

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Statistics

Calculating the median

v1.0

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. e.g. 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 e.g. 3.14, 3.142, 3.1416
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 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.

Puts toffees in order

or

orders the numbers to at least the sixth number from either end

47, 49, 49, 50, 50, 51

or

57, 55, 55, 55, 54, 51

or

gives median of toffees as 51

allow one error or omission on an attempt at a full list

M1

Identifies 48 and 50 for mints

or gives median of mints as 49

eg circled in list or vertical line between 48 and 50

M1

51 for toffees and 49 for mints

with no errors seen

A1

Yes for toffees

and

No for mints

correct decision for their values with M1M1 awarded and a single median given for each

A1ft

Additional Guidance

Ignore modes or means if medians also given, but modes or means only scores zero

Beware of medians coming from only using the distinct values:

47, 49, 50, **51**, 54, 55, 57

46, 47, 48 | 50, 53, 54

M0

For the A1ft, the median may be a decimal

eg 47, 49, 49, 50, 50, 51, 51, 54, 55, 55, 57 median = 50.5

$48 + 50 = 98, 98 \div 2 = 49$

Yes for toffees, No for mints

M1M1A0A1ft

[4]

Q2.

$$2x + 2 + 3x - 1 = 36$$

oe

M1

$$5x = 35 \text{ or } x = 35 \div 5$$

A1

7

ft on $5x = a$ ($a \neq 36$) or $bx = 35$ ($b \neq 2$ or 3)

A1ft

$2 \times$ their 7 + 2 **and** $3 \times$ their 7 – 1 **and**

$4 \times$ their 7 – 6 **and** $5 \times$ their 7 + 2

*their 7 **must** come from the solution (correct or incorrect) of a single equation formed from an expression = 36*

If 7 used, three of 16, 20, 22 and 37

M1

16, 20, 22 and 37 **and** 21 shown as median

or all 4 expressions correctly evaluated and median correctly identified

SC3 $2x + 2 = 36$, $x = 17$, values 36, 50, 62, 87 and median identified as 56

SC2 $2x + 2 = 36$, $x = 17$, values 36, 50, 62, 87

SC1 $2x + 2 = 36$, $x = 17$ (no other equation seen)

A1ft

Additional Guidance

As x is positive only the first 3 values are needed to find the median.

If the 4th value is worked out it must be evaluated correctly

Range is 21 so $37 - 16 = 21$ is A0

$$2x + 2 + 3x - 1 = 36$$

$$5x = 37$$

$$x = 7.4$$

16.8, 21.2, 23.6

22.4 *Only first 3 values necessary*

M1
A0
A1ft
M1
A1ft

$$2x + 2 = 36, x = 17$$

No other equation seen

SC1

Above and 36, 50, 62, 87

SC2

Above and 56

SC3

$$3x - 1 = 36, x = 12.33$$

26.66, 36, 43.32, 63.65

39.66

Decimals must be to two dp or better

M0, A0, A0
M1
A1ft

$$2x + 2 = 36$$

$$2x = 38$$

$$x = 19$$

36, 56, 70, 96

63

Median correct but as last value evaluated wrongly, follow through mark is lost

M0
A0
A0
M1
A0ft

$$2x + 2 + 3x - 1 = 36$$

$$3x = 39$$

$$x = 13$$

28, 38, 46, 67

42

Two errors in solving the equation

M0
A0
A0ft
M1
A1ft

[5]

Q3.

$$\frac{29+1}{2} \text{ or 15th value identified}$$

6

M1

A1

[2]

Q4.

- (a) Total 100 so median 50(th) value or 50.5(th) value

Check diagram for indication of 50 or cumulative totals

M1

Cumulative total

their 18 + their 24 (evaluated)

or 42 up to 5

or their 18 + their 24 + their 32

(evaluated)

or 74 up to 6

18, 42, 74, 94, 100

M1

5.25

oe accept 5.25 – 5.27

A1

- (b) 20 in 6 to 7 bar so 6.8 is $\frac{4}{5}$ of 20 = 16

or $\frac{1}{5}$ of 20 = 4

May need to check diagram in (a)

M1

4 + 6 or 10

A1

35

ft their value for men plus 25

SC1 25 for number of Women > 6.8

A1ft

[6]

Q5.

17 21 21 21 23 25 29 32 36
or 36 32 29 25 23 21 21 21 17
or 17 21 21 21 23
or 36 32 29 25 23
or $\frac{9+1}{2}$ or 5th value

Puts list into order

Allow one omission, extra or transcription error in a full list

*Allow one transcription error in a list of only the first or last five
or Works out the position of the median in the list*

M1

23

A1

Additional Guidance

Answer 23 (from any or no list)

M1A1

Puts list into order then finds the mean

M1A0

Just circles or identifies 29 or gives answer 29

M0

States 5th and circles 29

M1A0

[2]

Q6.

2 6 7 7 8 10 11 12 18
or
18 12 11 10 8 7 7 6 2
or
2 6 7 7 8
or
18 12 11 10 8

allow one miscopy, extra or omission in a full ordered list

M1

8

A1

Additional Guidance

8 from an incorrect list

eg 2 6 7 7 8 10 11 12 16 Answer 8

M1A0

List correctly ordered but clearly used for mode or mean or range

eg1 2 6 7 7 8 10 11 12 18 Answer 7 (mode)

M1A0

eg2 $2+6+7+7+8+10+11+12+18=81$ Answer 9 (mean)

M1A0

eg3 2 6 7 7 8 10 11 12 18 = 81 Answer 9 (mean)

M1A0

eg4 2 6 7 7 8 10 11 12 18 Answer 16 (range)

M1A0

[2]

Q7.

(a) $4 \leq t < 6$

B1

(b) **Alternative method 1**

$18 + 10 + 16 + 12$ or 56 and

60×0.9

or

$(18 + 10 + 16 + 12) \div 60 \times 100$ or 93.3...

oe

M1

56 and 54 and Yes

or

$93(.33)(\%)$ and Yes

A1

Alternative method 2

4 and 60×0.1

or

$4 \div 60 \times 100$ or 6.66

oe

M1

4 and 6 and Yes

or

$6(.66)(\%)$ or 7(%) and Yes

A1

[3]

Q8.

1 2 3 4 6 9

at least the first four values or the last four values in the correct order

M1

3.5

A1

[2]

Q9.

10×1.5 or 15
or 5×4 or 20
or 15×3 or 45
or 10×1 or 10
or 5×2 or 10

May be on diagram
Counting squares
6 or 8 or 18 or 4 or 4

M1

15 and 20 and 45
or 10 and 10 and 45
(working from end of histogram)

May be on diagram
6 and 8 and 18
or 4 and 4 and 18
(working from end of histogram)

M1

$\frac{15}{45} \times (50 - 35)$ or 5
 $\frac{30}{45} \times (50 - 35)$ or 10
 $\frac{6}{18} \times (50 - 35)$ or 5
 $\frac{12}{18} \times (50 - 35)$ or 10

oe
i.e. identifies that 15 or 30 is needed for median depending on
which end they work from in middle bar
or identifies that 6 squares or 12 squares is needed for median
depending on which end they work from in middle bar

M1dep

40

A1

[4]