

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Algebra

Plotting linear real-life graphs and sketching graphs of water flows

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) Continuous graph from (1, 9) to (9, 1)

B1 all integer points from (1, 9) to (9, 1)

or B1 for a continuous graph beyond the given limits, unless $x \leq 1$ or $x \geq 9$ clearly shown as a crossed out region.

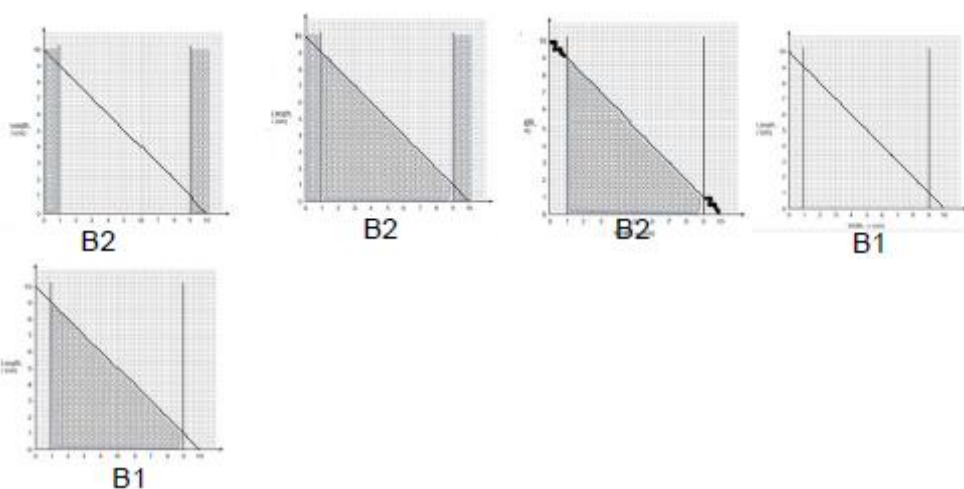
Ignore any other shading or B1 for continuous graph from (2, 8) to (8, 2)

B2

Additional Guidance

Ignore lines, such as $w = 1$ or $w = 9$, but not any lines that may be a wrong $w + l = 10$.

If there is a choice of lines then correct line must be clearly marked but not if the other line is $l = 3w$ or $w = 3l$



- (b) **Alternative method 1**

Graph of $l = 3w$ drawn

M1

2.5

SC1 7.5 from $w = 3l$ drawn

A1

Alternative method 2

$4w = 10$

oe

M1

2.5

Allow embedded.

A1

Additional Guidance

If 2.5 stated in script, award full marks, otherwise scroll up to check graph for possible working.

[4]

Q2.

- (a) Line from (08 00, 0) to (09 30, 60)
Line need not be straight
 ± 1 small square

B1

1 cm horizontal line from their (09 30, 60)
or horizontal line ending at 10 00
 ± 1 small square

B1ft

Line from (10 00, 60) to meet the time axis between (11 06, 0) and (11 18, 0) inclusive

or line from their (10 00, 60) down 6 cm and across 2.4 cm oe
Line need not be straight
 ± 1 small square

B1ft

- (b) Correct ft decision and reference to their graph
or correct ft decision and correct ft time (± 6 minutes) read from their graph
Must be from a line that meets the time axis at least 6 mins after their 10 00

B1ft

Alternative Method

Correct ft decision and calculation of home time
eg 60 miles at 50 mph = 1.2 hours
11 30 is 1.5 hours after 10
or 10 + 1.2 hours = 11 12 ft from their 10 00

B1ft

[4]

Q3.

Line (0900,0) to (1100,80)
need not be straight, but gradient must be positive for all points on the line

B1

Horizontal line $4\frac{1}{2}$ squares long for stage 2
ft from the end of the preceding part of the journey and each stage must be in correct order

and

The sections for stages 3 and 5 need not be straight, but gradient must be negative for all points on the line

Horizontal line 1 square across for stage 4

B1ft

Line $\frac{1}{2}$ square across and 3 squares down for stage 3

B1ft

line $\frac{1}{2}$ squares across and down to time axis to represent arriving home for stage 5

B1ft

[4]

Q4.

- (a) Straight line from (0900, 0)
to (1100, 120)

B1

- (b) Straight line from (1030, 0)
to (1200, 120)

ft (1200, their 120) from their distance at 1100 in part (a)

B1ft

- (c) 80

ft speed from their distance-time graph for Train B

B1ft

Additional Guidance

If their distance-time graph for train B goes from (1030, 0) to (1200, 120) the answer for (c) must be 80

For ft their distance-time graph for Train B must be a straight line for at least 90 minutes

[3]

Q5.

- (a) (10, 20.8), (20, 21.6), (30, 22.4) and (40, 23.2) plotted

B1

Straight line through their points

ft line of best fit following plotting error

B1ft

- (b) [19.9, 20.1]

B1

- (c) **Alternative method 1**

21.2 or 22.8

M1

1.6 *ft their graph*

A1ft

Alternative method 2

$(20.8 + 21.6) \div 2$ or 21.2

or

$(22.4 + 23.2) \div 2$ or 22.8

M1

1.6

A1

Alternative method 3

$23.2 - 21.6$

or $22.4 - 20.8$

or $21.6 - 20$

or $(22.4 - 21.6) \times 2$

or $(23.2 - 22.4) \times 2$

Finds the difference for any two masses 20 kg apart

or

Doubles the difference for any two masses 10 kg apart

M1

1.6

A1

[5]

Q6.

- (a) Fully correct line drawn.

B1 plots (20, 32) or (40, 64) ($\pm \frac{1}{2}$ square)

B2

- (b) 56

ft their graph or correct

B1ft

- (c) 15

ft their graph or correct

B1ft

[4]

Q7.

- (a) 7

B1

- (b) 15

B1

- (c) 20 + 3 or 23
or
10.58

may be implied by a journey (lines or curves) ending at 10.58 on the graph

M1

Straight line from (10.35, 7) to (10.58, 0)

$\pm \frac{1}{2}$

small square

ignore any other working lines on the graph

A1

Additional Guidance

Fully correct graph

M1A1

Accept unruled line if intention clear

[4]

Q8.

- (a) Correct ruled straight line through (0, 0) and (20, 72)

$\pm \frac{1}{2}$ square

B1 any one correct coordinate plotted or seen in a table of values with $1 \leq x \leq 20$

eg (1, 3.6) (2, 7.2) (3, 10.8) (4, 14.4) (5, 18) (10, 36) (15, 54) or (20, 72)

B2

Additional Guidance

Ignore lines beyond (0, 0) to (20, 72)

Ignore incorrect points plotted

To award B1, points plotted cannot be implied by an incorrect line, there must be a coordinate plotted or values in a table

Correct ruled line but too short

B1

(b) 14

ft from their graph in part (a)

$$\pm \frac{1}{2} \text{ square}$$

B1ft

Additional Guidance

Answer must be a whole number

(c) **Alternative method 1** (using formula and conversion factor)

$$30 \times 3.6 \text{ or } 108$$

$$\text{or } 30 \div 1.61 \text{ or } [18.6, 18.64]$$

$$\text{or } 3.6 \div 1.61 \text{ or } [2.2, 2.24]$$

$$\text{or } 1.61 \div 3.6 \text{ or } [0.4, 0.45]$$

oe working in metres

$$\text{eg } 30 \times 60 \times 60 \text{ or } 108\,000$$

M1

$$\text{their } 108 \div 1.61$$

$$\text{or their } [18.6, 18.64] \times 3.6$$

$$\text{or their } [2.2, 2.24] \times 30$$

$$\text{or } 30 \div \text{their } [0.4, 0.45]$$

oe working in metres

$$\text{eg } 108\,000 \div 1610$$

M1dep

$$[67, 67.1]$$

$$[67, 67.1]$$

A1

Alternative method 2 (using graph and conversion factor)

Uses their graph to convert 30 m/s to km/h

or 108

$$\text{eg } 3 \times (\text{their } y \text{ at } x = 10)$$

or

$$(\text{their } y \text{ at } x = 10) + (\text{their } y \text{ at } x = 20)$$

$$\pm \frac{1}{2} \text{ square}$$

M1

$$\text{their } 108 \div 1.61$$

M1dep

$$[67, 67.1]$$

ft from their graph in part (a) and M2

A1ft

Additional Guidance

Alt 2 For A1ft answers may be rounded to the nearest integer or rounded to 1 decimal place

eg their graph used correctly gives 114 km/h

M1

$$114 \div 1.61$$

M1dep

$$[70.8, 71]$$

A1ft

[6]

Q9.

(a) 20

B1

(b) Horizontal line from (09.00, 20) to (10.00, 20)

B1

Straight line with a negative gradient from their (10.00, 20) to (11.30, 0)
ft their (10.00, 20)

B1ft

Additional Guidance

Tolerance within one small square

Accept unruled line if intention for straight line is clear

Their (10.00, 20) can be (09.00, 20)

Their 10.00 cannot be earlier than 09.00

[3]

Q10.

Graph 1 = *D*

Graph 2 = *A*

Graph 3 = blank

Graph 4 = *B*

Graph 5 = blank

Graph 6 = *C*

B1 for each correct letter in the correct position

B4

Additional Guidance

Choice of answers eg *A* in every position

B0

A in two positions, *D B* and *C* correct

B3

[4]

Q11.

(a) Joins (0, 0) to (30, 20)

Line does not need to be straight but must start and finish at correct points and not be decreasing

Mark intention

B1

Horizontal **line** for 15 minutes from their (30, 20)

Mark intention

B1ft

Line with gradient 1 or a curve from their (45, 20)

and stops at 60 minutes

or stops at top edge of grid or higher but not beyond 60 minutes

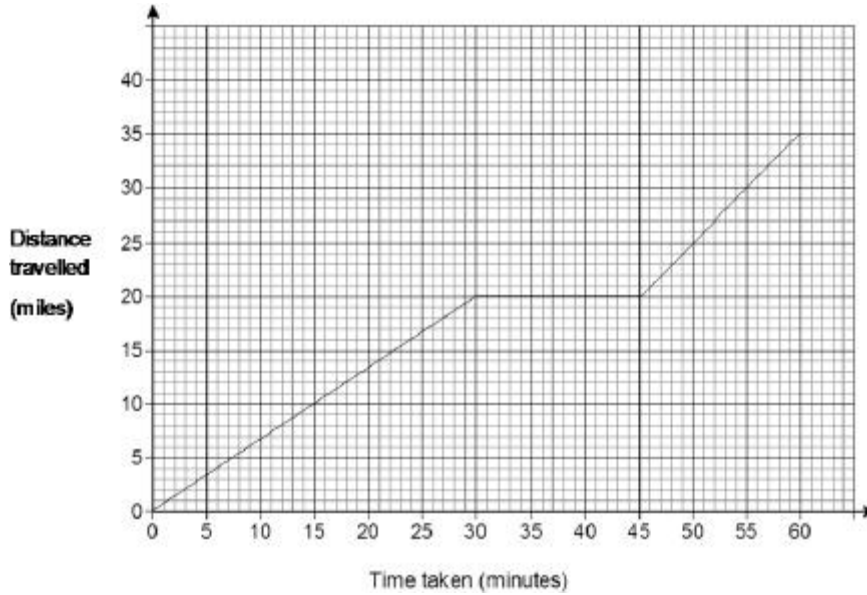
A curve must not be decreasing and must start and finish at two points that could be joined by a line with gradient 1

Condone a horizontal or vertical line from 60 minutes

Mark intention

B1ft

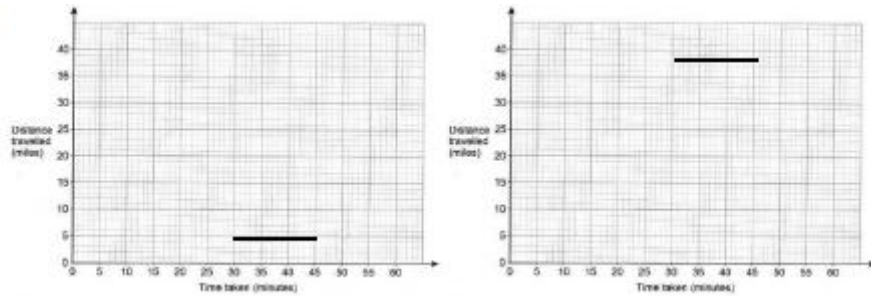
Additional Guidance



B3

Allow any horizontal line between 30 minutes and 45 minutes if first part of journey is blank

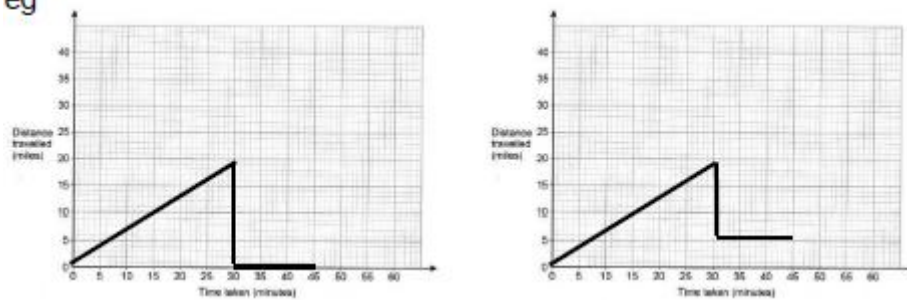
eg



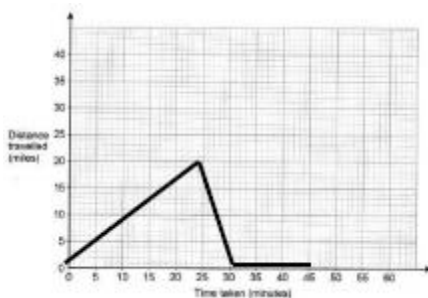
B0B1

Do not allow second mark if their first line is followed by a drop back towards the horizontal axis before she stops

eg



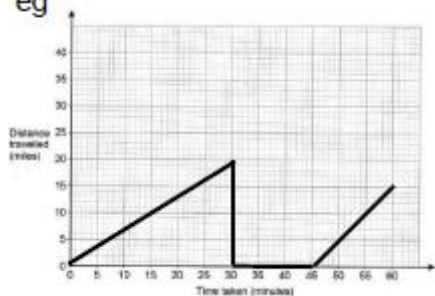
B1B0



B0B0

If there are more than 3 lines or curves assume the last part is the part where she completes her journey.

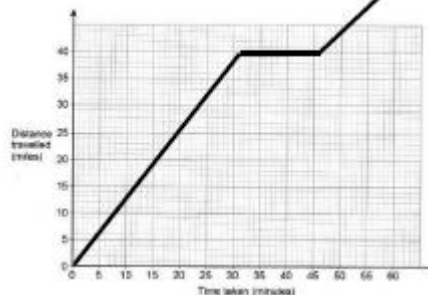
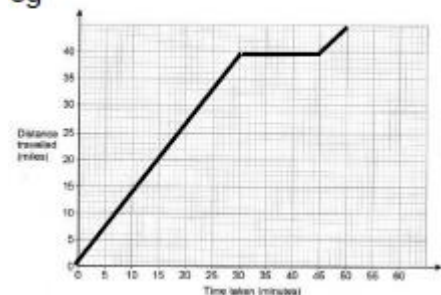
eg



B1B0B1ft

If their (45, 20) is too high to fit a line of gradient 1 ending at 60 minutes, allow the final line to stop at the top of the grid or higher, but not beyond 60 minutes

eg



B0B1ftB1ft

Points but no lines

B0

Ignore any lines that could be working for part (a) or part (b)

(b) 35

Correct or ft total distance travelled for their graph at 60 minutes

B1ft

Additional Guidance

35 from any or no graph

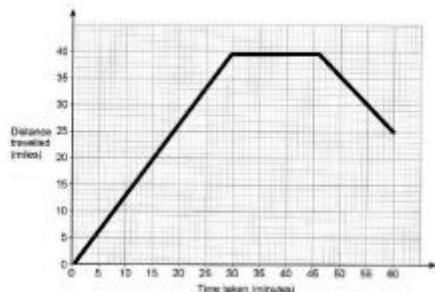
B1

If their graph extends beyond 60 minutes, read off at 60 minutes for ft

Follow through total distance travelled

eg

(a)



(b) answer 25

B0ft

(b) answer 55

B1ft

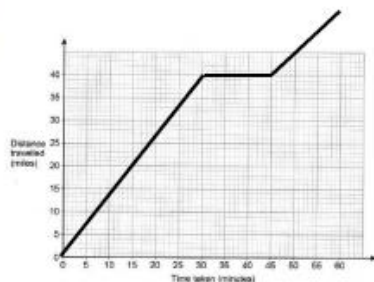
Ignores the stationary parts

B0

Do not follow through a graph above the grid at 60

eg

(a)



(b) answer 55

B0ft

[4]

Q12.

(a) [4, 5]

B1

(b) Correct ruled straight line from $(-25, -50)$ to $(25, 50)$

$\pm \frac{1}{2}$ small square

ignore ends of line outside $[-25, 25]$

B1 two correct points added to the table

or at least two correct points plotted

or correct line too short but crosses 2 horizontal centimetre squares

B2

Additional Guidance

The correct points in the table or on the graph may be outside $[-25, 25]$

e.g. $(100, 200)$ and $(-100, -200)$ in the table

B1

For B1, do not count a point as correct if another point has the same x -coordinate, otherwise ignore extra points that are incorrect

The B1 for points plotted cannot be implied by a line – you must see e.g. crosses or dots

Ignore incorrect points in the table if B1 or B2 gained elsewhere

(c) Correct reading of C coordinate of intersection of their graph with the given graph
ft their intersection from any line or curve

$\pm \frac{1}{2}$ small square

B1 horizontal line drawn from point of intersection to y -axis

or F coordinate of intersection given

B2ft

Additional Guidance

Their line does not intersect given line or they have no line

B0

If their graph intersects given line at more than one point and they give **all** the C coordinates of the intersections

B1

If their line is correct the answer should be approximately -25

If their line is correct the F coordinate should be approximately -12

Both their -25 and their -12 given

e.g. correct line seen and $(-25, -12)$ or $(-12, -25)$

B1

[5]

Q13.

(a) D

(b) C

(c) E

B1

B1

B1

[3]