

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Number

Estimating calculations (non-calculator)

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.	30 or 5	<i>Allow 30.0 or 5.0</i>	M1	
	150	<i>Allow [145,156], but not 153.92 rounded.</i>	A1	[2]
Q2.	Any two numbers approximated <i>ie 400, 402, 403, 2, 39 or 40</i>		M1	
	All three numbers approximated or a calculation using two approximated values eg $\frac{402.5}{78}$		M1	
	5	<i>must come from $\frac{400}{2 \times 40}$</i>	A1	[3]
Q3.	$\frac{10 \times 10}{0.5}$ oe eg $\frac{10^2}{0.5}$		M1	
	200		A1	[2]
Q4.	Any two of 800 or 2 ² (or 4) or 10 seen		M1	
	800 ÷ 40 or 200 ÷ 10 or 80 ÷ 4 oe		M1	
	20		A1	[3]
Q5.	40 or 300 or 60 or 5 or 12 000		M1	
	200		A1	
	Additional Guidance			
	200 with no working		M1A1	
	Attempt at full calculation		M0A0	[2]

Q6.

Any two of 60, 50 and 100

$$\frac{60 \times 50}{100}$$

$$100$$

60 and 50 may be implied by 3000

30

M1

A1

Additional Guidance

30 with no working

M0A0

28.1... (from original values) and then rounded to 30

M0A0

[2]

Q7.

32

B1 4 or 16 or 0.5

B2

[2]

Q8.

$\sqrt{100}$ or 10 **and** 2

M1

5

A1

[2]

Q9.

100 seen

M1

20

A1

[2]

Q10.

10 or 40 used as an approximation

M1

400 or 410

A1

[2]

Q11.

Sight of 20, 0.5, 10 or 2

M1

$$\frac{20 \times 0.5}{2}$$

oe $\frac{10}{2}$ or 10×0.5 or 20×0.25

M1

5

A1

[3]

Q12.

$$\frac{40 \times 200}{80}$$

M1 for any two shown in the appropriate calculation
*M1 for $41 \approx 40$ **and** $198 \approx 200$ **and** $77 \approx 80$ clearly stated if not used in a calculation*

M1

100

Correct answer only is M1A1 but must use correct approximations if working is seen

A1

[2]

Q13.

$$\sqrt{98.5} < 10$$

oe May be implied by numerator is negative

B1

negative $\div$ negative = positive
and No

B1

[2]

Q14.

80 or 10 or 400

M1

80 and 10 and 400 seen

$$\frac{80 \times 10}{400}$$

or $\frac{80 \times 10}{400}$ with two correct

M1

2 from correct approximations

A1

Additional Guidance

2 without any correct approximations

M0M0A0

[3]

Q15.

20 or 100 or 10

M1

400 or 300 from correct rounding to 1 sig fig

M1dep

700

A1

Additional Guidance

$19^2 = 361 \rightarrow 400$ (no other working)

M0M0

[3]

Q16.

30

B1

20

B1

(30 and 20 and) 600

*ft their $30 \times$ their 20 with B1B0 or B0B1
SC1 ($31 \times 18 =$) 558, answer 560*

B1ft

Additional Guidance

Answer only 600 with no working

B1B1B1

Answer 558 with neither 30 nor 20 seen

B0B0B0

30×18 with answer 540

B1B0B1ft

31×20 with answer 620 and answer 600 (ignore further work)

B0B1B1ft

31×20 with answer 600

B0B1B0ft

[3]

Q17.

80 or 10 or 40

M1

80 and 10 and 40 seen

$$\frac{80 \times 10}{10}$$

or 40 with two correct

M1

20 from correct approximations

A1

Additional Guidance

20 without correct approximations

M0M0A0

[3]

Q18.

30 or 80 or 10

M1

$$\frac{30 + 80}{10} \text{ or } \frac{110}{10}$$

$$\text{or } \frac{112.62}{10} \text{ or } 11.262$$

M1dep

11 with 30, 80 and 10 seen

A1

Additional Guidance

11 with no working

M0M0A0

[3]

Q19.

7

B1

[1]

Q20.

(262 rounded to) 260
or (19.8 rounded to) 20
or $26 \div 2$

M1

13

A1

Additional Guidance

13 embedded
eg $260 \div 13 = 20$

M1A0

Beware, 13 may not get full marks eg $262 \div 20 = 13.1$, answer 13

M1A0

$300 \div 20$

M1A0

[2]

Q21.

(a) 300 or 600 or 50 or 100 or 20

M1

300 or 600
and
50 or 100
and
20

M1

720 SC2 480
 SC2 860
 SC2 719
 SC1 any table value rounded to 1sf
 SC1 715
 SC1 720 without M1 awarded

A1

(b) $(349 + 349 + 59 + 59 + 39 \text{ or } 855) - (299 + 299 + 49 + 49 + 19 \text{ or } 715 \text{ or their incorrect total of exact values for July in part(a)})$

M1

140 ft 855 – their incorrect total of exact values in part(a)

A1ft

Alternative Method

$2 \times 50 + 2 \times 10 + 20$
or
 $350 + 350 + 60 + 60 + 40 - \text{their } 720$

M1

140

ft 860 – their 720 from rounding in part(a)

A1ft

[5]

Q22.

Alternative method 1

$$\begin{array}{r} 37 \quad 23 \\ \times 23 \quad \times 37 \\ \hline 111 \quad 161 \\ 740 \quad \text{or} \quad 690 \end{array}$$

At least one row correct, with the 0 correct for multiplication by the multiple of 10

M1

their 111 + their 740
or
their 161 + their 690

M1dep

851

A1

$$651 \times 8 + 200 \times 6$$

oe
ft their 851

M1

$$5208 + 1200$$

ft their 851

M1dep

Close and 6408

ft their 851

A1ft

Alternative method 2

	30	7
20	600	140
3	90	21

At least three correct, with the 00 and the 0s correct for multiplication by the multiples of 10

M1

their 600 + their 140 + their 90 + their 21

M1dep

851

A1

$$651 \times 8 + 200 \times 6$$

oe
ft their 851

M1

$$5208 + 1200$$

ft their 851

M1dep

Close and 6408

ft their 851

A1ft

Alternative method 3

2	7	
1 2	4 2	6
1 6	5 6	8

At least 3 of the 2-digit numbers correct

M1

Total calculated for each diagonal

M1dep

851

A1

$651 \times 8 + 200 \times 6$

oe
ft their 851

M1

$5208 + 1200$

ft their 851

M1dep

Close and 6408

ft their 851

A1ft

Alternative method 4

$(23 \times 8 =) 184$

or $(37 \times 8 =) 296$

B1

their 184×37

or

their 296×23

M1dep

851

A1

$651 \times 8 + 200 \times 6$

oe
ft their 851

M1

$5208 + 1200$

ft their 851

M1dep

Close and 6408

ft their 851

A1ft

[6]

Q23.

800 or 1600 or 200 or 60 or 120 or 100

M1

800 or 1600

and

200

and

60 or 120 or 100

M1

1920 or 1900 or 2000

SC1 1900 without working or 1900 from 1899

A1

[3]

Q24.

(a) Correct statement

eg she used the height instead of the slant height

or she used the vertical height

or she used 12 (instead of 13)

B1

Additional Guidance

Check diagram

For 'vertical' accept anything that implies she has used the wrong height

Condone 'length' to mean 'height' or 'slant height'

12 or 13 circled on the diagram must be accompanied by a supporting statement

Indicates '12' in the calculation

B1

She should have done $\pi \times 5 \times 13$

B1

It should be 65π

B1

She used the wrong height / the (value of) l is wrong

B1

She hasn't used the slant height (she used the (vertical) height)

B1

She hasn't used the 13

B1

She hasn't used the 13 and should be $5 \times 12 \times 13 \times \pi$

B0

The multiplication used the wrong number(s)

B0

She hasn't used a value for π

B0

An incorrect statement with a correct statement

eg she used 13 instead of 12 and didn't square the radius

B0

(b) $\pi \times 5 \times 5$ or 25π

or $3 \times 5 \times 5$ oe

accept [3.14, 3.142] or $\frac{22}{7}$ for π

M1

75

A1

Additional Guidance

$\pi 25$

M1

- (c) 'More than' indicated or implied by statement
and
valid reason

eg valid reasons

3.14 is greater (than 3)

Beth's number is bigger (than Adam's)

(the correct answer is) 78.5 (with their answer to (b) less than 78.5)

B1

Additional Guidance

If calculations are used, the outcomes must be correct

Accept 78 or 79 for 78.5 unless from incorrect working

'Less than' indicated

B0

Do not penalise use of the same incorrect formula in (b) and (c)

eg $3 \times 10 = 30$ in (b) and $3.14 \times 10 = 31.4$ in (c) with 'More than' ticked

B1

Ignore a non-contradictory reason with a correct reason

eg 3.14 is bigger than 3 and nearer the true value of pi

B1

Acceptable reasons

Adam has rounded (pi) down / Adam only used 3

B1

There is an extra 0.14 to multiply by

B1

Her number has decimal places

B1

Her number is to more significant figures

B1

Non-acceptable reasons

3.14 will give a bigger answer / 3.14 is more accurate

B0

[4]

Q25.

$\sqrt{400}$ or 20

or

2^3 or 8

or

$\cos 60^\circ$ or 0.5. oe

M1

20 and 8 and 0.5

M1

56 with correct values

A1

Additional Guidance

56 seen then rounded to 60

M1M1A1

30

28 rounded to 30 then 0.5 leading to 60 as final answer

M1M1A0

[3]

Q26.

$101.4^{\frac{1}{2}}$ estimated as 10
condone - 10

B1

$(6.43^0 =) 1$

B1

$7.99^{\frac{2}{3}}$ estimated as 4

B1

14

condone -6 if -10 used
ft fully correct evaluation with B2 scored

B1ft

[4]