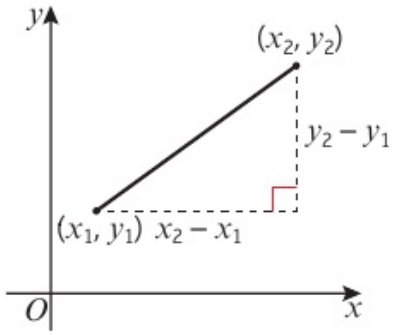
AS Pure – Chapter 5 – Straight Line Graphs

Gradients



The gradient m of the line joining the point with coordinates $(x_1\ ,\ y_1)$ to the point with coordinates $(x_2\ ,\ y_2)$ can be calculated using the formula:

$$\boldsymbol{m = \frac{y_2 - y_1}{x_2 - x_1}}$$

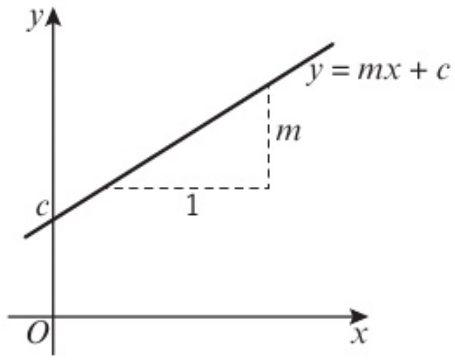
Think of this as the vertical change divided by the horizontal change.

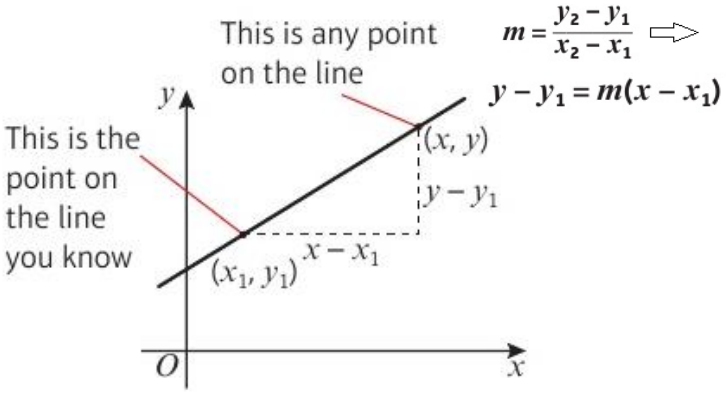
A gradient is negative if the line slopes downwards **from left to right**.

Equations of Straight Lines

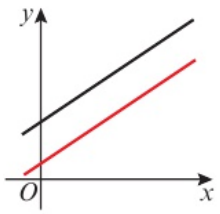
The equation of a straight can be written in three common forms:

$y = mx + c$	where m is the gradient and c is the y-intercept.
$\boldsymbol{y - y_1 = m(x - x_1)}$	where m is the gradient and $(x_1\ ,\ y_1)$ is *any* coordinate on the line.
$ax + by + c = 0$	a rearrangement of either of the above equations.



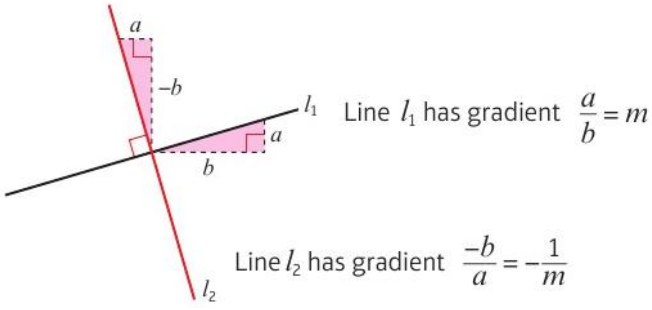


Parallel and Perpendicular Lines



Parallel lines have the **same gradient**

If a line has gradient m, a **perpendicular** line has gradient $-\frac{1}{m}$



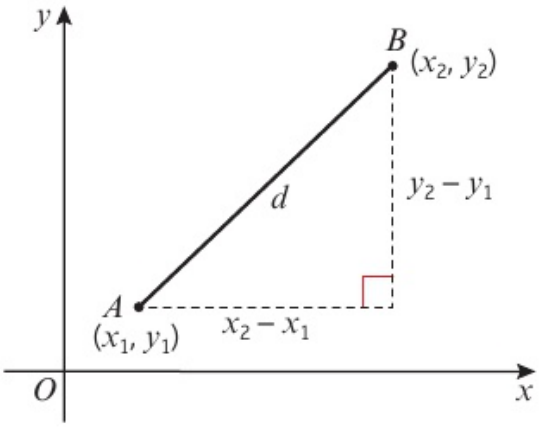
This is a **negative reciprocal**. If two lines are perpendicular, the **product of their gradients is** $\boldsymbol{-1}$

Distance between Two Points

You can find the distance between two points using the formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Don't worry about memorising this! It's just a complicated re-statement of Pythagoras' Theorem:



Just sketch the two points, work out the horizontal and vertical distances and apply Pythagoras in the usual manner.

Areas between Straight Lines

You know the area of a triangle can be calculated using $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$.

Always draw a sketch for the triangle you're working with.

Try to find horizontal and vertical lengths to represent the "base" and "height" in the above formula.

Proportion and Modelling

We can use straight line graphs to model real-life situations.

Two quantities are in **direct proportion** if they increase at the same proportional rate.

The graph of these quantities is a straight line **through the origin**.

An example of direct proportion would be a currency exchange rate.

If the graph is a straight line which *doesn't* pass through the origin, the quantities are *not* in direct proportion.

The relationship between them is still linear, and described by an equation of the form $y = ax + b$.

If the data points don't lie exactly on the line, a linear model may still be appropriate if they are close.

Here, your line would be a **line of best fit**.

Expect to be asked about any **modelling assumptions** you have made - what have you assumed to be true that you don't actually know?

You may also be asked about **limitations** of using a linear model – the fact that a linear equation gives an infinitely long line is a fairly common issue here, although the question can account for this by restricting the values of x.