GCSE

STATISTICS

43101H Unit 1: Statistics Written Paper (Higher)
Mark scheme

43101H
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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.
M dep	A method mark dependent on a previous method mark being awarded.
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.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
E	Explain marks are awarded for a full and detailed explanation
ft	Follow through marks. Marks awarded following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
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.

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 1 Higher Tier

Q	Answer	Mark	Comments
1	Any two from - No label on vertical axis - Symbols wider as well as taller / other referencing of 2D (allow 3D) issue - Difficult to read off values - Title incomplete / unclear	B2	oe B1 any one correct reason

2(a)	Continuous	B1	Any indication

2(b)	Discrete	B1	Any indication

2(c)	Qualitative	B1	Any indication

3(a)	$3 + 8 + \ldots + 109$ (= 141) and $1500 + 2100 + \ldots + 3100$ (= 12 000)	M1	Allow one error or omission
	$\dfrac{their\,141}{their\,12000}$ or 0.011 75	M1	oe
	11.75 or 11.8	A1	Allow 12 if supported

3(b)	Hopewell likely to have a higher proportion of older people	B1ft	Oe Ft their value from 3(a)

3(c)	SDR takes in to account differing population age distribution	B1	oe e.g. takes into account people's ages

Q	Answer	Mark	Comments
4(a)	Completes key appropriately	B1	
	Correct ordered leaves 7 8 9 9 4 6 1 2 5 6 1 3 9 6 8	B2	B1 up to two errors or omissions Count unordered as one error

Q	Answer	Mark	Comments
4(b)	Evidence of selecting their middle value(s)	M1	8th if from correct stem-and-leaf
	102	A1ft	Ft their values as long as ordered SC1 101.5 SC1 2

Q	Answer	Mark	Comments
4(c)	4th position identified (LQ) or 12th position identified (UQ)	M1	ft for 15 ordered values
	89 or 113	A1	
	113 – 89 (= 24)	A1	Allow embedded 24

Q	Answer	Mark	Comments
4(d)	Higher average (on Sunday)	B1ft	oe
	Smaller interquartile range (on Sunday)	B1	oe

Q	Answer	Mark	Comments
5(a)	certain subject examiners may not be included	B1	Randomness does not guarantee representativeness oe

Q	Answer	Mark	Comments
5(b)	Convenience or judgement	B1	

Q	Answer	Mark	Comments
5(c)	**Alternative method 1**		
	$\dfrac{185}{400}$ or 0.4625	M1	oe
	their 0.4625 × 50 or 23.125	M1	oe
	23	A1	SC1 25 or 2
	Alternative method 2		
	400 ÷ 50 or 8 or 50 ÷ 400 or $\dfrac{1}{8}$	M1	oe
	185 ÷ their 8 or 185 × their $\dfrac{1}{8}$ or 23.125	M1	oe
	23	A1	SC1 25 or 2

Q	Answer	Mark	Comments
5(d)	(advantage) Convenient or easier or quicker or cheaper	B1	oe
	(disadvantage) Access issues	B1	oe

Q	Answer	Mark	Comments
5(e)	Overlap (at 10)	B1	Oe
	not exhaustive	B1	Oe e.g.1 nothing under 2 e.g.2 nowhere if you have worked for 4½ years

Q	Answer	Mark	Comments
6(a)	East	B1	

Q	Answer	Mark	Comments
6(b)	11.6 or –6.3 seen	M1	
	17.9	A1	SC1 5.3 or –17.9

Q	Answer	Mark	Comments
6(c)	170 – 133 (= 37)	M1	or $\dfrac{170}{133}$ (= 1.278)
	$\dfrac{\text{their } 37}{133} \times 100$	M1	(their 1.278 – 1) × 100
	27.8 or better	A1	Accept 28

Q	Answer	Mark	Comments
6(d)	**Alternative 1**		
	107.3 + 6.4 + 16.1 + 8.7 or [138,139)	M1	Allow one error or omission
	16.1 ÷ their [138,139) or 0.116...	M1dep	oe
	their 0.116… × 360 or 41.8…	M1dep	oe allow 41.9

	42	A1	SC3 17 or 23 or 76 or 84 or 90 or 279
			SC2 [16.6, 16.7] or [22.6, 22.7]
			  or [76.1, 76.2] or [83.9, 84.0]
			  or [89.5, 89.6] or [278.9, 279.0]

	Alternative 2		
	107.3 + 6.4 + 16.1 + 8.7 or [138,139)	M1	Allow one error or omission
	360 ÷ their [138, 139) or 2.599… or 2.6	M1dep	oe
	Their 2.599… × 16.1 or 41.8…	M1dep	oe allow 41.9

	42	A1	SC3 17 or 23 or 76 or 84 or 90 or 279
			SC2 [16.6, 16.7] or [22.6, 22.7]
			  or [76.1, 76.2] or [83.9, 84.0]
			  or [89.5, 89.6] or [278.9, 279.0]

Q	Answer	Mark	Comments
6(e)(i)	traffic decrease	B1	oe
6(e)(ii)	lowest level of recycling	B1	oe
7(a)	70 total Angus	B1	
	85 total Ayrshire	B1ft	ft 280 – 125 – their 70
	All 8 remaining values correct	B3ft	B2ft 4 – 7 remaining values correct B1ft 1 – 3 remaining values correct ft 40% of their 70 or 60% of their 70 and 40% of their 85 or 60% of their 85 **only**

	Angus	Hereford	Ayrshire	Total
Tested	28	50	34	112
Not Tested	42	75	51	168
Total	70	**125**	85	**280**

Q	Answer	Mark	Comments
7(b)(i)	$\dfrac{\text{their } 75}{280}$	B1ft	oe eg 0.27 or better or $\dfrac{15}{56}$ ft their table

Q	Answer	Mark	Comments
7(b)(ii)	their 70 + 125 or 280 – their 85 or 195	M1	oe
	$\dfrac{195}{280}$	A1ft	oe eg 0.70 or better or $\dfrac{39}{56}$

Q	Answer	Mark	Comments
7(b)(iii)	**Alternative method 1**		
	$\dfrac{\text{their } 70}{280} + \dfrac{\text{their } 112}{280}$	M1	or 0.65 oe
	$-\dfrac{\text{their } 28}{280}$	M1	
	$\dfrac{154}{280}$	A1ft	oe $\dfrac{11}{20}$, 55%, 0.55
	Alternative method 2		
	their 70 + their 112	M1	
	their 182 – their 28	M1	M2 their 112 + their 42 or their 70 + their 50 + their 34
	$\dfrac{154}{280}$	A1ft	oe $\dfrac{11}{20}$, 55%, 0.55

Q	Answer	Mark	Comments
7(c)	$\dfrac{\text{their } 112}{280}$ or $\dfrac{\text{their } 168}{280}$	M1	ft from their table oe, eg 0.4
	$\dfrac{\text{their } 112}{280} \times \dfrac{\text{their } 168}{279} \times \dfrac{\text{their } 167}{278}$ (= 0.1446)	M1	
	their 0.1446… × 3	M1	$3 \times \dfrac{\text{their } 112}{280} \times \dfrac{\text{their } 168}{280} \times \dfrac{\text{their } 168}{280}$ is M1 M0 M1 A0
	0.434	A1ft	Accept 0.43 if supported. SC2 for $\dfrac{54}{125}$ or 0.432

Q	Answer	Mark	Comments
8(a)	$\dfrac{3}{5} \times 30$ (= 18)	M1	or $\dfrac{2}{5} \times 30$ (= 12)
	their 18 + 48 + 21 + 15	M1dep	or 132 – their 12 – 18
	102	A1	SC1 108

Bar charts can only score a maximum of **one** mark i.e. M0A0B0B1

Q	Answer	Mark	Comments
8(b)	any 1 of 3.6 4.8 1.4 0.6	M1	seen or implied by heights of bars
	all of 3.6 6 4.8 1.4 0.6	A1	seen or implied by heights of bars
	vertical plots including scale	B1ft	
	horizontal plots	B1	

Q	Answer	Mark	Comments
8(c)	Positive	B1	

Q	Answer	Mark	Comments
8(d)	Loss of detail	B1	oe

Q	Answer	Mark	Comments
9(a)	$\dfrac{\text{vertical}}{\text{horizontal}}$ (eg $\dfrac{10}{200}$)	B1	Oe Accept substitution of coordinates of a point in the given equation

Q	Answer	Mark	Comments
9(b)(i)	$y = 0.02x + 6$	B2	B1 for gradient = 0.02 oe **or** B1 for y-intercept = 6

Q	Answer	Mark	Comments
9(b)(ii)	(fixed) monthly charge	B1	oe
	cost per minute used	B1	oe

Q	Answer	Mark	Comments
9(c)	**Alternative method 1**		
	Mean = 220	B1	Accept median = 230
	Contract: cheaper per month	B1dep	oe
	Alternative method 2		
	9 + 12.5(0) + 11.5(0) **and** 9.6(0) + 11 + 10.6(0)	M1	Allow 20p tolerance on each
	£33 and £31.20 **and** Contract cheaper per month	A1	Allow 60p tolerance on totals. oe
	Alternative method 3		
	Two months are over 200 (where the contract is cheaper)	B1	oe
	Contract cheaper per month	B1dep	oe
	Alternative method 4		
	9.6(0) – 9(.00) **and** 12.5(0) – 11(.00) **and** 11.5(0) – 10.6(0)	M1	Allow 20p tolerance on each value. Allow either order for each subtraction.
	£1.80 **and** Contract cheaper per month	A1	Allow £1.20 tolerance on the difference oe

Q	Answer	Mark	Comments
10(a)(i)	$\dfrac{3636}{36}$ (= 101)	B1	Allow embedded use of result eg (36 × 101 = 3636)
10(a)(ii)	$\dfrac{367\,677}{36} - (101)^2$	M1	oe
	$\sqrt{12.25}$ (= 3.5)	A1	
10(b)(i)	$\dfrac{115 - 101}{3.5}$	M1	oe
	(+) 4	A1	
10(b)(ii)	outside 3σ limits or outside 2σ limits	B1	oe
10(c)	different times, traffic delays, weather conditions, additional effort in trial	B1	oe
10(d)(i)	75	B1	
10(d)(ii)	112	B1	
11(a)(i)	4 9 5 3 8 (1) 7 (2) 6	B1	
	9 3 7 (1) 4.5 (2) 6 4.5 8	B1	

Q	Answer	Mark	Comments
11(a)(ii)	For differences of attempt at ranking	M1	Ft allow one error in their values
	$\sum d^2$ = 93.5 if correct but allow one error in squaring	M1	Ft only for differences of ranks
	$1 - \dfrac{6(\text{their } 93.5)}{9(81-1)}$	M1dep	$1 - \dfrac{6(\text{their } 93.5)}{9(9^2-1)}$
	0.22 or better	A1	

Q	Answer	Mark	Comments
11(b)	(The claim is) wrong	B1ft	Strict follow through (must have an answer for a(ii) stated between -1 and 1 inclusive)

Q	Answer	Mark	Comments
11(c)	6400 – 4300 or 2100	M1	or (6400 – 4301) or (6400 – 4300.01)
	(£)2099 or (£)2099.99	A1	

Q	Answer	Mark	Comments
11(d)	0.01 0.08 -0.57 0.84 -0.85	B2	B1 for the 2 ends correct or first 2 correct or last 2 correct or for the reverse order B1 all in reverse order

Q	Answer	Mark	Comments
11(e)	increase in one variable but a **reduction** in the other variable	B1	oe e.g. it's negative (correlation)
	correlation does not imply causation	B1	

Q	Answer	Mark	Comments
12(a)	1801 + 136 – 118	M1	oe
	1819	A1	
	1841	A1	

Q	Answer	Mark	Comments
12(b)	Both correct and joined	B2ft	Tolerance ½ small square B1ft one correct plot

Q	Answer	Mark	Comments
12(c)	Increasing trend **on previous year** or specific comment on seasonal change	B1	oe e.g. sales increase towards Christmas oe