

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Geometry

Volume – Finding the volume of cubes and cuboids

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.

$$5 \times 7 \times 10$$

M1

$$350$$

A1

Additional Guidance

Ignore further “method” for M1

e.g. $5 \times 7 \times 10 \div 2 = 175$

however $5 \times 7 \times 10 \times 5 \times 7 \times 10$ or 350^2 is M0A0

M1A0

ignore units

[2]

Q2.

$$0.7^3$$

or $0.7 \times 0.7 \times 0.7$

M1

$$0.343$$

A1

[2]

Q3.

$$11 \times 3 \times 4$$

M1

$$132$$

A1

[2]

Q4.

$$240$$

B1

[1]

Q5.

(a) 10

B1

$$\text{cm}^3$$

B1

(b) $5 \times 2 \times 2$ or their 10×2 oe

M1

$$20$$

A1ft

[4]

Q6.

$$2.85 \times 0.72 \times 0.9$$

oe

$$285 \times 72 \times 90$$

M1

$$1.8(468)$$

$$1\,846\,800$$

A1

$$\text{m}^3$$

$$\text{cm}^3$$

B1

Additional Guidance

Accept any rounding to 2 sf or more without working seen,
eg 1.85 or 1 850 00

[3]

Q7.

Alternative method 1

$$6 \times 2 \times 2 \text{ or } 2 \times 2 \times 2 \times 3 \text{ or } 24$$

oe volume of one layer

or

$$6 \times 2 \times 2 + 2 \times 2 \times 2 \times 3 \text{ or } 48$$

oe volume of two layers

M1

$$336 \div \text{their } 24 \text{ or } 14$$

or

$$336 \div \text{their } 48 \text{ or } 7$$

oe eg } 336 \div 2 \div \text{their } 24

M1dep

$$21$$

A1

Alternative method 2

$$6 \times 2 \times 2 \times 2 + 2 \times 2 \times 2 \times 6 \text{ or } 96$$

oe volume of four layers

M1

$$336 \div \text{their } 96 \text{ or } 3.5$$

oe

M1dep

$$21$$

A1

Alternative method 3

$$336 \div 2 \text{ or } 168$$

oe total volume of all cubes

M1

$$\text{their } 168 \div (2 \times 2 \times 2)$$

or

$$\text{their } 168 \div 8$$

oe

M1dep

$$21$$

A1

Alternative method 4

$$6 \times 2 \times 2 \text{ or } 2 \times 2 \times 2 \times 3 \text{ or } 24$$

oe volume of one layer

or

$$6 \times 2 \times 2 \times 2 + 2 \times 2 \times 2 \times 6 \text{ or } 96$$

oe volume of four layers

M1

$$(336 - \text{their } 96) \div \text{their } 24 + 4$$

$$\text{or } 240 \div \text{their } 24 + 4$$

$$\text{or } 10 + 4 \text{ or } 14$$

oe

using volume of additional layers

M1dep

$$21$$

A1

Additional Guidance

24, 48 and 96 must not come from area or perimeter calculations

[3]

Q8.

Evaluates method

- eg 1 his method does not work because 1.2 m does not divide exactly by 50 cm*
- eg 2 there are not a whole number of 50 cm in 1.2 m*
- eg 3 50 cm will not fit in 0.2 m*
- eg 4 $1.2 \div 0.5 = 2.4$ which is not a whole number*
- eg 5 $120 \div 50 = 2.4$ and cannot have 2.4 boxes*
- eg 6 can only fit 2 layers of boxes*

Evaluates claim

- eg 1 he can only fit 40*
- eg 2 he will not fit (as many as) 48*

B1

Additional Guidance

Volume divided volume doesn't always work

(1st) B0

He is wrong as he can put 42 boxes

(2nd) B0

Only 2 layers will fit so he can't fit 48 boxes

B1B1

Can't have 0.4 of a box so he can only fit 45 boxes

B1B0

$5 \times 4 \times 2 = 40$

B0B1

[2]

Q9.

Side of square = 5

Or $5 \times 5 = 25$ oe

May be on diagram

B1

$400 \div 25$

M1

16

May be on diagram

$16 \times 25 = 400$ oe is M1, A1

A1

Yes and 5 and their 16

*Strand (iii) Conclusion must be based on length not volume
ft their 16 if B1, M1 awarded and correct conclusion*

Q1ft

Additional Guidance

Ignore any volume calculations

Square = 5 cm

B1

$25 \times 21 = 400$

M1

No

A0

Q1ft

[4]

Q10.

Alternative method 1

(Width =) 10 or (length =) 15 seen

May be on the diagram

B1

their height $\times$ their width $\times$ their length with at least two values correct

or $5 \times 10 \times 15$

M1

750

Ignore incorrect units, eg cm^2

SC2 for 6000 from using 10 as diameter

A1

Alternative method 2

$5 \times 5 \times 5$ or 125

B1

$6 \times$ their 125

their 125 must be from $5 \times 5 \times 5$

M1

750

Ignore incorrect units, eg cm^2

SC2 for 6000 from using 10 as diameter

A1

Additional Guidance

On diagram, height marked as 10, width as 10 and length as 15

B1

$10 \times 10 \times 15$

M1

1500

A1

On diagram, height marked as 10, width as 20 and length as 15

B1

$10 \times 20 \times 15$

M1

3000

A1

On diagram, height marked as 10, width as 20 and length as 30

$10 \times 20 \times 30$

6000

SC2

On diagram, height marked as 5, width as 10 and length as 15

In script $10 \times 20 \times 30$

6000

Mark method that leads to answer.

SC2

On diagram, height marked as 5, width as 20 and length as 30	B0	
$5 \times 20 \times 30$	M0	
3000	A0	
$5 \times 10 \times 15 = 750$	B1	
$750 \div 3 = 250$ (on answer line) <i>Mark whole method</i>	M0, A0	[3]
Q11.		
(a) 10.8×8 or 86.4	M1	
$50 \times 110 \times 35$ or 192 500 <i>Must use correct volume formula</i>	M1	
their 192 500 $\div$ 1000 or 192.5 <i>Dep on 2nd M1</i>	M1dep	
their 192.5 – their 86.4 <i>Dep on M1M1M1</i>	M1dep	
106.1 or 106	A1	
Alternative method 2		
$10.8 \times 8 \times 1000$ or 86 400 <i>oe</i>	M1	
$50 \times 110 \times 35$ or 192 500 <i>Must use correct volume formula</i>	M1	
their 192 500 – their 86 400 or 106 100 <i>Dep on M1M1</i>	M1dep	
their 106 100 $\div$ 1000 <i>Dep on M1M1M1</i>	M1dep	
106.1 or 106	A1	
Additional Guidance		
192.5	2ndM1M1dep	
106 100	M1M1M1dep	
$50 \times 110 \times 35 = 192\,500 \div 2$	2ndM0	

- (b) A comment that the answer to part (a) was too low or that the amount saved would be greater

B1

Additional Guidance

It was more

B1

More water saved

B1

She underestimated it

B1

She underestimated the water saved

B1

She's saving more water because she's using more water than the cuboid

B1

Greater than 106.1 litres (may need to check value in part (a) if they quote a different value)

B1

More than Eva's assumption

B1

Eva's assumption was not accurate therefore the prediction was wrong

B0

She underestimated the water

B0

Less water used

B0

It was inaccurate

B0

A uses more water than B (only talking about the diagram)

B0

B saves more than A (only talking about the diagram)

B0

Saves a lot of water

B0

More water used

B0

Cuboid smaller than bath

B0

Used more water in the bath than she thought

B0

[6]

Q12.

12

B1

their 12×1000 or 12 000
or $1.25 \times 60 (\times 60)$ or 75 or 4500
or their $12 \div 1.25$ or 9.6
or $1000 \div 1.25$ or 800
or $1.25 \div 1000$ or 0.001 25

oe

M1

their $12\ 000 \div$ their 75
or their $12\ 000 \div 1.25$
or their $12 \div$ their 0.001 25
or their 9.6×1000
or their $12 \times$ their 800 or 9600
or their $800 \div 60 (\div 60)$
or 13.3(...) or 0.2(...)
or their 12×1000 and $1.25 \times 60 (\times 60)$
or their 12×1000 and their 75 ($\times 60$)
or their 12 000 and their 4500

oe

M1dep

160

or 2.66(...) or 2.67

oe

A1

2 hours 40 minutes

A1

Additional Guidance

160 or 2.66(...) or 2.67 implies 4 marks

B1M1M1A1A0

2 hours 66 minutes implies 2.66

B1M1M1A1A0

their 12 is their volume

[5]

Q13.

(a) 4.5

B1

(b) $30 \times 20 \times 20$ or 12 000

M1

12000 $\div$ 1000 or 12

2 $\times$ their 4.5 $\times$ 1000 or their 9000

M1

12 and their 9 and Yes

or

$12 \div$ their 4.5 = their 2.6(...) and Yes

or

12000 and their 9000 and Yes

ft correct decision based on their (a) if M2 scored

A1ft

[4]

Q14.

(a) $4 \times 4 \times 6$

M1

96

A1

(b) 'No' selected **and** valid reason such as:

Only holds 8.

Not high enough for 2 layers or 2 cm.

Need to cut

B1 Correct reason but incorrect or no decision

SC1 Yes ticked and volume clearly calculated as 12 cm^3 – must have evidence of calculation.

Ignore units

B2

[4]

Q15.

(a) $6 \times 3 \times 12$

M1

216

A1

cm^3 or ml

SC2 2.16 m^3 with no working

B1

(b) $54 \div 6 (= 9)$

M1

$\sqrt{(\text{their } 9)}$

$3 \times 3 = 9$

M1

$\frac{12}{\text{their } 3} \times \frac{6}{\text{their } 3} \times \frac{3}{\text{their } 3}$

Allow (their 216)/27

M1

8

A1

[7]

Q16.

(a) $90 \times 40 \times 60$ **or** $120 \times 60 \times 30$

M1

216 000

A1

Both $90 \times 40 \times 60 = 216\,000$

and

$120 \times 60 \times 30 = 216\,000$

and

Volumes are equal

or

(Tanks hold) same amount (of water)

Q1

(b) (Tank) A and valid reason

Examples of valid reasons

A has a smaller base area

A is thinner

A is taller

oe

B1

[4]

Q17.

Intention to divide 1.2 m by 3 mm

eg1 $1.2 \div 3 (= 0.4)$

eg2 $120 \div 0.03 (= 4000)$

Allow inconsistent units and/or incorrect unit conversions

M1

$1200 \div 3$ **or**

$120 \div 0.3$ **or**

$1.2 \div 0.003$ **or**

400

Consistent dimensions with no incorrect unit conversions

This mark implies M1 M1

M1

800

A1

800 **and** Yes

*ft their 800 **and** correct ft decision if M2 gained*

Strand (ii)

*SC4 375 **and** 400 **and** Yes*

Q1ft

Alternative

$750 \times 3 (= 2250)$

$750 \div 2 (= 375)$

$750 \times 0.003 (= 2.25)$

or

$750 \times 0.3 (= 225)$

$750 \div 2 (= 375)$

M1

their $2250 \div 2$

$(= 1125)$

their 375×3

$(= 1125)$

their $2.25 \div 2$

or

their $225 \div 2 (= 112.5)$

their 375×0.003

or

their $375 \times 0.3 (= 112.5)$

M1

1125 **and** 1200

or

112.5 **and** 120

or

1.125

A1

1125 **and** 1200 **and** Yes

or

112.5 **and** 120 **and** Yes

or

1.125 **and** Yes

*ft their value(s) **and** correct ft decision if M2 gained*

Pairs of values must be in the same unit

Strand (ii)

SC4 375 **and** 400 **and** Yes

Q1ft

[4]

Q18.

- (a) $5x \times 5x \times 5x$ or $125x^3$
oe $(5x)^3$
or $5x \times 2x \times x$ or $10x^3$

M1

$$5x \times 5x \times 5x - 5x \times 2x \times x$$

M1dep

$$125x^3 - 10x^3$$

SC1 for 125 and 10 seen

A1

- (b) 115×3.5^3

$$(5 \times 3.5)^3 - 10 \times 3.5^3$$

M1

$$4930(.625) \text{ or } 4931$$

A1

[5]

Q19.

(a) $4.8 \times 1.2 \times 2.8$ oe

M1

16.128 or 16.13 or 16.1 or 16

A1

m^3

B1

(b) their 16.128×1000

$$16\,128$$

or their 16.128×3

$$48.384$$

or their $16.128 \div 4$

$$4.032$$

M1

their $16.128 \times 1000 \times 3$

$$48\,384$$

or their $16.128 \times 1000 \div 4$

$$4032$$

or their $16.128 \times 3 \div 4$

$$12.096$$

M1dep

[12 000, 12 100]

ft from their (a)

A1ft

Alternative method

$2.8 \div 4 \times 3$ or 2.1 oe

$$2.8 - \frac{2.8}{4} \text{ or } 2.1$$

M1

$4.8 \times 1.2 \times$ their 2.1

$$12.096$$

or their 2.1×1000

$$2100$$

M1dep

[12 000, 12 100]

A1

[6]

Q20.

0.65 seen

B1

$4.8 \times 1.2 \times$ their 0.65 or 3.744

or $4.8 \times$ their 0.65 or 3.12

their 0.65 must be in range [0.65, 0.75] but not 0.7

$$\frac{h}{4.8} = \frac{\text{their 0.65}}{2.8}$$

M1

their $3.744 \div (1.2 \times 2.8)$

or their $3.12 \div 2.8$

$$\frac{\text{their } 0.65 \times 4.8}{2.8}$$

M1dep

1.11...

A1

1.1

SC2 for 1.2

ft their rounded value from 2 d.p. or more

B1ft

[5]

Q21.

$$5x + 1 = 2x + 3 + 7$$

oe

B1

$$5x - 2x = 3 + 7 - 1$$

oe

Collecting terms from their linear equation using $5x + 1$ and $2x + 3$

M1

$$3x = 9 \text{ or } x = 3$$

A1 ft

$(5 \times \text{their } 3 + 1) \times (2 \times \text{their } 3 + 3) \times \text{their } 3$

their $16 \times \text{their } 9 \times \text{their } 3$

Their 3 must be positive to ft

Using $x(10x^2 + 2x + 15x + 3)$ i.e. their $(3 \times (10 \times 3^2 + 17 \times 3 + 3))$

or their 3×144

M1

432

A1

[5]

Q22.

$\frac{5}{6}$

$$\frac{5}{6} \times 8 \times 1.5 \times 3$$

$$\text{or } 8 \times 1.5 \times 2.5$$

$$\text{or } 30$$

$\frac{5}{6}$

$$\text{or } \frac{5}{6} \times 1000 \text{ or } 833.(...)$$

oe

$$36 \div 6 \times 5$$

M1

$$\text{their } 30 \times 1000 \text{ or } 30\,000$$

$$\text{or } 1000 \div 20 \text{ or } 50$$

$\frac{5}{6}$

$$\text{or } \frac{5}{6} \times 1000 \div 20 \text{ or } 41.6(6..).$$

oe

$$36 \div 6 \times 5 \times 1000$$

M1

$$\text{their } 30\,000 \div 20 (\div 60)$$

$$\text{or } 30 \times 50 (\div 60)$$

$$\text{or } 1500 (\div 60)$$

$\frac{5}{6}$

$$\text{or } \frac{5}{6} \times 1000 \div 20 \times 36 (\div 60)$$

M1dep

$$25$$

A1

Showing understanding of
a volume divided by flow rate

or a capacity divided by flow rate

Strand (iii)

Award if a volume or a capacity divided by 20

Q1

[5]

#Q23.

$$2x \times x \times 6x$$

$$\text{or } 6x \times 6x \times 6x$$

$$\text{or } 12 \text{ and } 216$$

oe

M1

$$\frac{2x \times x \times 6x}{6x \times 6x \times 6x} \text{ or } \frac{12}{216}$$

oe

M1 dep

$$\frac{1}{18}$$

A1