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 $y = mx + c$.

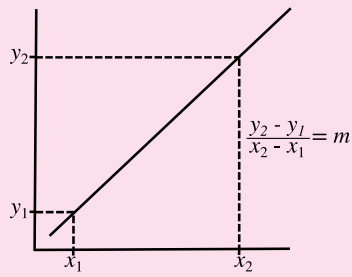
Example – If a student records every second how far something has travelled at constant speed, they can plot a graph distance on the y-axis and time on the x-axis. The gradient will be the speed.

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.

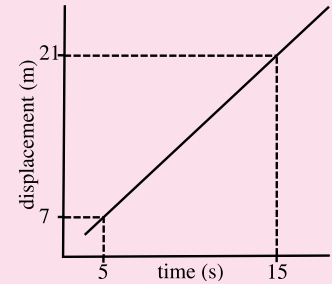
(a) What variable should be plotted on the y-axis?

(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:

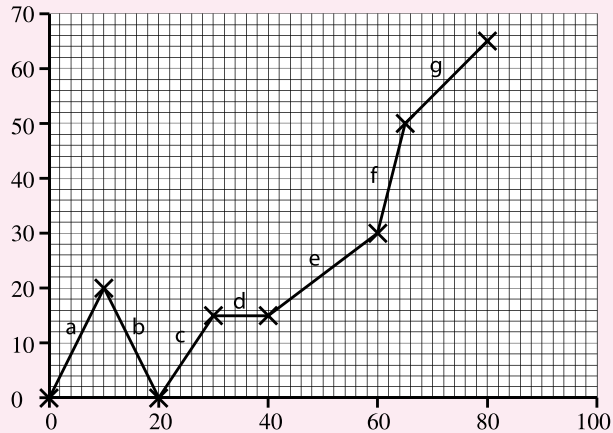


e.g.



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

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 $x = 5$.