

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Number

Estimating calculations (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.

(a) 2950.2745(00...)

B1

Additional Guidance

2'950.2745 or 2,950.2745

B1

2.950.2745

B0

(b) Allow correct rounding or truncation once full value seen
10 or 10^2 or 100 or 30

M1

$10 \times 10 \times 30$ or $10^2 \times 30$
or 100×30

M1dep

$10 \times 10 \times 30 = 3000$ and Sensible
or $10^2 \times 30 = 3000$ and Sensible
or $100 \times 30 = 3000$ and Sensible

ft their answer to part (a) for the decision

A1ft

Additional Guidance

3000 (and Sensible) with no working

M0M0A0

Their decision must be based on part (a) unless new calculation shown in part (b)

$10^2 \times 30 = 3000$ and $10^2 \times 29 = 2900$ and Sensible

$10^2 \times 30$ and 102×29 and Sensible

M1M1A0

$10^2 \times 29 = 2900$ and Sensible

M1M0A0

ft should be Sensible if their part (a) is 3000 to 1sf or vice versa

eg (a) 295.02745 (b) $10 \times 10 \times 30 = 3000$ and Not sensible

(B0)M1M1A1ft

[4]

Q2.

(a) 752951 or 752951 or 752,951

Allow commas even if positioning incorrect

eg 75,2951 or 752'951 B1

B1

Additional Guidance

752.951

B0

(b) 20 000 and 400 and 10
and 800 000 and Yes

ft correct decision for their answer to (a)

oe decision e.g. it is sensible

B2 20 000 and 400 and 10

B1 20 000 or 400 or 10

B3ft

Additional Guidance

800 000 (and Yes) with no other values

B0

If answer to (a) is 800 000 to 1sf then the correct ft decision in (b) is Yes

eg1 (a) 770 000 (b) decision should be Yes

eg2 (a) 1762 (b) decision should be No

eg3 (a) 752.951 (b) allow decision to be Yes or No

[4]

Q3.

(a) 494.325 or $\frac{19\ 773}{40}$ or $494\frac{13}{40}$ or 40.96 or $\frac{1024}{25}$ or $40\frac{24}{25}$
 535.29 or 535.3 or $\frac{107\ 057}{200}$ or $535\frac{57}{200}$

535.285

M1

A1

Additional Guidance

Ignore any subsequent truncation or rounding if 535.285 seen in working

M1A1

- (b) 10^3 and 2 and 6^2
 and 536 and indicates Sensible

ft correct decision for comparing 536 with their 535.285

B2 10^3 and 2 and 6^2 seen

B1 any two of 10, 2 and 6 seen allow 1000 to imply 10 or 10^3 and

36 to imply 6 or 6^2 for B1 or B2 only

Additional Guidance

Students must give the correct ft decision for part (a) for B3

Correct decision for their (a) should be Sensible if their 535.285 is 530 or 540 to 2 sf.

Otherwise they should indicate Not sensible

Condone e.g. 10.00 for 10 etc

[5]

Q4.

- (a) 390 or 1480

M1

1870

A1

Additional Guidance

Answer only

M1A1

Ignore calculation of 1864 but 1870 only coming from incorrect rounding of 1864 is M0

- (b) Valid explanation referring to **both** of the original numbers being rounded **up**

eg he rounded each number up

or each rounded number is bigger than the actual number

or 390 is bigger than 385 and 1480 is bigger than 1479

B1

Additional Guidance

Ignore irrelevant, non-contradictory statements

Ignore 1864 alongside a correct explanation

Incorrect rounding or values seen in this part even alongside a correct explanation

B0

The numbers are rounded **up** (to the nearest 10)

B1

385 became 390 and 1479 became 1480

B1

One number increased 5 and the other 1 (so it will be 6 bigger)

B1

385 became 390 and 1479 became 1500

B0

The numbers are rounded to the nearest 10

B0

It's rounding so the answer is bigger

B0

1870 is bigger than 1864

B0

[3]

Q5.

(a) 8 or 10

8 may be implied by 2^2 or 4

M1

8 and 10

and

$\frac{1}{40}$

or 0.025

8 may be implied by 2^2 or 4

accept 0.03 with $\frac{1}{40}$ or 0.025 seen

A1

Additional Guidance

Do not allow exact calculations for M1A1

eg $4.113 = 4$ and $10.21 = 10$ and $\frac{1}{40}$

M1A0

$\frac{1}{40}$

or 0.025 with 8 or 10 seen (8 may be implied by 2^2 or 4)

M1A0

$\frac{1}{40}$

or 0.025 without 8 or 10 seen (8 may be implied by 2^2 or 4)

M0A0

(b) Valid explanation

eg both numbers have been rounded down

B1

Additional Guidance

Ignore irrelevant reasons alongside a correct reason, unless contradictory

Ignore a calculation using exact values alongside a correct reason

eg 0.025 is greater than 0.0238... and both numbers rounded down

B1

0.025 is greater than 0.0238...

B0

The denominator is smaller

B1

The denominator using the exact values is bigger

B1

(Decimals) rounded down

B1

Because 8.34 is more than 8 and 10.21 is more than 10

B1

One is divided by less (with answer more)

B1

Estimating rounds the numbers down which makes the denominator less

B1

Estimating rounds the numbers down which makes it less

B0

Because it rounds up

B0

Because she rounded each number to one significant figure

B0

The numbers get rounded up so more than the exact value

B0

Rounded up when estimating

B0

Removing the decimals makes the number bigger

B0

[3]

Q6.

(a) 375.112(1656)

*Condone if correctly rounded to 7 significant figures or better
eg 375.1122*

B1

(b) 20^2 or 400 or $\sqrt[3]{1000}$ or 10
or 5

M1

$400 - 10 \div 5 = 398$ or

$400 - 2 = 398$

A1

[3]

Q7.

(a) 1.4

oe

B1

(b) 1.26

B1

[2]

Q8.

(a) 2.17158...

B1

(b) 2.2

ft their answer to (a)

B1ft

[2]

Q9.

$\frac{1}{2} \times 8.6 \times 5.2$ *oe*

M1

22.36

A1

22.4

ft from 2 d.p. or more

B1ft

[3]

Q10.

Attempt to count squares

or any area calculation e.g. 4×7

*Evidence of counting areas e.g. dots or numbers in shaded
squares*

M1

[22, 27]

A1 for [19, 22) or (27, 30]

A2

[3]

Q11.

2.2 pounds = 1000 grams seen or implied

May be implied from working

$1 \div 2.2 (= 0.45 \text{ kg}) (= 1 \text{ pound})$

M1

(1 pound =) $1000 \div 2.2$

(= 454 ... grams)

(1 gram =) $2.2 \div 1000 (= 0.0022 \text{ pound})$

or $1 \div 2.2 \times 1000$

$1 \div 2.2 \times 0.5 (= 0.227 \dots \text{grams})$

[454, 455] or 450

[0.227, 0.2275] or 0.225 or 0.230

M1

$\frac{1}{2}$
($\frac{1}{2}$ pound =) $1000 \div 2.2 \div 2$

100 grams = $2.2 \div 1000 \times 100$

(= 0.22 pounds)

(= 227.2 ... grams)

or 200 grams = $2.2 \div 1000 \times 200$

(= 0.44 pounds)

[227, 227.5] or 225 or 230

or 250 grams = $2.2 \div 1000 \times 250$

(= 0.55 pounds)

or 500 grams = $2.2 \div 1000 \times 500$

(= 1.1 pounds)

M1

[227, 227.5] or 225 or 230 and 250 g stated

0.55 (pounds) and 250 g stated

0.44 (pounds) and 250 g stated

SC3 for e.g. 0.227 and 250 g stated

A1

Alternative method

2 pounds = 1000 grams seen or implied

May be implied from working

$1 \div 2 (= 0.5 \text{ kg}) (= 1 \text{ pound})$

M1

(1 pound =) $1000 \div 2$

(= 500 grams)

(1 gram =) $2 \div 1000 (= 0.002 \text{ pound})$

or $1 \div 2 \times 1000$

(= 500 grams)

$1 \div 2 \times 0.5 (= 0.25 \text{ grams})$

M1

$\frac{1}{2}$
($\frac{1}{2}$ pound =) $1000 \div 2 \div 2$
(= 250 grams)

100 grams = $2 \div 1000 \times 100 (= 0.2 \text{ pounds})$

or 200 grams = $2 \div 1000 \times 200 (= 0.4 \text{ pounds})$

or 250 grams = $2 \div 1000 \times 250 (= 0.5 \text{ pounds})$

or 500 grams = $2 \div 1000 \times 500 (= 1 \text{ pound})$

M1

250 g stated

SC3 for e.g. 0.25 and 250 g stated

A1

[4]

Q12.(a) $26 \div 4$ or 6.5or $26 \times 20 \times \frac{1}{4}$ or 130**M1**

26 – their 6.5

or $26 \div 4 \times 3$ or $(520 - 130) \div 20$ or $390 \div 20$ or $(520 - \text{their } 130) \div 20$ or their $390 \div 20$

oe

M1dep

19.5

A1(b) Any trial with correct factors giving 168 except 1×168

or any correctly evaluated product

such that $10 \leq \text{rows} \leq 13$ and $10 \leq \text{seats} \leq 16$ $2 (\times) 84$ or $168 \div 2 = 84$ $3 (\times) 56$ or $168 \div 3 = 56$ $4 (\times) 42$ or $168 \div 4 = 42$ $6 (\times) 28$ or $168 \div 6 = 28$ $7 (\times) 24$ or $168 \div 7 = 24$ $8 (\times) 21$ or $168 \div 8 = 21$ $12 (\times) 14$ or $168 \div 12 = 14$

oe

M1A different trial with correct factors giving 168 except 1×168

or a different correctly evaluated

product such that $10 \leq \text{rows} \leq 13$ and $10 \leq \text{seats} \leq 16$ **M1dep**

12 rows

SC2 for 12 seats and 14 rows

14 seats

*SC2 for 12 and 14 as final working***A1****[6]**

Q13.

$$\frac{1}{1}(-)\frac{1}{4}(+)\frac{1}{9}(-)\frac{1}{16}(+)\frac{1}{25}$$
 or

$$1(-)0.25(+)0.1(-)0.0625(+)0.04$$

$$[0.8386, 0.8387]$$

Allow one error

M1

$$10.06\dots$$

$$\frac{3019}{300}$$

A1

$$\sqrt{\text{their } 10.0633333}$$

[3.172, 3.173] dep on first M1

M1dep

$$\text{Their } 3.17228 \div 3.142 \times 100$$

$$\frac{\text{their } 3.17228 - 3.142}{3.142} \times 100$$

M1

$$[100.96, 100.97](\%) \text{ and Yes}$$

[0.96, 0.97](\%) and Yes

A1ft

Alternative 1

$$\frac{1}{1}(-)\frac{1}{4}(+)\frac{1}{9}(-)\frac{1}{16}(+)\frac{1}{25}$$
 or

$$1(-)0.25(+)0.1(-)0.0625(+)0.04$$

$$[0.8386, 0.8387]$$

Allow one error

M1

$$10.06\dots$$

$$\frac{3019}{300}$$

A1

$$\sqrt{\text{their } 10.0633333}$$

[3.172, 3.173] dep on first M1

M1dep

$$\text{Their } 3.17228 - 3.142$$

M1

$$[0.03, 0.031] \text{ and } 0.03142 \text{ and Yes}$$

A1ft

Alternative 2

$$\frac{1}{1}(-)\frac{1}{4}(+)\frac{1}{9}(-)\frac{1}{16}(+)\frac{1}{25} \text{ or}$$

$$1(-)0.25(+)0.\dot{1}(-)0.0625(+)0.04$$

$$[0.8386, 0.8387]$$

Allow one error

M1

$$10.06\dots$$

$$\frac{3019}{300}$$

A1

$$3.142^2 (= 9.872164)$$

M1

$$\sqrt{\text{Their } 10.063333 \div 9.872164}$$

$$\sqrt{\text{Their } 10.063333 \div 9.872164} \times 100$$

dep on first M1

M1dep

$$[1.0096, 1.0097] \text{ and Yes}$$

$$[100.96, 100.97]\% \text{ and Yes}$$

A1ft

Alternative 3

$$\frac{1}{1}(-)\frac{1}{4}(+)\frac{1}{9}(-)\frac{1}{16}(+)\frac{1}{25} \text{ or}$$

$$1(-)0.25(+)0.\dot{1}(-)0.0625(+)0.04$$

$$[0.8386, 0.8387]$$

Allow one error

M1

$$10.06\dots$$

A1

$$\sqrt{\text{their } 10.063333}$$

$$[3.172, 3.173] \text{ dep on first M1}$$

M1dep

$$3.142 \times 1.01 \text{ or } 3.17342$$

$$3.142 \times 0.99 \text{ or } 3.11058$$

M1

$$3.1734(2) \text{ and } [3.172, 3.173] \text{ and Yes}$$

A1ft

[5]