

E3.3 Gradient of linear graphs

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

KEY WORDS gradient 斜率 • rise 纵向变化 • run 横向变化 • horizontal 水平的
• undefined 无定义

Objective

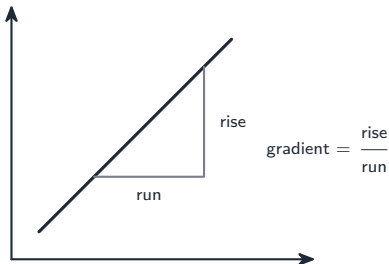
Build the skills to answer Extended exam questions on the **gradient of a linear graph** 直线的斜率 — calculating it from two points, reading its **sign** 符号, and using a known gradient to find a missing coordinate.

You must be able to:

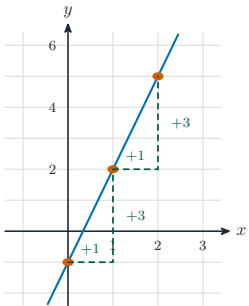
- calculate a gradient from the coordinates of two points
- say what a positive, negative, zero or undefined gradient looks like
- use a known gradient to find a missing coordinate on the line

1 Worked examples

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



Rise over run — and the rise is measured going up, the run going right



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: $x = 0, 1, 2 \rightarrow y = -1, 2, 5$

A gradient of 2 means up 2 for every 1 across

- **Formula:** 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.

2 Practice

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

2.2 Find the gradient of the line through $(-3, 4)$ and $(5, 0)$. [2]

2.3 Write down the gradient of the line $y = 7$. [1]

3 Exam-style questions

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

(a) Find the gradient of AB . [2]

(b) The point $C(k, 5)$ lies on the line AB . Find the value of k . [3]

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

Solutions

Marking: **M1** a correct method, **A1** the correct answer.

Each answer shows the steps, then the **result**.

2.1

$$\begin{aligned} \bullet \quad \frac{17-5}{6-2} &= \frac{12}{4} \\ &= \mathbf{3} \end{aligned}$$

2.2

$$\begin{aligned} \bullet \quad \frac{0-4}{5-(-3)} &= \frac{-4}{8} \\ &= -\frac{1}{2} \end{aligned}$$

2.3

- the line is horizontal, so y never changes

$$= \mathbf{0}$$

3.1

(a)

$$\begin{aligned} \bullet \quad \frac{-3-9}{2-(-4)} &= \frac{-12}{6} \\ &= -\mathbf{2} \end{aligned}$$

(b)

- from A to C the gradient is still -2 : $\frac{5-9}{k-(-4)} = -2$
- $-4 = -2(k+4)$, so $-4 = -2k - 8$

$$k = -\mathbf{2}$$

3.2

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

$$1 + 9 = \mathbf{10}$$