AQA

GCSE
Mathematics

Higher Tier   Unit 1   Statistics and Number
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.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

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 …	Accept 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)	Negative	B1	Accept eg strong negative, weak negative

1(b)	One straight line through both gates (20, 75 – 90) and (80, 30 – 40)	B1	

Additional guidance

Ignore outside gates	
Line must cross at least 5 large squares	
Joining points only	B0
If the points are joined and a line of best fit is also drawn then mark the line of best fit	

Q	Answer	Mark	Comments
1(c)	66	B1ft	ft their line of best fit $\pm\frac{1}{2}$ small square Accept any value in the range [62, 70] if B0 awarded in (b)

2(a)	$\frac{1}{6}(\times 420)$ or $\frac{70}{420}$ seen	M1	oe
	70	A1	Accept 70 out of 420

2(b)	$\frac{23}{50}$ and 0.46 and 46%	B2	B1 circles one or two correct values **and** no more than one incorrect value

Q	Answer	Mark	Comments
3	9 brown-eyed girls **and** 23 girls	B1	9 brown-eyed boys **and** 17 boys
	(their 23 − their 9 – 2) + 3 or 15	M1	40 – 18 – ((their 17 – their 9 – 3) + 2) or 15
	their 15 ÷ 40 ($\times$ 100)	M1	their 15 must be their total blue
	37.5	A1ft	ft their 9 and their 23 or their 9 and their 17 if B0 M2 scored Condone an answer of 38 if full method or 37.5 seen

Additional guidance

If build up is used for the percentage, the answer must be correct or a fully correct method seen

The 2nd M may be implied by a correct ft percentage for their total blue

The table does not need to be completed and only the relevant parts need be correct (ie 9, 12, 23 and 15 or 9, 17, 5, 7 and 15) but the correct table for reference is

	Boys	Girls	Total
Brown	**9**	**9**	18
Blue	3	**12**	**15**
Green	**5**	2	**7**
Total	**17**	**23**	40

Q	Answer	Mark	Comments
4	States a valid reason about increasing sample size or interviewing a variety of people	B1	eg ask more people ask boys and girls ask adults too

Q	Answer	Mark	Comments
5	$\dfrac{1}{4} \times 20$ or 5 or 6 seen	M1	May be implied by $\dfrac{5}{20}$ or $\dfrac{6}{20}$
	$\dfrac{6}{21}$ or $\dfrac{2}{7}$	A1	oe Accept 0.29 or 29% (or better)
	Additional guidance		
	Decimal answer is 0.285714…		

Q	Answer	Mark	Comments
	Alternative method 1		
	Correct conversion of one value to another form $\dfrac{5}{12}$ oe fraction or 2 : 3 oe ratio 41.(...)% or 42% or 40% 0.41(...) or 0.42 or 0.4	M1	Accept in words eg 5 out of 12 Accept missing percentage signs
6	Box A and correct comparable forms eg $\dfrac{25}{60}$ and $\dfrac{24}{60}$ or $\dfrac{10}{24}$ and $\dfrac{10}{25}$ or 15 : 21 and 14 : 21 or 41.(...)% or 42% and 40% or 0.41(...) or 0.42 and 0.4	Q1	oe Strand (ii) Logical argument with steps shown
	Alternative method 2		
	$\dfrac{2}{5} \times 12$ or 4.8 or $\dfrac{5}{12} \times 5$ or 2.08... or 2.1	M1	oe
	Box A and 4.8 (and 5) or Box A and 2.08... or 2.1 (and 2)	Q1	oe Strand (ii) Logical argument with steps shown

Q	Answer	Mark	Comments
7	4 × 4 or 16 or 7 × 13 or 91 or 11 × 8 or 88 or 16 × 5 or 80 or 22 × 1 or 297	M1	Attempt at fx using one correct midpoint
	(their 16 + their 91 + their 88 + their 80 + their 22) ÷ 31	M1	Condone missing brackets eg 275.7(...) implies M1M1A0
	9.58(...) or 9.6	A1	Accept 10 if correct method shown SC2 8.09 or 8.1 (lower class bounds used) or 11.06 or 11.1 (upper class bounds used)

Additional guidance	
Ignore rounding/ truncation once 9.6 or better seen	M1 M1 A1
(4 × 4 + 7 × 13 + 11 × 8 + 16 × 5 + 22 × 1) ÷ 31, answer 10	M1 M1 A1
Ignore incorrect/ no use of brackets if correct answer given	M1 M1 A1
59.4 implies 297 ÷ 5	M1 M0 A0
297 ÷ 31 seen rounded to 300 ÷ 30 = 10	M1 M1 A0
297 in table then 300 ÷ 30 = 10 (no rounding shown)	M1 M0 A0
A correct product in the table or 297 seen does not imply M1 if there is a choice of methods	

Q	Answer	Mark	Comments
8(a)	20	B1	

Q	Answer	Mark	Comments
8(b)	Vertical line drawn at 34 (for median)	B1	$\pm\frac{1}{2}$ small square
	Vertical lines drawn at 30 and 38 (for lower and upper quartiles)	B1	$\pm\frac{1}{2}$ small square
	Whiskers drawn to 5 and 70 and complete, correct plot	Q1ft	ft B0B1 or B1B0 if fully correct structure and 4 out of 5 measures correctly plotted $\pm\frac{1}{2}$ small square Strand (ii) Correct structure

Additional guidance	
Mark intention throughout	
Accept unconventional plots eg line through middle of box arrows/ dots/ longer vertical lines/ no endings on whiskers any depth of box	
Median at 35 is in tolerance so give benefit of the doubt (even if median = 35 stated)	B1

Q	Answer	Mark	Comments
9	3×6 or (total =) 18	M1	Implied by three integers with a sum of 18
	1, 1, 16	A1	May be implied by an answer of 15
	15	A1ft	ft correct calculation of the range of a group of three integers with a sum of 18

Additional guidance	
The 'three integers' must be clearly in a group of three	
If more than one group of 'three integers' is given but all have a sum of 18	M1A0
0, 0, 18 with no or incorrect range given	M1 A0 A0
0, 0, 18 with answer = 18	M1 A0 A1ft
1, 3, 15 with answer = 14	M0 A0 A0
1, 2, 15 with answer = 14	M1 A0 A1ft
1, 1, 16 with answer = 14	M1 A1 A0

Q	Answer	Mark	Comments
10(a)	Men and modal class (women) = 160 – 170	B1	Condone mode = [164, 166]

	Additional guidance	
Women chosen	B0
Ignore reference to range if mode also seen in (a) and Men chosen	B1
Ignore reference to median or mean if mode also seen in (a) and Men chosen	B1
Range or median or mean only	B0

Q	Answer	Mark	Comments
10(b)	190 – 160 or (range =) 30 or 195 – 155 or (range =) 40 or 200 – 150 or (range =) 50	M1	Condone [194, 196] – [154, 156]
	Men and minimum range (women) is 30	A1	Condone Men and range (women) is 40 or result of [194, 196] – [154, 156]

	Additional guidance	
Correct working or value for any of the three ranges, even if seen in part (a) scores the M mark but must be referring to range in (b) to score the A mark	M1
Any suggestion of using the mode for the decision in this part	A0
NB The frequency for 170 – 180 (ie at 175) is 30	M0
The range of frequencies = 35 – 1 = 34	M0
Use of men's range as 180 – 170 or 10	A0

Q	Answer	Mark	Comments
11	0.73 or 73(%) or $\frac{73}{100}$ or $\frac{100}{73}$ seen	B1	
	1138.8(0) ÷ 0.73	M1	oe
	1560	A1	SC2 896.69

	Additional guidance	
Misread as increase	SC2

Q	Answer	Mark	Comments
12	Mean	B1	
	One value not representative	B1	oe Accept any indication that one of the values is non-typical, or that the mean would be non-typical
	Additional guidance		
	Mark the reason independently of the given average		
	Ignore non-contradictory statements alongside a correct reason		
	Accept any indication that 3420 is **significantly** different **compared** to all others	B1	
	Accept outlier, anomaly, extreme value etc	B1	
	Accept an indication that it would skew the mean	B1	
	Do not accept inaccurate to mean unrepresentative if this is the only reason given	B0	
	Just stating that 3420 is very large with no comparison	B0	

Q	Answer	Mark	Comments
13(a)	$\dfrac{4}{625}$	B2	B1 0.0064 or $\dfrac{64}{10000}$ oe fraction
	Additional guidance		
	If 0.0064 or $\dfrac{4}{625}$ seen but then further work can score B1 max (but not if choice) eg $\dfrac{4}{625}$ seen with answer $\dfrac{16}{25}$		B1
	Condone an attempt to change form eg correct fraction to percentage or correct decimal to fraction for max B1 eg $\dfrac{4}{625}$ × 100 = $\dfrac{8}{125}$ eg 0.0064 = $\dfrac{64}{1000}$		B1 B1

Q	Answer	Mark	Comments
13(b)	$1.5 \times 10^{-2} \ \times \ 1.5 \times 10^{-2}$ or 0.000 225 or $\dfrac{9}{40\ 000}$	M1	oe
	2.25×10^{-4}	A1	SC1 for an incorrect answer (< 1) correctly converted to standard form
	Additional guidance		
	$1.5 \times 10^{-2} \ \times \ 2 = 0.03$ Answer 3×10^{-2}		SC1
	$1.5 \times 10^{-2} \ \times \ 2$ Answer 3×10^{-2}		SC1
	Answer only of 3×10^{-2}		SC0

Q	Answer	Mark	Comments
14	<table><tr><td>5</td><td>4</td><td>9</td></tr><tr><td>16</td><td>35</td><td>51</td></tr><tr><td>21</td><td>39</td><td></td></tr></table> or <table><tr><td>6</td><td>4</td><td>10</td></tr><tr><td>15</td><td>35</td><td>50</td></tr><tr><td>21</td><td>39</td><td></td></tr></table>	B3	B2 at least five cells correct B1 three or four cells correct or 60 ÷ 500 or 0.12 oe seen or 500 ÷ 60 or 8.3(...) oe seen For B2 or B1 accept any of these values: <table><tr><td>5.4</td><td>3.96</td><td>9.36</td></tr><tr><td>15.6</td><td>35.04</td><td>50.64</td></tr><tr><td>21</td><td>39</td><td></td></tr></table>

Q	Answer	Mark	Comments
15(a)	**Alternative method 1**		
	Counts the 'squares' in one rectangle	M1	eg 7.2 or 3 or 4 or 2 (squares) respectively or 180 or 75 or 100 or 50 respectively
	their 7.2 + their 3 + their 4 + their 2 or 16.2 or their 180 + their 75 + their 100 + their 50 or 405	M1dep	If correct, the areas will be in the ratio 36 : 15 : 20 : 10 At least two must be in the correct ratio
	$\dfrac{\text{their } 7.2}{\text{their } 16.2}$ (× 81) or 81 ÷ their 16.2 or $\dfrac{\text{their } 180}{\text{their } 405}$ (× 81) or 81 ÷ their 405	M1dep	5 small squares ≡ 1 tree or 1 small square ≡ 0.2 tree
	36	A1	SC1 frequency density scale 1 cm ≡ 5
	Alternative method 2		
	Labels vertical axis 1x, 2x, 3x, 4x, 5x	M1	
	2.4 × 3x + 0.6 × 5x + 1 × 4x + 2 × x (= 81)	M1dep	Allow one error or omission
	16.2x = 81 or x = 5	M1dep	
	36	A1	SC1 frequency density scale 1 cm ≡ 5
	Additional guidance		
	NB If the student only labels the widths of the rectangles: 2.4 (often 2.5), 0.6 (often 0.5), 1 and 2 then this 2 is a width and not an area		M0
	For the 1st M1 any other method must be clear and must include at least two areas in the correct ratio		M1
	If the frequency density scale is linear but incorrect eg 1 cm ≡ 20, then at least two areas correct for that scale implies the first M mark		M1
	Dividing the rectangles into squares is not enough for the first mark, the number of squares needs to be stated		M0
	Answer of 36 implies 4 marks (unless clearly from wrong working)		M1 M1dep M1dep A1

Q	Answer	Mark	Comments
15(b)	6 ÷ 16.2 or 150 ÷ 405 or 30	M1	oe
	$\frac{150}{405}$ or $\frac{30}{81}$ or $\frac{10}{27}$	A1	oe fraction

Additional guidance	
Correct use of their areas from part (a)	M1

16	**Alternative method 1**		
	47.5 or 48.5 or 6995 or 7005 seen	B1	
	6995 ÷ 48.5 or 144.22... or 144.23	M1	Condone [6995, 7000) ÷ (48, 48.5]
	144	A1	Must be using 6995 and 48.5
	Alternative method 2		
	47.5 or 48.5 or 6995 or 7005 seen	B1	
	48.5 × 144 = 6984 and 48.5 × 145 = 7032.5	M1	Condone (48, 48.5] × n = a and (48, 48.5] × (n + 1) = b where a < 6995 and b > 6995
	144	A1	Must be using (6995 and) 48.5

Additional Guidance	
Answer only of 144	B0 M0 A0
6995 ÷ 48.49 = 144.256, answer 144	B1 M1 A0
7005 ÷ 48.5 = 144	B1 M0 A0
48.4$\dot{9}$ is equivalent to 48.5 so can have full marks, however eg 48.499 will not gain the A mark	

Q	Answer	Mark	Comments
17	$\dfrac{a}{11} \times \dfrac{b}{10}$ or $\dfrac{7}{n} \times \dfrac{6}{n-1}$ or $\dfrac{4}{n} \times \dfrac{3}{n-1}$	M1	
	$\dfrac{7}{7+4} \times \dfrac{6}{7+4-1}$ or $\dfrac{7}{11} \times \dfrac{6}{10}$ or $\dfrac{42}{110}$ or $\dfrac{21}{55}$ or 0.38... or $\dfrac{4}{7+4} \times \dfrac{3}{7+4-1}$ or $\dfrac{4}{11} \times \dfrac{3}{10}$ or $\dfrac{12}{110}$ or $\dfrac{6}{55}$ or 0.109... or 0.11	M1dep	oe
	$\dfrac{7}{7+4} \times \dfrac{6}{7+4-1}$ + $\dfrac{4}{7+4} \times \dfrac{3}{7+4-1}$ or $\dfrac{7}{11} \times \dfrac{6}{10}$ + $\dfrac{4}{11} \times \dfrac{3}{10}$	M1dep	oe
	$\dfrac{54}{110}$ or $\dfrac{27}{55}$ or 0.49... or 49.(...)%	A1	oe SC2 $\dfrac{54}{121}$ or $\dfrac{65}{110}$ or $\dfrac{43}{99}$ oe SC1 $\dfrac{65}{121}$ oe