

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Algebra

Solving shape problems involving coordinates

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) (10, 3)

B1

Additional Guidance

Check diagram if answer line blank

(b) $x = 6$

B1

Additional Guidance

Check diagram if answer line blank

[2]

Q2.

x -coordinate of $L = 10$ or y -coordinate of $L = 8$

or

10 marked on x -axis below L and 8 marked on y -axis left of L

or

(x -coordinate of $M =$) $5 + 5 + 5$ or (y -coordinate of $M =$) $12 - 2 - 2 - 2$

or

15 marked on x -axis below M or 6 marked on y -axis left of M

oe

M1

(L) (10, 8)

or (M) (15, ...) or (... , 6)

or

15 marked on x -axis below M

and

6 marked on y -axis left of M

condone missing brackets if intention is clear

A1

15, 6

SC2 (6, 15)

A1

Additional Guidance

(10, 8, 15, 6) (ie both sets of coordinates on answer line) correctly assigned to L and M previously

M1A1A1

(10, 8, 15, 6) on answer line not correctly assigned to L and M previously

M1A1A0

Accept correct working on diagram and/or correct answer on diagram if not contradicted by answer line

[3]

Q3.

x -coordinate of $C = 12$

or y -coordinate of $C = 8$

or

12 marked on x -axis below C

and 8 marked on y -axis left of C

or

x -coordinate of $D = 6 + 6 + 6$

oe

or y -coordinate of $D = 2 + 3 + 3 + 3$

or

$\frac{x}{6}$

$= 3$ or $6 = (2 \times 0 + x) \div 3$

sets up a correct equation for

x -coordinate of D or y -coordinate of D

$\frac{y-2}{5-2}$

or $= 3$ or $5 = (2 \times 2 + y) \div 3$

or

18 marked on x -axis below D

or 11 marked on y -axis left of D

M1

(C is the point) (12, 8)

or (D is the point) (18, ...) or (... , 11)

condone missing brackets if intention is clear

or

18 marked on x -axis below D

and 11 marked on y -axis left of D

A1

18, 11

A1

Additional Guidance

(12,8 , 18,11) on answer line with previous link to C and D

M1A1A1

(12,8 , 18,11) on answer line with no previous link to C and D

M1A1A0

12, 8 on answer line with no other working

M1A1A0

Accept correct working on diagram and correct answer on diagram if not contradicted by answer line

11, 18 on answer line does not score the last mark, but may score M1A0 or M1A1

11, 18 with no working

M0A0A0

[3]

Q4.

(a) **Alternative method 1**

$$\frac{-9 - -5}{4 - 2} \text{ or } \frac{-5 - -9}{2 - 4}$$

$$\text{or } (2, -5) - (4, -9) = (-2, 4) \text{ or } (4, -9) - (2, -5) = (2, -4)$$

$$\text{or } \frac{\text{change in } y}{\text{change in } x} \text{ or } \frac{\Delta y}{\Delta x}$$

or triangle drawn with points A and B and side lengths of 4 and (-)2 identified

or correct explanation of pattern of graph

$$\text{and } \frac{-4}{2} = -2 \text{ or } \frac{4}{-2} = -2$$

$$\text{oe fraction eg } \frac{-9 + 5}{4 - 2} \text{ or } \frac{-5 + 9}{2 - 4}$$

$$\text{B1 for } \frac{-9 - -5}{4 - 2} \text{ or } \frac{-5 - -9}{2 - 4}$$

$$\text{or } (2, -5) - (4, -9) = (-2, 4) \text{ or } (4, -9) - (2, -5) = (2, -4)$$

$$\text{or } \frac{\text{change in } y}{\text{change in } x} \text{ or } \frac{\Delta y}{\Delta x}$$

or triangle drawn with points A and B and side lengths of 4 and (-)2 identified

or correct explanation of pattern of graph

$$\text{or } \frac{-4}{2} = -2 \text{ or } \frac{4}{-2} = -2$$

B2

Alternative method 2

Gives $y = -2x + c$ and substitutes (2, -5) or (4, -9) to find $c = -1$

$$\text{or } y - -5 = -2(x - 2) \text{ or } y + 5 = -2(x - 2)$$

$$\text{or } y - -9 = -2(x - 4) \text{ or } y + 9 = -2(x - 4)$$

and gives $y = -2x - 1$ **and** correctly substitutes and evaluates with the other pair of coordinates to check

B1 for (2, -5) or (4, -9) to find $c = -1$

$$\text{or } y - -5 = -2(x - 2) \text{ or } y + 5 = -2(x - 2)$$

$$\text{or } y - -9 = -2(x - 4) \text{ or } y + 9 = -2(x - 4)$$

or gives $y = -2x - 1$ and correctly substitutes and evaluates with one or both pair(s) of coordinates

B2

Alternative method 3

$-5 = 2m + c$ and $-9 = 4m + c$ and works out $m = -2$ using a correct algebraic method

oe equations

$$\text{B1 for } -5 = 2m + c \text{ and } -9 = 4m + c$$

B2

Alternative method 4

$-5 = -2(2) + c$ and $-9 = -2(4) + c$ and works out $c = -1$ for both

oe equations

$$\text{B1 for } -5 = -2(2) + c \text{ and } -9 = -2(4) + c$$

B2

Additional Guidance

In alt 1, examples of correct explanation are:

2 left and 4 up or 2 right and 4 down

In alt 1, points A and B can be identified on a diagram by their coordinates

In alt 2, accept rearrangements of $y = -2x - 1$ eg $2x + y = -1$

$$\frac{-5 - 9}{2 - 4} \text{ or } \frac{-9 - 5}{4 - 2} (= -2 \text{ or } = 2)$$

B0

(b) **Alternative method 1** – uses given point with one from (a) to show gradient = -2

$$\frac{601 - -9}{-301 - 4} \text{ or } \frac{601 - -5}{-301 - 2} \quad \text{oe eg } \frac{610}{-305} \text{ or } \frac{606}{-303}$$

M1

-2 and Yes

Must see working for M1

A1

Alternative method 2 – correct or no equation shown in (a)

Correct method to find $y = -2x - 1$

May be seen in part (a)

M1

$y = -2x - 1$ and shows that $601 = -2(-301) - 1$ and Yes

A1

Alternative method 3 – incorrect equation shown in (a)

Substitutes -301 and 601 into their equation from (a)

Equation must involve x and y

M1

Correct evaluation and No

A1ft

Alternative method 4 – have gained two marks in (a) by any method

Uses (2, -5) or (4, -9) to work out $c = -1$

M1

$601 = -2(-301) + c$ and $c = -1$ and Yes

A1

Alternative method 5 – have shown that $c = -1$ for both points in (a)

$601 = -2(-301) + c$

M1

$601 = -2(-301) + c$ and $c = -1$ and Yes

A1

Additional Guidance

$y = -2x - 1$ given in (a) but not used in (b)

M0 for equation

Correct method in (a) to show that the gradient is -2, but followed by incorrect equation. Incorrect equation then used correctly in (b)

B2 in (a) M1A0 in (b)

[4]

Q5.

- (a) Right-angled triangle ABC drawn with
A at $(-3, -2)$
and
B at $(1, -2)$
and
C at $(-3, 4)$ or $(1, 4)$

B2 for

A, B and C correctly plotted with no triangle drawn

or

*A and B correctly plotted and a right-angled triangle drawn
with A and B at two of the vertices*

or

*C plotted on the line $y = 4$ and a right-angled triangle drawn
with C at one of the vertices*

or

*A and B correctly plotted with C plotted at $(k, 4)$ with $k \neq -3$ or 1
and triangle ABC drawn*

B1 for

A and B correctly plotted

or

C plotted on the line $y = 4$

or

a right-angled triangle drawn

B3

Additional Guidance

Condone incorrect or omitted labelling

- (b) **Alternative method 1**

$\frac{1}{2} \times \text{their base} \times \text{their height}$

M1

12

ft their triangle

A1ft

Alternative method 2

Evidence of counting squares seen

M1

12

ft their triangle

A1ft

[5]

Q6.

(3, 1) marked on the grid or stated for P
implied by (3, 5) or (3, -3)

B1

(3, 5) and (3, -3)

*ft 4 squares vertically above their (3, 1)
and 4 squares vertically below their (3, 1)
with P on the line AB but not at A or B
B1ft (3, 5) or (3, -3)
SC2 (3, 5) and (3, -3) correctly marked on grid
SC1 (3, 5) or (3, -3) correctly marked on grid*

B2ft

Additional Guidance

If more than one point marked on the line AB then P must be labelled or used to locate C

$P(4, 1)$

B0

Answers (4, 5) and (4, -3)

B2ft

$P(4, 1)$

B0

Answers (4, 5) and (4, 9)

B1ft

[3]

Q7.

$-\frac{5}{4}$ or $-1\frac{1}{4}$ or -1.25

B1 $\frac{5}{4}$ or $1\frac{1}{4}$ or 1.25

or

$x + 4$ and $y - 5$

or

possible coordinates for P and Q stated or shown on a diagram

eg $P(0, 5)$ and $Q(4, 0)$

or

right-angled triangle shown with 4 as horizontal length and 5 as vertical length

B2

Additional Guidance

B1 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts

Ignore attempts at rounding after correct answer seen

Accept $\frac{-5}{4}$ and condone $\frac{5}{-4}$

B2

$(x + 4)(y - 5)$

B1

$x + 4$ and $y - 5$ may be seen embedded in a fraction eg $\frac{y-(y-5)}{x-(x+4)}$ or $\frac{y-(y-5)}{x+(x+4)}$

B1

$-\frac{4}{5}$ or $\frac{4}{5}$

B0

[2]

Q8.

- (a) Correct method for finding the difference between the x or y coordinates for line AC

may be on diagram eg $9 - -7$ or 16 or $3 - -5$ or 8

M1

Correct method for finding the difference between the x or y coordinates for line AB or line BC

M1dep

may be on diagram

eg $16 \div (1 + 3)$ or 4

or $8 \div (1 + 3)$ or 2

or

$$16 \times \frac{3}{(1+3)} \text{ or } 12$$

$$\text{or } 8 \times \frac{3}{(1+3)} \text{ or } 6$$

$(-3, 5)$

A1

Additional Guidance

Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts

Condone any missing minus signs if absolute values for the differences are correct

$(-3, \dots)$ or $(\dots, 5)$

M1M1A0

- (b)

$$(m_1 =) \frac{-7-9}{3--5} \text{ or } (m_1 =) \frac{9--7}{-5-3}$$

or -2

gradient of AC

M1

$$-1 \div \text{their } -2 \text{ or } \frac{1}{2}$$

gradient of line perpendicular to AC

their -2 must be identified as a gradient

$\frac{1}{2}$ implies M1M1

M1

$$-7 = \text{their } \frac{1}{2} \times 3 + c \text{ or } (c =) -8.5$$

or

$$y - -7 = \text{their } \frac{1}{2}(x - 3)$$

*oe condone any letter for c
dep on 2nd M1*

M1dep

$$y = \frac{1}{2}x - 8.5$$

oe eg $2y = x - 17$

A1

Additional Guidance

Check part (a) for working for part (b)

[7]

Q9.

(32, 8)

B2 E (32, ...) or E (... , 8)

B1 C (17, 18) or D (23, 14)

SC1 C (a, b) and D (a + 6, b - 4)

B3

Additional Guidance

Mark the answer line for B3 and B2 (if blank check working lines and diagram)

B1 or SC1 is likely to be seen in working lines or on the diagram

Condone missing brackets eg C 17, 18

B1

Coordinates can be implied eg $D \ x = 23 \ y = 14$

B1

Condone answers given as vectors for B2, B1 or SC1

B1

eg $C \begin{pmatrix} 17 \\ 18 \end{pmatrix}$

eg

SC1 C cannot be (5, 26) or (11, 22) and coordinates of D must be evaluated

eg C (15, 17) and D (21, 13)

SC1

[3]