

Exercise walk-through

E3.3

Gradient of linear graphs

IGCSE Mathematics

You must be able to

- calculate a gradient from the coordinates of two points
- say what a positive, negative, zero or undefined gradient looks like
- use a known gradient to find a missing coordinate on the line

1

The method

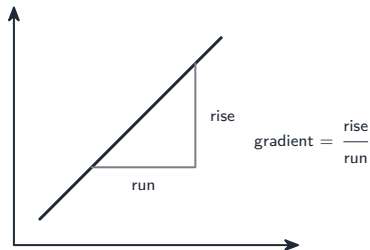
Method — Change in y over change in x , in the same order both times

- **Formula:** $\text{gradient} = \frac{y_2 - y_1}{x_2 - x_1}$. Take the points in the SAME order on the top and the bottom.
- **Worked:** through $(1, 3)$ and $(5, 11)$ the gradient is $\frac{11 - 3}{5 - 1} = 2$.
- **Negative:** through $(-2, 7)$ and $(4, -5)$ it is $\frac{-5 - 7}{4 - (-2)} = \frac{-12}{6} = -2$ — the line slopes down as x increases.
- **Special cases:** a horizontal line ($y = 7$) has gradient 0; a vertical line ($x = 7$) has an **undefined** gradient, because the denominator would be zero.

Answer shapes (marked by **method marks** — M1 for a correct method, A1 for the correct answer): the substituted fraction before it is worked out is the method mark, so write it down.

Method — Change in y over change in x , in the same order both times

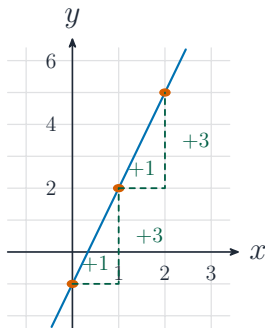
Answer shapes (marked by method marks — M1 for a correct method, A1 for the correct answer): the substituted...



A right-angled triangle drawn on a line to show rise over run

Method — Change in y over change in x , in the same order both times

Answer shapes (marked by method marks — M1 for a correct method, A1 for the correct answer): the substituted...



drawing $y = 3x - 1$:

1. mark the intercept $c = -1$
2. gradient 3: step 1 right, 3 up, again and again
3. join the points

check with a table: $x = 0, 1, 2 \rightarrow y = -1, 2, 5$

Steps for drawing a straight line from its gradient

2

Practice

Practice 2.1 ■ 2 marks

Find the gradient of the line through $(2, 5)$ and $(6, 17)$.

Solution 2.1

Method: Change in y over change in x , in the same order both times — p.4

Worked steps

$$\blacksquare \frac{17 - 5}{6 - 2} = \frac{12}{4} \quad \text{M1}$$

$$= 3$$

A1

Practice 2.2 ■ 2 marks

Find the gradient of the line through $(-3, 4)$ and $(5, 0)$.

Solution 2.2

Method: Change in y over change in x , in the same order both times — p.4

Worked steps

$$\blacksquare \frac{0 - 4}{5 - (-3)} = \frac{-4}{8} \quad \text{M1}$$

$$= -\frac{1}{2}$$

A1

Practice 2.3 ■ 1 mark

Write down the gradient of the line $y = 7$.

Solution 2.3

Method: Change in y over change in x , in the same order both times — p.4

Worked steps

- the line is horizontal, so y never changes

$$= 0$$

B1

3

Exam-style

Exam-style 3.1 ■ 5 marks

A is the point $(-4, 9)$ and B is the point $(2, -3)$.

Exam-style 3.1 (a) ■ 2 marks

Find the gradient of AB .

Solution 3.1 (a)

Method: Change in y over change in x , in the same order both times — p.4

Worked steps

$$\blacksquare \frac{-3 - 9}{2 - (-4)} = \frac{-12}{6} \quad \text{M1}$$

$$= -2$$

A1

Exam-style 3.1 (b) ■ 3 marks

The point $C(k, 5)$ lies on the line AB . Find the value of k .

Solution 3.1 (b)

Worked steps

■ from A to C the gradient is still -2 : $\frac{5 - 9}{k - (-4)} = -2$ **M1**

■ $-4 = -2(k + 4)$, so $-4 = -2k - 8$ **M1**

$$k = -2$$

A1

Exam-style 3.2 ■ 2 marks

A line has gradient 3 and passes through $(2, 1)$. Find the y -coordinate of the point on the line where $x = 5$.

Solution 3.2

Method: Change in y over change in x , in the same order both times — p.4

Worked steps

- from $x = 2$ to $x = 5$ is 3 across, so y rises by $3 \times 3 = 9$ **M1**

$$1 + 9 = 10$$

A1