

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Algebra

Substituting into formulae

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.

$$\frac{1}{2} \times 10^2 \times 7 \text{ or } 700 \text{ oe}$$

M1

350

A1

[2]

Q2.

2160 *may be implied by 240 or 10 800*

B1

$$\frac{5 \times \text{their } 2160}{9} \text{ or } 5 \times 240 \text{ or } 10\,800 \div 9 \text{ or } 1200 \text{ oe}$$

M1

1473

A1

Additional Guidance

Accept 0.55 or 0.56 or better for $\frac{5}{9}$

eg $\frac{5}{9}(2160) + 273$ (no indication that they know to multiply by $\frac{5}{9}$)

B1M0A0

$$\text{eg } \frac{5}{9} \times (2160) + 273$$

B1M1A0

$$\text{eg } 2130, 5 \times 2130 \div 9$$

B0M1A0

[3]

Q3. (a) 2×6 or 12 or 1700 oe

M1

17(.00) *accept 1700p*

A1

(b) 9.5 or $9\frac{1}{2}$ or valid reason *eg shows that 9 windows cost £23 and 10 windows cost £25 or you can't have half a window*

B1

Additional Guidance

Calculated values must be correct (19, 21,) 23, 25 (, 27...)

B1

Even number + 5 can't be even / can't end in a 4

B1

There's no whole number you can times by 2 to get to 19

B1

There's no number you can times by 2 to get to 19

B0

Even + 5 = odd, 24 is even

B1

Even + 5 = odd

B0

Costs are all always odd numbers, 24 is even

B1

Costs are all always odd numbers

B0

19 is a prime number and so doesn't divide exactly by 2

B1

19 is a prime number

B0

[3]

Q4.

(a) 5×4 or 20 oe

M1

18

A1

(b) $-40 + 10$ or -30
or $-40 = 5P - 10$

or $P = \frac{T + W}{5}$

M1

their $-30 \div 5$

M1dep

-6

*SC2 -10 with -50 seen***A1****Additional Guidance**Embedded answer of -6 **M1M1A0**SC2 -10 with -50 seen for $-40 + 10 = -50$ and then $\div 5$ $-40 = 5P - 10$ may use a different letter or symbol for P but not T or W

[5]

Q5.

(a) 20 Allow $P = 20$

B1

(b) $53 - 11$ or 42
or 33×3 or 99
or 11×2
or $33 - 11$
or 22

M1

their $42 \div 3$ or 14

or their $99 - 53 -$ their 22

or (their 22×3) - their 42

or 24

*oe e.g. build up - allow one error***M1dep**

$33 - 11 -$ their 14 or their $24 \div 3$

*Dep on M1M1***M1dep**

8

A1**Additional Guidance**

$3 \times 14 + 11 = 53$

M2

[5]

Q6.

$15^2 - 2 \times 63$ or 225 or 126

*-126 implies M1***M1**

99

A1

[2]

Q7.

(a) $\frac{165 + 567}{12}$ or $\frac{732}{12}$

oe

M1

61

SC1 212.25

A1

Additional GuidanceOnly $165 + 567 \div 12$ with brackets missing

M0A0

61.00

M1A1

61.0

M1A0

(b) **Alternative method 1**

$$50 = \frac{165 + x}{15}$$

or

 50×15 or 750 seen

oe eg $750 = 165 + \text{cost of minibus}$
any letter or symbol or word(s)

M1

 $50 \times 15 - 165$

oe

M1dep

585

SC1 915

A1

Alternative method 2 $165 \div 15$ or 11

oe

M1

 $(50 - \text{their } 11) \times 15$

or

 39×15

oe

M1dep

585

SC1 915

A1

Additional Guidance

Up to M2 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts

(165 + any value) $\div$ 15 does not imply M1 unless set up as an equation for the first mark of Alt 1

Allow 12 as a misread for 15

[5]

Q8.

(a) $0.2(20\,000 - 10\,600)$
or 0.2×9400
oe

M1

1880

A1

(b) 10 600

B1

Additional Guidance

Accept 10 600.01 or 10 600.02 or 10 600.03 or 10 600.04

(c) **Alternative method 1**

$5200 = 0.2(E - 10\,600)$
oe

M1

$5200 \div 0.2$

or 26 000

oe 5200×5

M1dep

36 600

A1

Alternative method 2

$5200 = 0.2(E - 10\,600)$
oe

M1

$5200 + 0.2 \times 10600$

or $5200 + 2120$

or 7320

M1dep

36 600

A1

[6]

Q9.

$0.5 \times 10 \times 12$ or 60
oe

M1

$180 \div \text{their } 60$

M1dep

3

SC1 1.5 oe

A1

[3]

Q10.

Alternative method 1 Compares 70% of volume of hemisphere with volume of water

$$\frac{4}{3} \times \pi \times 12^3 \text{ or } 2304\pi \text{ or } [7216, 7239.2]$$

$$\text{or } \frac{2}{3} \times \pi \times 12^3 \text{ or } 1152\pi \text{ or } [3581, 3638]$$

$$\text{oe eg } \frac{4}{3} \pi \times 1728$$

allow without any multiplication signs

$$\text{eg } \frac{4}{3} \pi 12^3$$

M1

$$0.7 \times \text{their } 1152\pi \text{ or } 806.4\pi$$

$$\text{or } [2506, 2547]$$

oe

$$0.7 \times \text{their } [3581, 3638] \text{ or } \frac{4032}{5} \pi$$

must be using volume of hemisphere

M1dep

$$325 \times 8 \text{ or } 2600$$

oe

M1

$$[2506, 2547] \text{ and } 2600 \text{ and Yes}$$

oe

A1

Alternative method 2 Works out volume of water as proportion of volume of hemisphere

$$\frac{4}{3} \times \pi \times 12^3 \text{ or } 2304\pi \text{ or } [7216, 7239.2]$$

$$\text{or } \frac{2}{3} \times \pi \times 12^3 \text{ or } 1152\pi \text{ or } [3581, 3638]$$

$$\text{oe eg } \frac{4}{3} \pi \times 1728$$

allow without any multiplication signs

$$\text{eg } \frac{4}{3} \pi 12^3$$

M1

$$325 \times 8 \text{ or } 2600$$

oe

M1

$$\text{their } 2600 \div \text{their } 1152\pi$$

$$\text{or } [0.71, 0.73]$$

$$\text{oe eg their } 2600 \div \text{their } [3581, 3638]$$

or 72%

dep on M2

must be using volume of hemisphere

M1dep

$$[71, 73](\%) \text{ and Yes}$$

$$\text{oe eg } 0.72 \text{ and } 0.7 \text{ and Yes}$$

A1

Alternative method 3 Works out time to fill 70% of volume of hemisphere

$$\frac{4}{3} \times \pi \times 12^3 \text{ or } 2304\pi \text{ or } [7216, 7239.2]$$

$$\text{Or } \frac{2}{3} \times \pi \times 12^3 \text{ or } 1152\pi \text{ or } [3581, 3638]$$

$$\text{oe eg } \frac{4}{3} \pi \times 1728$$

allow without any multiplication signs

$$\text{eg } \frac{4}{3} \pi 12^3$$

M1

$0.7 \times \text{their } 1152\pi$ or 806.4π
 or $[2506, 2547]$
 or
 $\text{their } 1152\pi \div 325$
 or $[11, 11.2]$

oe
 $0.7 \times \text{their } [3581, 3638] \quad \frac{4032}{5}\pi$ or
 or
 $\text{their } [3581, 3638] \div 325$
must be using volume of hemisphere

M1dep

$0.7 \times \text{their } 1152\pi \div 325$
 or $0.7 \times \text{their } [3581, 3638] \div 325$
 or $[7.7, 7.84]$

oe
 $\text{their } [2506, 2547] \div 325$
 or $0.7 \times \text{their } [11, 11.2]$

M1dep

$[7.7, 7.84]$ and Yes

oe

A1

Additional Guidance

Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

Allow $1.33(\dots)$ for $\frac{4}{3}$

Allow $0.66(\dots)$ or 0.67 for $\frac{2}{3}$

π may be seen as $[3.14, 3.142]$ eg Alt $1 \frac{2}{3} \times 3.14 \times 12^3$

M1

If a number (or calculation) in terms of π is seen but π is subsequently omitted, treat as a miscopy for M marks

eg Alt 1

1152π

M1

$0.7 \times 1152 = 806.4$

M1dep

$325 \times 8 = 2600$ Yes

M1A0

Yes cannot be implied by inequalities

Alts 1 and 2

$325 \text{ cm}^3 \times 8$ seen is M1 even if evaluated incorrectly

$325^3 \times 8$ seen is M0 unless recovered to 2600

Do not allow misreads of the given formula unless recovered

eg1 using 12^2 instead of 12^3

eg2 using $\frac{3}{4}$ instead of $\frac{4}{3}$

For $0.7 \times \text{their } 1152\pi$, do not accept $70\% \times \text{their } 1152\pi$ unless recovered

[4]

Q11.

(a) $5 \times 1.2 \times 1.2$

oe

M1

7.2

A1

(b) $2 = 5t^2$

oe

M1

0.4 seen

oe implied by $-0.6(3\dots)$

M1dep

0.6(3...)

Must be the positive value only

A1

(c) **Alternative method 1**

$1 = 5t^2$

oe

M1

0.4(4...) or 0.45

A1

Indicates **less than**

ft their (a)

A1ft

Alternative method 2

$5 \times (\frac{1}{2} \times \text{their } 0.6(3\dots))^2$

oe

their 0.6(3...) from (a)

M1

0.5

ft their (a)

A1ft

Indicates **less than**

ft their (a)

A1ft

Alternative method 3

States that the ball is accelerating

M1

States that this means the 2nd metre takes less time

A1

Indicates **less than**

A1

Additional Guidance

Explanation must mention acceleration

[8]