 000 × 1.013 or 16 000 ×1.014	M1	
	12 156 **and** 16 224	A1	Either of these values implies B1 M1
	their 224 – their 156	M1	subtracting the two amounts of interest
	(£)68	A1	
	Alternative method 2		
	12 000 linked to 1.3% or 16 000 linked to 1.4%	B1	Implied by use of digits 13 or 14 eg 12000 x 1.3
	12 000 × 0.013 or 16 000 ×0.014	M1	working out just the interest
	156 **and** 224	A1	Either of these values implies B1 M1
	their 224 – their 156	M1	
	(£)68	A1	

Q	Answer	Mark	Comments
13	**Alternative method 1**		
	$\frac{206}{770} \times 60$ or $\frac{50}{770} \times 60$ or 16.05(...) or 3.89(6) or 16 or 4	M1	
	their 16 – their 4 or their 16.05(..)- their 3.89(6..)	M1	
	12	A1	
	Alternative method 2		
	206 – 50 or 156	M1	
	$\frac{156}{770} \times 60$ or 12.1(..)	M1	
	12	A1	

Q	Answer	Mark	Comments
14(a)	**Alternative method 1**		
	4000 × (£)15 or (£) 60 000	M1	
	125 or 1.25 seen	M1	
	60 000 ÷ 1.25 = 48 000	A1	oe
	Alternative method 2		
	125 or 1.25 seen	M1	oe
	$\frac{15 \times 100}{125}$ or 15 ÷ 1.25 or 12	M1	
	their 12 × 4000 = 48 000	A1	
14(b)	**Alternative method 1**		
	48 000 × 1.2 or 57 600	M1	
	x × 5 or (4000 – x) × 15	M1	where x is the number damaged
	$5x$ + (4000 – x) × 15 = 57 600	M1	Any correct equation
	$10x$ = 2400	M1	
	240	A1	
	Alternative method 2		
	48 000 × 1.2 or 57 600	M1	
	x × 15 or (4000 – x) × 5	M1	where x is the number not damaged
	$15x$ + (4000 – x) × 5 = 57 600	M1	Any correct equation
	$10x$ = 37 600	M1	or 3760 not damaged
	240	A1	

Q	Answer	Mark	Comments
14(b)	**Alternative method 3 (Equation based on profit)**		
	48 000 × 0.2 or 9600	M1	
	x × -7 or (4000 – x) × 3	M1	where x is the number damaged oe
	-7x + (4000 – x) × 3 = 9600	M1	Any correct equation
	10x = 2400	M1	
	240	A1	
	Alternative method 4		
	48 000 × 1.2 or 57 600	M1	
	60000 – 57600 or 2400	M1	
	(Difference in price = £)10	M1	
	2400 ÷ 10	M1	
	240	A1	

Q	Answer	Mark	Comments
15(a)	40 ÷ 5 or 72 ÷ 10 or 102 ÷ 30	M1	May be implied by one correct height
	8 and 7.2 and 3.4	A1	
	All bars drawn correct height and width	A1	
15(b)	10 × 5.4 or 20 × 5.2 or 5 ×11	M1	Implied by one correct value
	54, 104, 55	A2	A1 for 2 correct values
15(c)	**Alternative method 1**		
	$\frac{25}{30} \times 102$ or 17 seen	M1	oe
	85	A1	
	Alternative method 2		
	25 × their 3.4	M1	
	85	A1 ft	Ft their frequency density
16(a)	$5x + 2.5y \geq 75$	B1	
16(bi)	$2x + y \geq 30$ drawn on graph	B1	
	Correct region shown clearly.	B1	Accept shaded in or shaded out.
16(bii)	Trial of any integer point at or near any vertex	M1	(12,24) => £120 (18,18) => £135 (8, 15) => £77.5(0) (10, 10) => £75 (17,18) => £130 (17,19) => £132.50
	Trial of (17,19)	M1	This implies first M1 also
	£132.50	A1	SC2 for £135
	Additional guidance		**Mark**
	SC2 for 135 is for those who do not realise that the line y= x is dotted(the number of children must be more than the number of adults) and therefore values on the line cannot be included		