IGCSE MATHEMATICS • EXERCISE SHEET

E3.2 Drawing linear graphs

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS perpendicular 垂直 • parallel 平行 • gradient 斜率 • parallel and perpendicular 平行和垂直 • drawing linear graphs 画直线图象

Objective

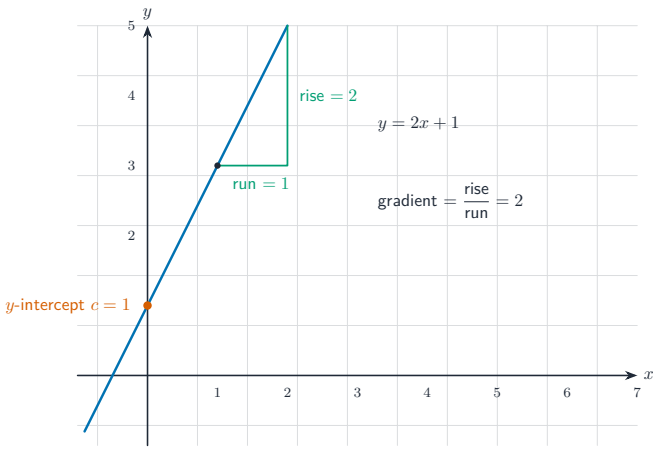
Build the skills to answer Extended exam questions on **drawing linear graphs** 画直线图象 — the equation $y = mx + c$, the **gradient** 斜率, finding the equation of a line, and **parallel and perpendicular** 平行和垂直 lines.

You must be able to:

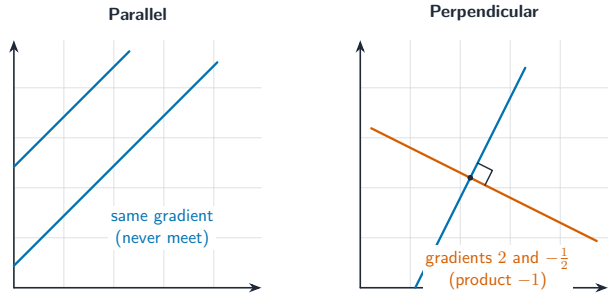
- find the gradient and y-intercept of a line
- find the equation of a line from its gradient and a point
- use the gradient rules for parallel and perpendicular lines

1 Worked examples

Straight lines



m = gradient, c = y-intercept



Gradients of parallel and perpendicular lines

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

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

2 Practice

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]

3 Exam-style questions

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]

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]

(b) Find the coordinates of the points where L crosses the two axes. [3]

(c) Find the equation of the line through B that is perpendicular to L. [3]

(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]

Solutions

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

2.1 gradient 4; y-intercept -3.

2.2 $m = \frac{10-1}{5-2} = \frac{9}{3} = 3$.

2.3 2.

3.1 $y = 2x + c$; substitute $(3, 1)$: $1 = 2(3) + c \to c = -5 \to y = 2x - 5$.

3.2 $2y = -3x + 12 \to y = -\frac{3}{2}x + 6$; gradient $-\frac{3}{2}$.

3.3 the gradient is $\frac{1}{2}$, so the perpendicular gradient is -2 (flip and change sign).

3.4 (a) gradient $= \dfrac{-5-7}{4-(-2)} = \dfrac{-12}{6} = -2$; using A: $7 = -2(-2) + c$, so $c = 3$; $y = -2x + 3$.
(b) y-axis: $x = 0$ gives $(0, 3)$. x-axis: $0 = -2x + 3$, so $x = 1.5$, giving $(1.5, 0)$.
(c) perpendicular gradient $= -\dfrac{1}{-2} = \dfrac{1}{2}$; through $B(4, -5)$: $-5 = \frac{1}{2}(4) + c$, so $c = -7$; $y = \frac{1}{2}x - 7$.
(d) midpoint $= \left(\dfrac{-2+4}{2}, \dfrac{7+(-5)}{2}\right) = (1, 1)$; the perpendicular bisector passes through $(1, 1)$ and has gradient $\frac{1}{2}$, so its equation is $y - 1 = \frac{1}{2}(x - 1)$, i.e. $y = \frac{1}{2}x + \frac{1}{2}$.