

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Number

Percentage change

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.

100

B1

[1]

Q2.

Method to calculate the increase on the salary or the decrease to the bonus

eg $26\,000 \times 0.06$ or 1560

or 4000×0.09 or 360

or decimal multiplier 1.06 or 0.91

oe fraction

M1

Method to calculate the value of the increased salary or the decreased bonus

eg $26\,000 \times 1.06$ or 27 560

or 4000×0.91 or 3640

or

Method to calculate the difference between the increase on the salary and the decrease to the bonus

eg their 1560 – their 360 or 1200

31 200 implies M2

M1dep

Method to calculate the decimal multiplier or percentage of the total annual pay

$\frac{31\,200}{30\,000}$

or

1.04 or 104(%) *oe*

or

Method to calculate the decimal multiplier or percentage change in the total annual pay

$\frac{\text{their } 1560 - \text{their } 360}{26\,000 + 4000}$
 $\frac{1200}{30\,000}$

or 0.04 or 4(%) *oe*

M1

4(%) increase

A1

Additional Guidance

For first M mark do not accept a misread of increase for decrease eg 1.09

M0

$26\,000 \times 1.06 = 27\,560$ and $4000 \times 1.09 = 4360$

$27\,560 + 4360 = 31\,920$ and $\frac{31\,200}{30\,000}$

M1M1M1A0

$24\,440 + 4360 = 28\,800$ and $\frac{28\,800}{30\,000}$

M0M0M1

$100 + 6 = 106\%$

M0

$26\,000 \times 1.06\%$

M1M0

[4]

Q3.

Alternative method 1

$6.31 - 3.6(0)$ or 2.71

M1

their $2.71 \div 3.6(0) (\times 100)$
or $0.752(7\dots)$ or 0.753

M1dep

$75.2(7\dots)$ or 75.28 or 75.3

Allow 75 with correct method seen

A1

Alternative method 2

$6.31 \div 3.6(0) (\times 100)$ or

$1.752(7\dots)$ or 1.753 or

$175.2(7\dots)$ or 175.3

M1

$1.752(7\dots) - 1$ or $1.753 - 1$ or

$175.2(7\dots) - 100$ or $175.3 - 100$

M1dep

$75.2(7\dots)$ or 75.28 or 75.3

Allow 75 with correct method seen

A1

[3]

Q4.

Alternative method 1

$60 \times (1 - 0.15)$ or 60×0.85 or 51

or

$40 \times (1 - 0.1)$ or 40×0.9 or 36

oe 60×0.15 or 9

or 40×0.1 or 4

M1

$2 \times$ their $51 + 2 \times$ their 36 or 174

oe $2 \times$ their $9 + 2 \times$ their 4 or 26

their 51 , their 36 , their 9 and their 4 must come from a correct method

M1dep

$(2 \times 60 + 2 \times 40) \times 0.75$

or 200×0.75 or 150

or

$(2 \times 60 + 2 \times 40) \times 0.25$

or 200×0.25 or 50 oe

M1

174 and 150 and No

or

224 and 200 and No

or

26 and 50 and No

SC3 176 and 150 and No

or 226 and 200 and No

or 24 and 50 and No

A1

Alternative method 2

$60 \times (1 - 0.15)$ or 60×0.85 or 51

or

$40 \times (1 - 0.1)$ or 40×0.9 or 36

oe

60×0.15 or 9

or

40×0.1 or 4

M1

$2 \times \text{their } 51 + 2 \times \text{their } 36$ or 174

oe

$2 \times \text{their } 9 + 2 \times \text{their } 4$ or 26

their 51, their 36, their 9 and their 4 must come from a correct method

M1dep

$$\frac{(2 \times 60 + 2 \times 40) - \text{their } 174}{2 \times 60 + 2 \times 40} \times 100$$

or $\frac{200 - \text{their } 174}{200} \times 100$

or 13(%)

or $\frac{174}{200} \times 100$ and $100 - 25$

or 87(%) and 75(%)

oe

$$\frac{2 \times \text{their } 9 + 2 \times \text{their } 4}{200} \times 100$$

or $\frac{26}{200} \times 100$ or 13(%)

or

$$\frac{200 - (2 \times \text{their } 9 + 2 \times \text{their } 4)}{200} \times 100$$

and $100(\%) - 25(\%)$

or 87(%) and 75(%)

M1dep

13% and No

or 87% and 75% and No oe

SC3 12% and No

or 88% and 75% and No

A1

Additional Guidance

Ignore incorrect statements or calculations with full mark response

Consistently working with half of a perimeter can score up to 4 marks

SC3 must come from transposing length and width values

Accept length and width values transposed for up to 3 marks

eg 60×0.9 with 40×0.85 and $2 \times 54 + 2 \times 34$

M1M1

eg 60×0.9 with 40×0.9 and $2 \times 54 + 2 \times 36$ (not transposed)

M1M0

eg 60×0.1 or 40×0.15 or 6

M1

[4]

Q5.

3 + 2 or 5

and

$$5\frac{1}{2} + 3\frac{1}{2} \text{ or } 9$$

$$5\frac{1}{2} - 3 \text{ or } 2\frac{1}{2}$$

or

and

$$3\frac{1}{2} - 2 \text{ or } 1\frac{1}{2}$$

or

4

oe eg $180 + 120$ or 300

and $330 + 210$ or 540

$$\text{implied by } 5\frac{1}{2} + 3\frac{1}{2} - 3 - 2$$

M1

$$\frac{9-5}{5} \text{ or } \frac{2\frac{1}{2}+1\frac{1}{2}}{3+2} \text{ or } \frac{4}{5} \text{ or } 0.8 \text{ or } \frac{5\frac{1}{2}+3\frac{1}{2}}{3+2} (\times 100) \text{ or } \frac{9}{5} (\times 100)$$

or $1.8 (\times 100)$ or 180

$$\frac{5\frac{1}{2}+3\frac{1}{2}-3-2}{3+2}$$

oe eg

$$\frac{540-300}{300} \text{ or } \frac{240}{300}$$

eg

or $1.8 - 100$

M1dep

80

A1

Additional Guidance

Allow working fully in minutes but units must be consistent in a single calculation

eg 2 h 30 and 1 h 30

M1

eg $3 + 2 = 5$ and $330 + 210 = 540$

M1

eg $3 + 120$ and $330 + 3\frac{1}{2}$ unless recovered

M0

$$3 + 2 = 6, 5\frac{1}{2} + 3\frac{1}{2} = 9, 9 - 6 = 3, 3 = 50\%$$

M1M1A0

$$3 + 2 = 6, 5\frac{1}{2} + 3\frac{1}{2} = 9, \text{ answer } 50\% (3 \text{ is implied})$$

M1M1A0

$9 - 6 = 3, 3 = 50\%$ (no method shown for 6)

M0M0A0

[3]

Q6.

Alternative method 1

60×40 or 2400 oe

M1

their 2400 – 2000 or 400

or 2000 – their 2400

M1dep

$\frac{\text{their } 400}{2000} (\times 100)$ or 0.2 oe

M1dep

20(%)

A1

Alternative method 2

60×40 or 2400 oe

M1

their 2400 – 2000 or 400

or 2000 – their 2400

M1dep

10% = $2000 \div 10$ or 1% = $2000 \div 100$ **and** correctly finds multiplier using build up or division to find percentage equivalent to total their 400 oe

*Correct build up to find percentage equivalent to total their
(their 2400 – 2000) or their (2000 – their 2400) implies M3*

M1

20(%)

A1

Alternative method 3

60×40 or 2400

M1

$\frac{\text{their } 2400}{2000} (\times 100)$ or 120(%) or 1.2

M1dep

their 120 – 100 or their 1.2(0) – 1(.00)

or 100 – their 120

or 1(.00) – their 1.2(0) or 0.2 oe

M1dep

20(%)

A1

Additional Guidance

20% on answer line and no working

M1M1M1A1

$480 \times 5 (= 2400)$ from 5 years scores minimum M1

$60 \times 40 = 1800$ and 200 scores minimum M1M1

$60 \times 40 = 1800$ and 200 and $\frac{200}{2000}$

M1M1M1A0

$60 \times 40 = 1800$ and $\frac{200}{2000}$

M1M1M1A0

$\frac{2000}{\text{their } 2400} (= 1.2)$ does not score second method mark on ALT3

[4]

Q7.

1.1 or 0.8

May be implied

M1

$1.1^2 \times 0.8$

oe

M1

0.968 or 96.8(%) or 0.032 or 3.2%

A1

3.2 % decrease

ft their 0.968 with both method marks awarded

A1ft

[4]

Q8.

1.2 or 0.9

May be implied

M1

$1.2^2 \times 0.9$

oe

M1

1.296 or 129.6(%) or 0.296 or 29.6(%)

A1

29.6% increase

ft their 1.296 with M2 awarded

A1ft

[4]

Q9.

12 500 – 11 750 or 750

M1

$\frac{\text{their 750}}{12500} \times 100$

oe eg $\frac{750}{125}$

M1 dep

6

SC2 for 94

A1

Alternative method

$\frac{11750}{12500} \times 100$

M1

100 – their 94

M1 dep

6

SC2 for 94

A1

[3]

Q10.

(a) $1430 - 1250 (= 180)$
 $\frac{1430}{1250} (\times 100)$

M1

$\frac{\text{their } 180}{1250} \times 100$ or 0.144 oe 1.144 or 114.4

M1dep

14.4

A1

- (b) At least 3 non-overlapping, exhaustive boxes with units
B1 at least 3 non-overlapping, exhaustive boxes without units
B1 at least 3 with gaps but no overlaps or
B1 at least 3 with overlaps but no gaps or
B1 2 exhaustive and non-overlapping

B2

[5]

Q11.

3000 – 2500 or 500
 $\frac{2500}{3000} \times 100(\%)$

M1

$\frac{\text{their } 500}{3000} \times 100(\%)$ oe $100 - \frac{2500}{3000} \times 100(\%)$

M1dep

16.6(6..) or 16.7 or 17

A1

[3]

Q12.

1200 – 970 or 230

M1

$\frac{\text{their } 230}{1200} \times 100$ or 19.1(6...)

M1dep

19.2

SC2 for an answer of 80.8

SC1 Any answer with at least 2 dp seen and correctly rounded to 1 dp

A1

Alternative method

$\frac{970}{1200} \times 100$ or 80.83...

M1

100 – their 80.83... or 19.1(6...)

M1dep

19.2

SC2 for an answer of 80.8

SC1 Any answer with at least 2 dp seen and correctly rounded to 1 dp

A1

[3]

Q13.

(a) $280 \div 4$

M1

Kiwi = 70

A1

Yogurt = 210

ft 280 – their 70.

Allow their 70×3 if M1 awarded

SC1 for 35 and 105

A1ft

(b) $\frac{1}{4 + 1 + 3} \times 100$

oe $\frac{10}{280 + 70 + 210} \times 100$

ft their weights

M1

12.5 *ft their weights*

A1ft

(c) (i) $72 \times \frac{30}{100} (= 21.6)$ *oe*

M1

$72 +$ their 21.6 or 22

M1 Dep

93.6

A1

94 pence or £ 0.94

Strand (i) – Correct money notation

ft their 93.6 rounded to nearest integer

Q1

Alternative

1.3 seen

M1

72×1.3

M1

93.6 or 94

A1

94 pence or £0.94

Strand (i) – Correct money notation

ft their 93.6 rounded to nearest integer

Q1

(ii) $0.4 \times 15 (= 6)$

78 implies this mark

M1

$\frac{\text{their } 6}{72} \times 100$ or $\frac{18}{72} \times 100$

$\frac{15}{72} \times 100 (= 20.83)$ and

$\frac{15 + 6}{72} \times 100 (= 29.16)$

M1

8.3....

A1

Organised response

Strand (ii) – present a logical mathematical argument with key steps clearly shown Dep on M2 awarded

Q1

[13]

Q14.

(a) 80 – 74 or 6 seen

$$\text{or } \frac{74}{80} (\times 100) \text{ or } 0.925 \text{ or } 92.5$$

M1

$$\frac{\text{their } 6}{80} (\times 100) \text{ or } 0.075$$

or 100 – their 92.5

or 1 – 0.925

0.075 implies both method marks

M1dep

7.5

SC1 for 8.1(...)

A1

(b) 11.5 kg

Circled or indicated

B1

[4]

Q15.

Alternative method 1

$$50 \times 1.2 \text{ or } 60$$

oe

Length of Q

May be on the diagram

M1

$$50 \times x \times 0.9 \text{ or } 45 \times x$$

oe

area of P reduced by 10%

May be on the diagram

M1

$$\text{their } 60 \times y = \text{their } 45 \times x$$

$$\text{or } \frac{y}{x} = \frac{\text{their } 45}{\text{their } 60}$$

$$\text{or } y : x = \text{their } 45 : \text{their } 60$$

or equivalent ratio to 4: 3 not in simplest form

or equivalent fraction to $\frac{4}{3}$ not in simplest form

oe

Dep on M2

$$\text{M3 } \frac{1.2}{0.9}$$

M1dep

$$4 : 3 \text{ or } 1 : \frac{3}{4} \text{ or } 1 : 0.75 \text{ or } \frac{4}{3} : 1$$

A1

Alternative method 2

$$50 \times 1.2 \text{ or } 60$$

oe

Length of Q

May be on the diagram

M1

Chooses a value for x and reduces area of P by 10%

oe

$$\text{eg } (x = 8) 50 \times 8 \times 0.9$$

M1

Their $60 \times y$ = their area of P reduced by 10%

or equivalent ratio to 4 : 3 not in simplest form

$\frac{4}{3}$

or equivalent fraction to $\frac{4}{3}$ not in simplest form

oe

$$\text{eg } 60y = 50 \times 8 \times 0.9$$

$$\text{or } 60y = 360 \text{ or } (y =) 360 \div 60 \text{ or } 6$$

Dep on M2

$$\text{M3 } \frac{1.2}{0.9}$$

M1dep

$$4 : 3 \text{ or } 1 : \frac{3}{4} \text{ or } 1 : 0.75 \text{ or } \frac{4}{3} : 1$$

A1

Additional Guidance

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

4 : 3 in working with 3 : 4 on answer line

M3A0

$$1 : \frac{45}{60}$$

M3A0

$$(\text{Alt 1}) 50x = 60y \times 0.9$$

M1M0M0A0

$$(\text{Alt 1}) 50x = 60y \times 1.1$$

M1M0M0A0

$$(\text{Alt 1}) 45x : 60y$$

M1M1

Answer 3 : 4

M0A0

$$(\text{Alt 1}) y : x = 3 : 4$$

Answer 3 : 4

M3A0

Alt 2 example

$$50 \times 10 = 500 \quad (\text{working not seen for reduction by 10\% but completed correctly in next line})$$

$$450 \div 60 = 7.5 \quad (60 \text{ here gains first M1})$$

M1M1

$$10 : 7.5 = 20 : 15$$

M1A0

Do not allow misreads

eg increases length of P by 10% (instead of 20%)

Alt 2 Allow choice of x to be 50

[4]

Q16.

Alternative method 1

$$5.88 \div 1.68 \text{ or } 3.5$$

$$\text{or } 1.68 \div 5.88 \text{ or } [0.285, 0.29]$$

$$\text{or } 5.88 \div 5.60 \text{ or } 1.05$$

$$\text{oe eg } \frac{7}{2} \text{ or } \frac{2}{7} \text{ or } \frac{21}{20}$$
$$\text{or } 5.6 \times 1.05 = 5.88$$

M1

$$5.6(0) \div (5.88 \div 1.68)$$

$$\text{or } 5.6(0) \times (1.68 \div 5.88)$$

$$\text{or } 1.68 \div (5.88 \div 5.60)$$

or

$$1.6$$

oe

$$\text{eg } 5.6(0) \div 3.5$$

or

$$5.6(0) \times [0.285, 0.29]$$

or

$$1.68 \div 1.05$$

M1dep

$$\text{their } 1.6 \div 1.68 \text{ or } [0.952, 0.9524]$$

$$\text{or } 1 - \text{their } 1.6 \div 1.68$$

$$\text{or } 1 - [0.952, 0.9524]$$

$$\text{or } [0.0476, 0.048]$$

$$\text{oe eg } \frac{20}{21} \text{ or } 1 - \frac{20}{21} \text{ or } \frac{1}{21}$$
$$5.6(0) \div 5.88 \text{ oe scores M3}$$
$$1 - 5.6(0) \div 5.88 \text{ oe scores M3}$$

M1dep

$$4.76$$

A1

Alternative method 2

$$5.88 \div 5.6(0) \text{ or } 1.05$$

$$\text{oe eg } \frac{21}{20}$$

M1

$$1 \div \text{their } 1.05$$

$$\text{oe eg } 1 \div \frac{21}{20}$$

M1dep

$$[0.952, 0.9524]$$

$$\text{or } 1 - [0.952, 0.9524]$$

$$\text{or } [0.0476, 0.048]$$

$$\text{oe eg } \frac{20}{21} \text{ or } 1 - \frac{20}{21} \text{ or } \frac{1}{21}$$
$$5.6(0) \div 5.88 \text{ oe scores M3}$$
$$1 - 5.6(0) \div 5.88 \text{ oe scores M3}$$

M1dep

$$4.76$$

A1

Additional Guidance

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

$$\frac{0.28}{5.60}$$

$= 0.05$ is M0 unless 1.05 subsequently used

$5.60 \div 1.68$ with no further correct working

M0

Note that 1.6 seen may be from an incorrect method

eg $1.68 \times 0.95 = 1.6$ does not score because 1.68×0.95 is an incorrect method and the actual value of 1.68×0.95 is 1.596

Any single calculation or set of calculations that lead to $\frac{20}{21}$ or $\frac{1}{21}$

M3

Some common oes for $1 - 5.6(0) \div 5.88$ are

$$\frac{5.88 - 5.6(0)}{5.88} \text{ or } \frac{0.28}{5.88} \text{ and } \frac{1.68 - 1.6}{1.68} \text{ or } \frac{0.08}{1.68}$$

M3

3rd M1 oes include

$$[0.952, 0.9524] \times 100 \text{ or } [95.2, 95.24]\%$$

$$100\% - [0.952, 0.9524] \times 100$$

$$[0.0476, 0.048] \times 100 \text{ or } (4.76, 4.8]\%$$

Values that score marks may be seen in ratios

eg $5.88 : 1.68$ (does not score at this stage)

$3.50 : 1$

M1

Allow working in pence eg $588 \div 1.68$ or 350

M1

Allow working in grams eg $5.88 \div 1680$ or 0.0035

M1

[4]

Q17.

Alternative method 1

53 – 46 or 7
or 53 million – 46 million
or 7 million oe

M1

$$\frac{7}{46} (\times 100) \text{ or } 0.152 (\dots)$$

oe Accept 0.15 if correct method shown

M1dep

15.2(...) (%) Accept 15(%) if correct method shown

A1

Alternative method 2

$$\frac{53}{46} (\times 100) \text{ or } 1.152\dots$$

or 115.2(...)

M1

1.152... – 1 or 0.152(...) or 115.2(...) – 100

M1dep

oe
Accept 1.15 if correct method shown
Accept 115 if correct method shown
Accept 0.15 if correct method shown

15.2(...) (%) Accept 15(%) if correct method shown

A1

Alternative method 3

Any correctly evaluated percentage of 46 (million)

eg
1(%) is 0.46 (million)
5(%) is 2.3 (million)
10(%) is 4.6 (million)

M1

15(%) (increase) is 52.9 (million)
or 15.1(%) (increase) is 52.946 (million)
or 15.2(%) (increase) is 52.992 (million)
or 15.3(%) (increase) is 53.038 (million)
or 15.4(%) (increase) is 53.084 (million)
or 15.5(%) (increase) is 53.13 (million)

oe
15(%) is 6.9 (million)
or 15.1(%) is 6.946 (million)
or 15.2(%) is 6.992 (million)
or 15.3(%) is 7.038 (million)
or 15.4(%) is 7.084 (million)
or 15.5(%) is 7.13 (million)
and 7 (million)

M1dep

15.2(...) (%) Accept 15(%) with two of the trials listed above (or better), one
with an answer below 53 million (or 7 million), the other with
an answer above 53 million (or 7 million)

A1

Additional Guidance

Incorrect number of zeros used for millions cannot score A mark
15(%) scores at least 2 unless clearly from incorrect working

[3]