

Exercise walk-through

E3.2

Drawing linear graphs

IGCSE Mathematics

You must be able to

- find the gradient and y -intercept of a line
- find the equation of a line from its gradient and a point
- use the gradient rules for parallel and perpendicular lines

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The method

Method — Straight lines

- **Gradient** : $m = \frac{\text{change in } y}{\text{change in } x}$. Through $(1, 2)$ and $(4, 11)$: $m = \frac{9}{3} = 3$.
- **Equation**: gradient 3 through $(1, 2) \rightarrow 2 = 3(1) + c \rightarrow c = -1 \rightarrow y = 3x - 1$.
- **Parallel** : same gradient. **Perpendicular** : $m_1 m_2 = -1$.

Answer shapes: M1 a correct method, **A1** the correct answer.

Exercises 2.1-2.3

2.1 Write down the gradient and y -intercept of $y = 4x - 3$. [2]

2.2 Find the gradient of the line through $(2, 1)$ and $(5, 10)$. [2]

2.3 Write down the gradient of a line parallel to $y = 2x + 7$. [1]

Exercises 2.1·2.3

2.1 Write down the gradient and y -intercept of $y = 4x - 3$. [2]

2.1

- gradient **4**; y -intercept **-3**
-

2.2 Find the gradient of the line through $(2, 1)$ and $(5, 10)$. [2]

2.2

$$m = \frac{10 - 1}{5 - 2} = \frac{9}{3} = \mathbf{3}$$

2.3 Write down the gradient of a line parallel to $y = 2x + 7$. [1]

2.3

- parallel lines have the same gradient: **2**

Exercises 3.1-3.3

3.1 Find the equation of the line with gradient 2 that passes through $(3, 1)$. [3]

3.2 Rearrange $3x + 2y = 12$ into the form $y = mx + c$ and write down its gradient. [2]

3.3 Find the gradient of a line perpendicular to $y = \frac{1}{2}x + 4$. [1]

Exercises 3.1·3.3

3.1 Find the equation of the line with gradient 2 that passes through (3, 1). [3]

3.1

- $y = 2x + c$
 - substitute (3, 1): $1 = 2(3) + c$ so $c = -5$
 - **$y = 2x - 5$**
-

3.2 Rearrange $3x + 2y = 12$ into the form $y = mx + c$ and write down its gradient. [2]

3.2

- $2y = -3x + 12$ so $y = -\frac{3}{2}x + 6$
 - gradient **$-\frac{3}{2}$**
-

3.3 Find the gradient of a line perpendicular to $y = \frac{1}{2}x + 4$. [1]

3.3

- flip and change sign: **-2**

Exercise 3.4 (a)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(a) Find the gradient of L and the equation of L in the form $y = mx + c$.

[4]

Exercise 3.4 (a)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(a) Find the gradient of L and the equation of L in the form $y = mx + c$. [4]

(a)

$$m = \frac{-5 - 7}{4 - (-2)} = \frac{-12}{6} = -\mathbf{2}$$

- using A : $7 = -2(-2) + c$ so $c = 3$
- $\mathbf{y = -2x + 3}$

Exercise 3.4 (b)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(b) Find the coordinates of the points where L crosses the two axes.

[3]

Exercise 3.4 (b)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(b) Find the coordinates of the points where L crosses the two axes.

[3]

(b)

- y -axis: $x = 0$ gives **(0, 3)**
- x -axis: $0 = -2x + 3$ so $x = 1.5$, giving **(1.5, 0)**

Exercise 3.4 (c)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(c) Find the equation of the line through B that is perpendicular to L .

[3]

Exercise 3.4 (c)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(c) Find the equation of the line through B that is perpendicular to L .

[3]

(c)

- perpendicular gradient $= \frac{1}{2}$
- through $B(4, -5)$: $-5 = \frac{1}{2}(4) + c$ so $c = -7$
- $y = \frac{1}{2}x - 7$

Exercise 3.4 (d)

3.4 The line L passes through $A(-2, 7)$ and $B(4, -5)$.

(d) Show that the point $(1, 1)$ is the midpoint of AB , and state what this tells you about the perpendicular bisector of AB . [3]

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(d)

$$\left(\frac{-2 + 4}{2}, \frac{7 + (-5)}{2} \right) = (1, 1)$$

- the perpendicular bisector passes through $(1, 1)$ with gradient $\frac{1}{2}$
- $y - 1 = \frac{1}{2}(x - 1)$ so $\mathbf{y = \frac{1}{2}x + \frac{1}{2}}$