

Coordinates and Midpoints

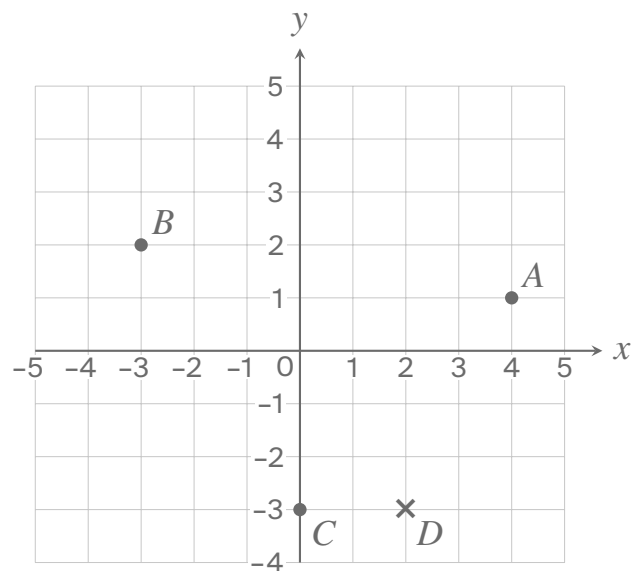
Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (5 marks)

The grid shows the points *A*, *B* and *C* (and the point *D* from part (d)).



(a) Write down the coordinates of point *A*.

Start at the origin (0, 0).

Go 4 to the right, then 1 up.

The *x*-coordinate (across) comes first.

Answer: (4, 1)

Tip: Across first, then up or down. Writing (1, 4) instead of (4, 1) is the most common mistake.

- (b) Write down the coordinates of point B .

Go 3 to the left, so $x = -3$.

Then go 2 up, so $y = 2$.

Answer: $(-3, 2)$

- (c) Write down the coordinates of point C .

C is on the y -axis, so $x = 0$.

It is 3 down, so $y = -3$.

Answer: $(0, -3)$

- (d) On the grid, mark with a cross ($\times$) the point $(2, -3)$. Label it D .

From the origin, go 2 to the right, then 3 down.

D is shown on the grid above.

Answer: Cross at $(2, -3)$

- (e) Write down the coordinates of the midpoint of AB .

A is $(4, 1)$ and B is $(-3, 2)$.

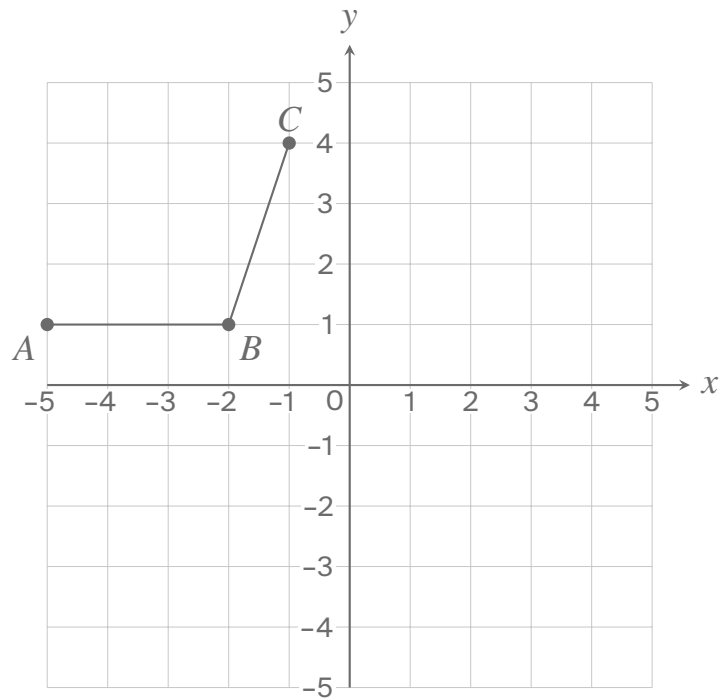
Add the x -coordinates and halve: $\frac{4 + (-3)}{2} = \frac{1}{2} = 0.5$

Add the y -coordinates and halve: $\frac{1 + 2}{2} = \frac{3}{2} = 1.5$

Answer: $(0.5, 1.5)$

2 (2 marks)

The points A , B and C are three vertices of a parallelogram $ABCD$.



$ABCD$ is a parallelogram.

Find the coordinates of D .

In a parallelogram, opposite sides are parallel and the same length.

So the move from A to D is the same as the move from B to C .

From B to C : 1 right and 3 up.

From A : $D = (-5 + 1, 1 + 3) = (-4, 4)$

Answer: $(-4, 4)$

Tip: Sketch the parallelogram on the grid first. D is **not** straight above A , because the sides BC and AD slope.

Marks: 1 mark for using the move 1 right and 3 up (or a correct sketch). 1 mark for $(-4, 4)$.

3 (2 marks)

P is the point with coordinates (3, 1).

Q is the point with coordinates (9, 5).

Find the coordinates of the midpoint of PQ .

Add the x -coordinates and halve: $\frac{3+9}{2} = \frac{12}{2} = 6$

Add the y -coordinates and halve: $\frac{1+5}{2} = \frac{6}{2} = 3$

Answer: (6, 3)

Tip: Use $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ and keep the x -coordinate first in your answer.

Marks: 1 mark for adding and halving the x or the y coordinates. 1 mark for (6, 3).

4 (2 marks)

A is the point (−5, −2) and B is the point (3, 8).

Find the coordinates of the midpoint of AB .

Add the x -coordinates and halve: $\frac{-5+3}{2} = \frac{-2}{2} = -1$

Add the y -coordinates and halve: $\frac{-2+8}{2} = \frac{6}{2} = 3$

Answer: (−1, 3)

Marks: 1 mark for adding and halving the x or the y coordinates. 1 mark for (−1, 3).

5 (2 marks)

The midpoint of PQ is (4, 1).

P is the point (−2, 3).

Find the coordinates of Q .

The step from the midpoint to Q is the same as the step from P to the midpoint.

From P to the midpoint: x goes from −2 to 4, which is +6.

y goes from 3 to 1, which is -2 .

Do the same step again from the midpoint:

$$Q = (4 + 6, 1 - 2) = (10, -1)$$

$$\text{Check: } \left(\frac{-2 + 10}{2}, \frac{3 + (-1)}{2} \right) = (4, 1) \quad \checkmark$$

Answer: $(10, -1)$

Marks: 1 mark for finding the step +6 across and -2 up. 1 mark for $(10, -1)$.

6 (1 mark)

Write down the coordinates of the point where the line $x = 3$ meets the line $y = -2$

Every point on the line $x = 3$ has x -coordinate 3.

Every point on the line $y = -2$ has y -coordinate -2 .

So the point on both lines is $(3, -2)$.

Answer: $(3, -2)$

Tip: $x = 3$ is a vertical line and $y = -2$ is a horizontal line. Don't swap them.

7 (2 marks)

$ABCD$ is a square.

A is the point $(2, 1)$ and B is the point $(6, 1)$.

Find the coordinates of the other two vertices.

AB is a side of the square. It is horizontal, with length $6 - 2 = 4$.

The other two vertices are 4 units directly above (or below) these points.

Above: $(2, 1 + 4) = (2, 5)$ and $(6, 1 + 4) = (6, 5)$

(Below also works: $(2, -3)$ and $(6, -3)$.)

Answer: $(2, 5)$ and $(6, 5)$ (or $(2, -3)$ and $(6, -3)$)

Marks: 2 marks for both vertices correct. 1 mark for one correct vertex.

8 (2 marks)

M is the point $(a, 4)$.

M is the midpoint of $A(2, b)$ and $B(10, 6)$.

Find the value of a and the value of b .

a is the x -coordinate of the midpoint.

$$a = \frac{2 + 10}{2} = \frac{12}{2} = 6$$

The y -coordinate of the midpoint is 4.

$$\text{So } \frac{b + 6}{2} = 4$$

Multiply by 2: $b + 6 = 8$

Subtract 6: $b = 2$

Answer: $a = 6$, $b = 2$

Marks: 1 mark for $a = 6$. 1 mark for $b = 2$.

9 (1 mark)

Kai says,

‘The point $(-1, 5)$ lies on the x -axis.’

Explain why Kai is wrong.

Every point on the x -axis has y -coordinate 0.

The point $(-1, 5)$ has y -coordinate 5.

So it is 5 units above the x -axis, not on it.

Answer: A point on the x -axis has y -coordinate 0; $(-1, 5)$ has $y = 5$.

10 (3 marks)

A straight path goes from a gate, G , past a café, C , to a lake, L .
On a map, C has coordinates $(7, 4)$ and L has coordinates $(11, 2)$.

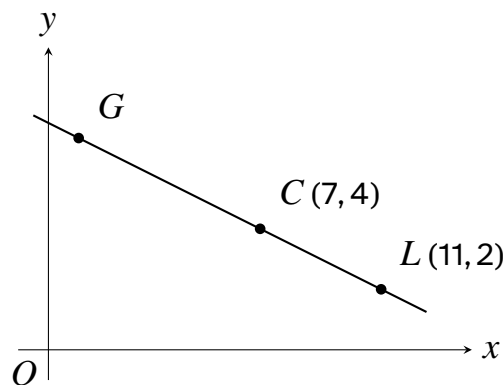


Diagram **NOT** accurately drawn

The distance from G to C is $\frac{3}{2}$ of the distance from C to L .
Find the coordinates of the gate, G .

Find the step from C to L :

x increases by $11 - 7 = 4$

y decreases by $4 - 2 = 2$

GC is $\frac{3}{2}$ of CL , so find $\frac{3}{2}$ of this step:

$$\frac{3}{2} \times 4 = 6 \quad \text{and} \quad \frac{3}{2} \times 2 = 3$$

G is on the other side of C , so go back from C : x decreases by 6 and y increases by 3.

$$G = (7 - 6, 4 + 3) = (1, 7)$$

Answer: (1, 7)

Tip: Check which way to go. G is on the opposite side of C from L , so you undo the step: x gets smaller and y gets bigger. Adding the step to C gives $(13, 1)$, which is on the wrong side.

Marks: 1 mark for the step from C to L (4 and 2). 1 mark for $\frac{3}{2}$ of the step (6 and 3). 1 mark for $(1, 7)$.

11 (4 marks)

The points E , F and G lie in that order on a straight line.

E is the point $(-3, -2)$ and F is the point $(6, 4)$.

$$EG: FG = 5: 2$$

Find the coordinates of G .

EG is the whole length from E to G , and $EG = EF + FG$.

EG is 5 parts and FG is 2 parts, so EF is $5 - 2 = 3$ parts.

Find the step from E to F :

x increases by $6 - (-3) = 9$

y increases by $4 - (-2) = 6$

EF is 3 parts, so 1 part is $9 \div 3 = 3$ across and $6 \div 3 = 2$ up.

FG is 2 parts: $2 \times 3 = 6$ across and $2 \times 2 = 4$ up.

Add this to the coordinates of F :

$$G = (6 + 6, 4 + 4) = (12, 8)$$

Answer: (12, 8)

Tip: Read the ratio carefully: it compares EG (the whole line) with FG , not EF with FG . Treating EF as 5 parts is the most common mistake here.

Marks: 1 mark for seeing that EF is 3 parts. 1 mark for the step from E to F (9 and 6). 1 mark for the FG step (6 and 4). 1 mark for $(12, 8)$.
