

8300

## GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

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Statistics

Choosing suitable averages and solving problems

v1.0

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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.

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

|                        |                                                                                                                                       |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>M</b>               | Method marks are awarded for a correct method which could lead to a correct answer.                                                   |
| <b>A</b>               | 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>B</b>               | Marks awarded independent of method.                                                                                                  |
| <b>ft</b>              | Follow through marks. Marks awarded for correct working following a mistake in an earlier step.                                       |
| <b>SC</b>              | Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.                       |
| <b>M dep</b>           | A method mark dependent on a previous method mark being awarded.                                                                      |
| <b>B dep</b>           | A mark that can only be awarded if a previous independent mark has been awarded.                                                      |
| <b>oe</b>              | Or equivalent. Accept answers that are equivalent.<br>e.g. accept 0.5 as well as $\frac{1}{2}$                                        |
| <b>[a, b]</b>          | Accept values between a and b inclusive.                                                                                              |
| <b>3.14...</b>         | Allow answers which begin 3.14 e.g. 3.14, 3.142, 3.1416                                                                               |
| <b>Use of brackets</b> | 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 student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

### **Questions which ask students to show working**

Instructions on marking will be given but usually marks are not awarded to students who show no working.

### **Questions which do not ask students to show working**

As a general principle, a correct response is awarded full marks.

### **Misread or miscopy**

Students often copy values from a question incorrectly. If the examiner thinks that the student 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.

**Q1.**

**Alternative method 1**

$6 \times 18$  or 108

$$(16.2 + 18.1 + 15.9 + 17.8 + 21 + x) \div 6 = 18$$

**M1**

their 108 –  $(16.2 + 18.1 + 15.9 + 17.8 + 21)$

*oe eg complete repeated subtraction.*

*Look for total written under or by table.*

**M1dep**

19

*SC1 89 seen*

**A1**

**Alternative method 2**

18 – each value in table, eg

1.8, –0.1, +2.1, +0.2, –3

*Allow one error*

**M1**

Totals their subtractions

their  $(1.8 + -0.1 + 2.1 + 0.2 + -3)$  or 1

**and** adds to 18

**M1dep**

19

**A1**

**Additional Guidance**

$$16.2 + 18.1 = 34.2, 34.2 + 15.9 = 60.1$$

$$60.1 + 17.8 = 77.9, 77.9 + 21.0 = 88.9$$

$$6 \times 18 = 118$$

**M1**

$$118 - 88.9 = 30.9$$

**M1dep, A0**

$$(16.2 + 18.1 + 15.9 + 17.8 + 21 + x) \div 6 = 18$$

**M1**

$$x = 118 - 89.7$$

**M1dep**

$$x = 28.3$$

**A0**

*Allow incorrect solution of equation if full method*

$$1.8 - 0.1 + 2.1 + 0.3 - 3 = 1.1$$

**M1**

19.1

**M1dep, A0**

**[3]**

**Q2.**

3

*B1 for 8 seen as value of X for Set A*

*or 3 seen as value of X for set A but different value for set B*

**B2**

**[2]**

**Q3.**

Median ticked

and

a valid reason for not using mode (eg there is no mode)

and

a valid reason for not using mean (eg 82 will affect the mean disproportionately)

*B1*

*median ticked*

*or*

*valid reason to reject mean or valid reason to reject mode with  
any box or no box ticked*

**B2**

**Additional Guidance**

Accept any indication in place of a tick

Ignore non-contradictory statements alongside a correct reason

Median ticked with reasons “There is no mode” and “82 would skew the mean”

**B2**

No box or mode ticked with reason “Not mean, because of the 82”

**B1**

No box or mean ticked with reason “Not mode, all the numbers are different”

**B1**

No box or mode ticked with statement that 82 is very large

**B0**

Condone “one number” or “82” in reason for mean if intention is clear, e.g.  
“One of the numbers is far bigger than the others”

Do not accept reasons for the mean indicating that 12.7 is too high unless 82 is  
also mentioned

Do not accept reasons given with the wrong measure

eg “It cannot be the mean as they’re all different”

Do not accept a reason which simply defines mean and mode

Giving reasons for mode and mean does not imply a selection of median – the  
box must be ticked to achieve both marks

Median ticked with two valid reasons which are not attributed to median and mode  
eg median ticked and “There is not a repeated number” and “82 is far too high  
to calculate the average”

**B2**

Otherwise, reasons must be attributed

**[2]**

**Q4.**

(a) mode = 8

*May be implied from answer  $\frac{8}{27}$*

**B1**

2 + 3 + 6 + 7 + 9 or 27

*Allow one error or omission if working shown*

**M1**

$\frac{9}{27}$  or  $\frac{1}{3}$

*oe*

*ft their mode*

**A1ft**

(b) 8 – 4 or 4

or

8 – 3 or 5

**M1**

Range of 3A is smaller

and

4 and 5

*SC1 4 to 8 and 3 to 8 seen oe*

**A1**

(c)  $\frac{29 + 1}{2}$  or 15th value identified

**M1**

6

**A1**

**[7]**

**Q5.**

8 and 10

*B2 for any whole number combination that satisfies the median equal to the mean.*

*There are an infinite number.*

*Common ones are*

*(1, 12), (2, 11), (3, 10), (4, 9), (5, 8), (2, 6), (6, 7), (9, 14), (10, 18), (11, 22)*

*(11 + n, 22 + 4n), (15, 18), (16, 17), (any pair greater than 11 that total 33).*

*B1 for any decimal combination that satisfies the median equal to the mean.*

*There are an infinite number.*

*Common ones are*

*(7.5, 8), (8.5, 12), (8.5 + n, 12 + 4n).*

**B3**

**Alternative Method 1**

22 + x + y = 5x *oe*

**M1**

4x – y = 22 *oe*

**M1**

8 and 10

**A1**

### Alternative Method 2

Chooses values for  $x$  and  $y$  (which may be the same) where both are between 7 and 11 inclusive and calculates mean correctly or compares total to  $5x$ .

e.g. 8 and 9 chosen, Mean =  $39 \div 5 = 7.8$  or total =  $39 \neq 40$

NB an attempt at another pair of values implies rejection of first pair

**M1**

Chooses two further values for  $x$  and  $y$  where both are between 7 and 11 inclusive and calculates mean correctly or compares total to  $5x$ .

e.g. 9 and 10 chosen, Mean =  $41 \div 5 = 8.2$  or total =  $41 > 40$

**M1**

8 and 10

**A1**

**[3]**

**Q6.**

(a) 1200

**B1**

(b)  $5\frac{1}{2}$  value after 5<sup>th</sup> value stated as 1200 and 6<sup>th</sup> value stated or implied as 1400 or list of 10 values in order with median marked between 1200 and 1400.

*Strand (ii)*

*(1200 + 1400) / 2 is Q0 unless list seen or 1200 and 1400*

*identified as 5<sup>th</sup> and 6<sup>th</sup> values*

**Q1**

(c) Manager's salary is too large  
or large values distort the mean  
or majority of employees earn less than the mean

*oe*

*eg Mean not representative of the majority*

*Must refer to 'distortion caused by one large salary or a majority of low salaries'.*

**B1**

**[3]**

**Q7.**

$2.5(0) \times 11$  or  $27.5(0)$   
or  $7.5(0) \times 7$  or  $52.5(0)$   
or  $12.5(0) \times 2$  or 25

**M1**

their  $27.5(0) +$  their  $52.5(0) +$  their 25  
or 105

*sum of fx*

**M1dep**

their  $105 \div 20$  or 5.25

**M1dep**

5.25 and correct conclusion

*oe*

*eg 5.25 and women gave more*

**A1**

### Additional Guidance

$105 \div 3 = 35$

**M1M1M0A0**

**[4]**

**Q8.**

- (a) Attempts to calculate  $fx$   
(at least one attempt)  
or 424 seen

$$\begin{aligned}8 \times 10 & (= 80) \\10 \times 18 & (= 180) \\12 \times 7 & (= 84) \\15 \times 4 & (= 60) \\20 \times 1 & (= 20)\end{aligned}$$

**M1**

their  $424 \div$  their 40  
10.6

**M1 dep**

10.60

*Strand (i)*  
*Correct notation required*  
*Do not accept 10.6*  
*SC2 404.5*

**Q1**

- (b) Mode = 10 as it is the value occurring most often  
oe

**B1**

Median is the 20th (or 20.5th) unless contradicts with conclusion  
oe  
*SC1 both definitions only without 'Yes' or '£10'*

**B1**

- (c) One similarity  
*eg same range, same mode, same values for data, same frequency for*  
*£15*  
oe

**B1**

One difference  
*Different mean, different median, Shelley 50 visits/fees, Paul 40*  
oe  
*Calculations/working not required*

**B1**

**[7]**

**Q9.**

- (a)  $(1 + 1 + 10 + 2 + 10 + 1 + 3) \div 7$  or  $1 + 1 + 10 + 2 + 10 + 1 + 3$   
*oe Allow one error or omission*

**M1**

4 or 28 and 35

**A1**

(range =) 9

*Range*

**B1**

Ed's scores are higher on average

or Danni's scores are more varied

*oe ft their values for mean or totals or range*

*Strand (iii)*

*Supporting answers with explanation and evidence*

**Q1**

Ed's scores are higher on average (or in total)

**and** Danni's scores have bigger range

*oe*

*ft their values for mean or totals and range*

**B1 ft**

- (b) Danni and valid reason or Ed and valid reason

*eg (Danni) only one that scored 10 (Ed) more consistent*

**B1 ft**

**[6]**

**Q10.**

- (a)  $2 \leq t < 4$

- (b) **Alternative method 1**

**B1**

$32 + 19 + 20$  or 71 and  $80 \times 0.9$

or

$(32 + 19 + 20) \div 80 \times 100$  or 88.75

*oe*

**M1**

71 and 72 and No

or

88(.75)(%) or 89(%) and No

*Accept 88(.75)(%) and Yes because it rounds to 90*

**A1**

**Alternative method 2**

$7 + 2$  or 9 and  $80 \times 0.1$

or

$(7 + 2) \div 80 \times 100$  or 11.25

*oe*

**M1**

9 and 8 and No

or

11(.25)(%) or 12(%) and No

**A1**

**[3]**

**Q11.**

5, 5 and 14  
Any order

*Conditions are  
three positive numbers  
mode 5  
median 5  
range 9  
B1 for 2 or 3 conditions satisfied*

**B2**

**Additional Guidance**

There are four condition to meet:

1. All three numbers must be positive
2. The mode must be 5
3. The median must be 5
4. The range must be 9

5, 5, -4 (satisfies three conditions but not positive)

**B1**

5, 5, blank (satisfies two conditions)

**B1**

Candidates who put more than 3 numbers score B0

Candidates who put 1 number score B0

**[2]**

**Q12.**

(a)  $200 < t \leq 240$

**B1**

(b)  $16 \times 220 (= 3520)$  or  $4 \times 260 (= 1040)$

*Attempt at fx using one correct midpoint*

or  $4 \times 300 (= 1200)$  or  $2 \times 380 (= 760)$

or  $2 \times 460 (= 920)$  or  $2 \times 500 (= 1000)$

or

8440

**M1**

(their 3520 + their 1040 + their 1200 + their 0 + their 760 + their 0 + their 920 + their 1000)  $\div 30$

*1055 implies M1M0A0*

*7473.(...) implies M1M1A0*

**M1 dep**

281 or 282 or 281.3 (...)

*SC2 301.(3..) or 261.(3..)*

**A1**

(c) Ticks modal class and gives valid reason oe

*the mean is affected by a few (older) slower times*

eg Current performance in this class

or

This class has shorter times

or

*older / slower times irrelevant to current performance*

**B1**

**[5]**

**Q13.**

(a) Line of height 4 above 0 goals

**B1**

(b)  $(0 \times 4) + 1 \times 6 + 2 \times 3 + 3 \times 4 + 4 \times 2 + 5 \times 1$

$(0) + 6 + 6 + 12 + 8 + 5$

*Allow one error or omission*

**M1**

37

*SC1 41*

**A1**

(c)  $2 \times 21$  (– their 37)

$2 \times 20$  (– *their* 37) + 2

**M1**

5

*ft their part (b)*

**A1 ft**

**[5]**

**Q14.**

$n + 18$

or  $18 \div 2$  or 9

or  $45 \times 2$

*Tries two numbers with a difference of 18*

*or tries two numbers with a sum of 90*

**M1**

$n + n + 18$  or  $n + 9$

or  $45 - 9$  or  $45 + 9$

or their  $90 - 18$  (= 72)

or their  $90 + 18$  (= 108)

*oe*

*Different trial*

**M1**

$n + n + 18 = 90$  or  $n + 9 = 45$

or  $45 - 9$  and  $45 + 9$

or their  $72 \div 2$

or their  $108 \div 2$

*oe*

*3rd trial*

**M1**

Amy 36

*36 and 54 in any order*

**A1**

Chris 54

**A1**

**[5]**

Q15.

$$\text{(Median =)} \frac{2x+6x}{2}$$

or  $4x (= 12)$  seen

oe

**M1**

$$x = 3$$

oe

**A1**

3, 6, 18 and 33 seen

or their  $3 + 2(\text{their } 3) + 6(\text{their } 3) + 11(\text{their } 3)$

or their 3, 6, 18 and 33 seen

$$\text{or (Mean =)} \frac{x+2x+6x+11x}{4}$$

Allow one error

**M1**

$$\frac{3+6+18+33}{4} \quad \text{or} \quad \frac{20x}{4} \quad \text{or} \quad 5x$$

or their  $5x$

or  $(\text{their } 3 + 2(\text{their } 3) + 6(\text{their } 3) + 11(\text{their } 3)) \div 4$

**M1dep**

15

ft  $5 \times \text{their } x \text{ value}$

**A1ft**

**[5]**

**Q16.**

$16 \times 2$  or 32 or  
 $7 \times x$  or  $7x$  or  
 $20 \times 12$  or 240 or  
 $10 \times 17$  or 170 or  
 $16 + x + 20 + 10$  or  $46 + x$   
oe

**M1**

$16 \times 2 + 7 \times x + 20 \times 12 + 10 \times 17$   
or  
 $16 \times 2 + 7x + 240 + 170$  or  
 $442 + 7x$

oe

*Must be the sum of 4 products*

*Award if correct expression seen, even if in an incorrect equation*

**M1**

their  $(32 + 7x + 240 + 170) =$   
 $8.5 \times$  their  $(16 + x + 20 + 10)$   
or  
their  $(442 + 7x) =$   
 $8.5 \times$  their  $(46 + x)$

oe equation

*ft their sum of at least 3 products, one of which must be  $7 \times x$*

*ft sum of at least 3 frequencies, one of which must be  $x$*

**M1**

their  $442 -$  their  $(8.5 \times 46) =$   
 $8.5x - 7x$

oe equation

*dep on 3<sup>rd</sup> M1*

*Expands and rearranges their equation*

*Allow one sign or expansion error*

**M1dep**

34

*Answer 34 with no incorrect working gains 5 marks*

**A1**

**[5]**

**Q17.**

Comment comparing mean

*eg On average treated plants are taller*

**B1**

Comment comparing IQR

*eg Less variation in treated plants*

*Treated plants more consistent (height)*

**B1**

**[2]**

**Q18.**

$70 \times 5$  or 350

**M1**

their 350 – (65 + 80 + 76 + 69)

**M1dep**

*their 350 – 290*

60

**A1**

**Additional Guidance**

Embedded answer of 60 is 2 marks

**[3]**