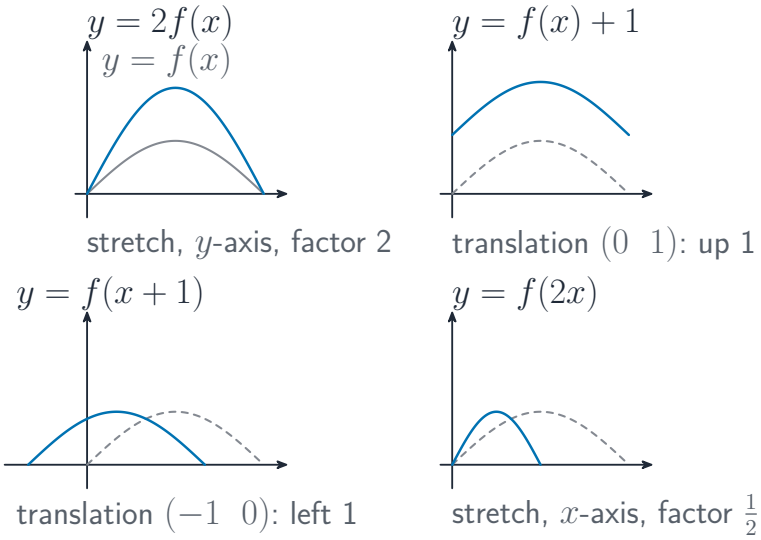
Exercise walk-through

1.3 Straight lines and coordinate geometry

Pearson Edexcel · International A-Level · Pure Mathematics

Figure: Algebra and functions (2)



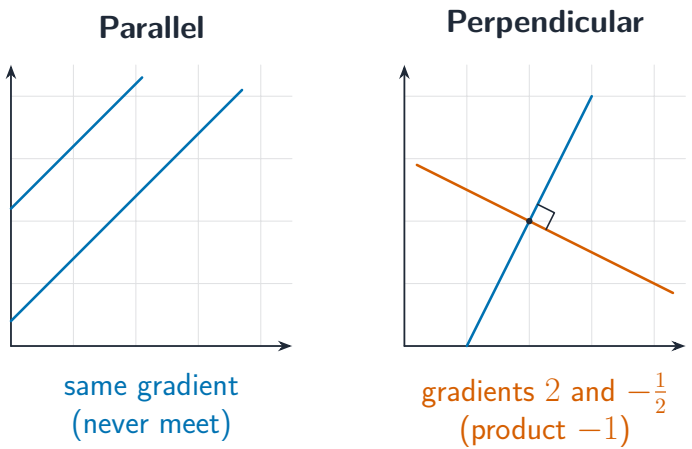
- Name the direction, the type and the scale factor (or vector).
- Read the axes and units first.

Coordinate geometry in the (x, y) plane

- **Parallel** lines have the same gradient: $m_1 = m_2$.
- **Perpendicular** lines have gradients that multiply to -1: $m_1 m_2 = -1$. (A horizontal line and a vertical line are also **perpendicular**.)
- Known: rearrange l_1: $2y = x + 25$, so $y = \frac{1}{2}x + \frac{25}{2}$ and $m_1 = \frac{1}{2}$.

$$y - 0 = -2(x - 0) \implies y = -2x$$

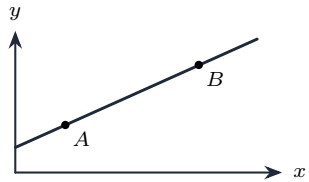
Figure: Coordinate geometry in the (x, y) plane



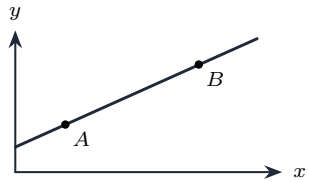
- **Parallel** lines have equal gradients; **perpendicular** lines have gradients that multiply to -1.
- Match each part of the diagram to the text.

Exercises 2.1·2.2

2.1 Find the gradient of the line through $(-2, 7)$ and $(4, -5)$. [2]

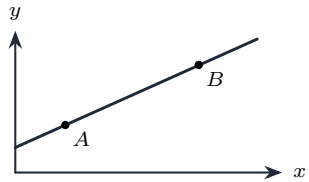


2.2 Write the equation of the line with gradient $-\frac{1}{2}$ through $(0, 4)$. [2]



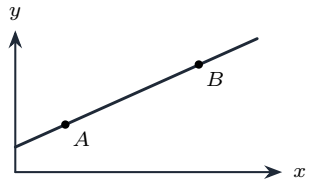
Exercises 2.1·2.2

2.1 Find the gradient of the line through $(-2, 7)$ and $(4, -5)$. [2]



2.1 $m = \dfrac{-5-7}{4-(-2)} = \dfrac{-12}{6} = -2.$

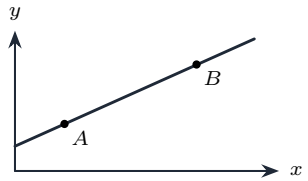
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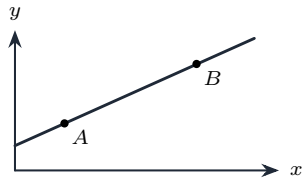
2.2 Through $(0, 4)$ (the y-intercept): $y = -\frac{1}{2}x + 4$.

Exercises 2.3·2.4

2.3 Find the equation of the line parallel to $2x - y = 6$ through $(3, 3)$. [3]

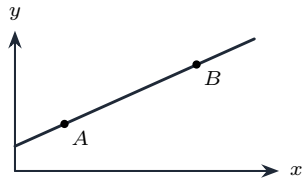


2.4 Find the equation of the line perpendicular to $y = \frac{1}{3}x + 2$ through $(6, 0)$. [3]



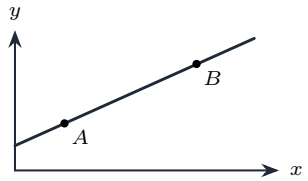
Exercises 2.3·2.4

2.3 Find the equation of the line parallel to $2x - y = 6$ through $(3, 3)$. [3]



2.3 $2x - y = 6 \implies y = 2x - 6$, so $m = 2$. Parallel keeps $m = 2$: $y - 3 = 2(x - 3) \implies y = 2x - 3$.

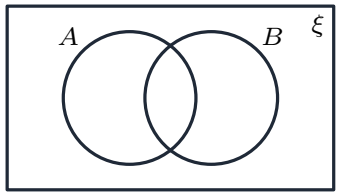
2.4 Find the equation of the line perpendicular to $y = \frac{1}{3}x + 2$ through $(6, 0)$. [3]



2.4 $m_1 = \frac{1}{3}$, so $m_2 = -3$: $y - 0 = -3(x - 6) \implies y = -3x + 18$.

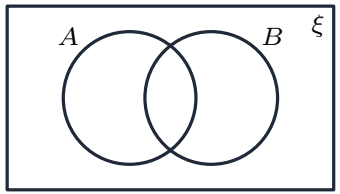
Exercise 2.5

2.5 Find the coordinates of the intersection of $y = 2x + 1$ and $y = -x + 7$. [2]



Exercise 2.5

2.5 Find the coordinates of the intersection of $y = 2x + 1$ and $y = -x + 7$. [2]



2.5 $2x + 1 = -x + 7 \implies 3x = 6 \implies x = 2$, and $y = 2(2) + 1 = 5$. The point is $(2, 5)$.

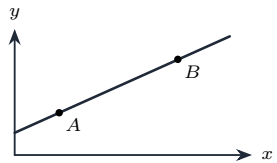
Exercise 3.1

3.1 *(Adapted from Edexcel IAL WMA11 June 2025 Q5.)* The line l_1 has equation $2x + y - 12 = 0$. The line l_2 passes through the origin and is perpendicular to l_1.

(a) Find an equation for l_2.

(b) Find the coordinates of P, the intersection of l_1 and l_2.

(c) Hence find the shortest distance from l_1 to the origin, giving your answer as an exact value. [7]



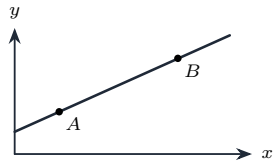
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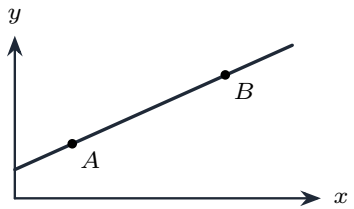
3.1 (a) Rearrange l_1: $y = -2x + 12$, so $m_1 = -2$ and $m_2 = \frac{1}{2}$. Through the origin: $y = \frac{1}{2}x$. (b) Substitute: $2x + \frac{1}{2}x - 12 = 0 \implies \frac{5}{2}x = 12 \implies x = \frac{24}{5}$, and $y = \frac{1}{2} \cdot \frac{24}{5} = \frac{12}{5}$. So $P\left(\frac{24}{5}, \frac{12}{5}\right)$. Check in l_1: $2 \cdot \frac{24}{5} + \frac{12}{5} - 12 = \frac{60}{5} - 12 = 0$ ✓. (c) The shortest distance is $|OP|$:

$$|OP| = \sqrt{\left(\tfrac{24}{5}\right)^2 + \left(\tfrac{12}{5}\right)^2} = \frac{\sqrt{576 + 144}}{5} = \frac{\sqrt{720}}{5} = \frac{12\sqrt{5}}{5}$$

using $\sqrt{720} = \sqrt{144 \times 5} = 12\sqrt{5}$.

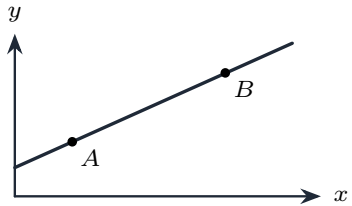
Exercise 3.2

3.2 Show that the points $A(-1, 4)$, $B(2, 1)$ and $C(4, -1)$ are collinear, and find the coordinates of the point where this line crosses the x-axis. [5]



Exercise 3.2

3.2 Show that the points $A(-1, 4)$, $B(2, 1)$ and $C(4, -1)$ are collinear, and find the coordinates of the point where this line crosses the x-axis. [5]



3.2 Gradient $AB = \dfrac{1-4}{2-(-1)} = -1$; gradient $BC = \dfrac{-1-1}{4-2} = -1$. The gradients are equal and the segments share B, so A, B, C are collinear. Line through A: $y - 4 = -1(x + 1) \implies y = -x + 3$. On the x-axis, $y = 0$: $x = 3$, so the line crosses at $(3, 0)$. Check: C fits the line: $-(4) + 3 = -1$ ✓.

Local review guidance: correct gradient method including the sign change for perpendiculars; exact coordinates; collinearity conclusion tied to the shared point. This is authored classroom guidance.