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6 Straight Line Graphs

To be able to correctly predict the effect of changing one variable on the value of another, physicists write **equations**. Part of the process of writing an equation requires the physicist to draw a **graph**, which reveals how one variable relates to another. When drawing graphs, it is common practice to plot the independent variable on the **x -axis** (the **horizontal** axis), and the dependent variable on the **y -axis** (the **vertical** axis). Occasionally, it is more sensible to plot the variables on the axes the other way around. The equation for a straight line graph is:

$$y = mx + c$$

where **y is the variable plotted on the y -axis**, **x is the variable plotted on the x -axis**, **m is the gradient of the straight line** and **c is the y -intercept**.

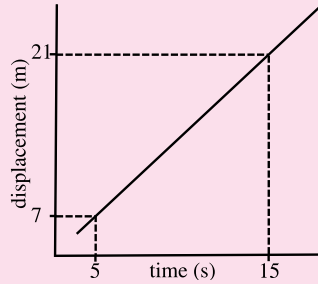
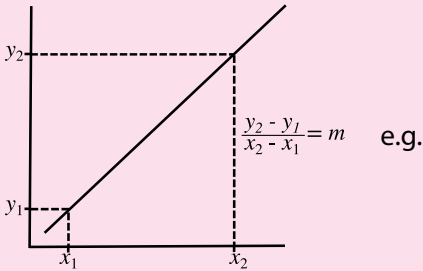
At GCSE level, the relationship between two chosen variables is often **linear**, which means a graph of one variable versus another produces a straight line graph and the above equation works. Most equations at GCSE level can be written in the form $y = mx + c$.

Example – If a student records every second how far something has travelled at constant speed, they can plot a graph distance on the y -axis and time on the x -axis. The gradient will be the speed.

6.1 A student wishes to measure the resistance, R , of a fixed resistor by varying the potential difference, V , across it and measuring the current, I , that flows through it. These quantities are related by $V = IR$. You might find it useful to re-write this relation as $I = (1/R) \times V$. The student plots V on the x axis.

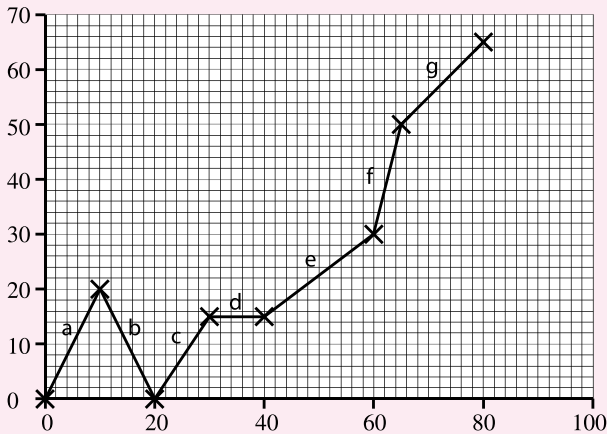
- (a) What variable should be plotted on the y -axis?
- (b) How can the resistance of the fixed resistor be determined from the graph?

The gradient of a straight line can be determined by considering two points on it:



$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(21 - 7) \text{ m}}{(15 - 5) \text{ s}} = \frac{14 \text{ m}}{10 \text{ s}} = 1.4 \text{ m/s}$$

- 6.2 For the following graph, calculate the gradient of the straight line sections labelled a, b, c, d, e, f and g.



- 6.3 Write the equation of a line which has a gradient of 2 if $y = 5$ when $x = 0$.
- 6.4 Write the equation of a line with gradient of 5, if $y = 7$ when $x = 1$.
- 6.5 Write the equation of a line with gradient of -8 , if $y = 0$ when $x = 5$.