The graph of a function

Introduction

A very useful pictorial representation of a function is the **graph**. On this leaflet we remind you of important conventions when graph plotting.

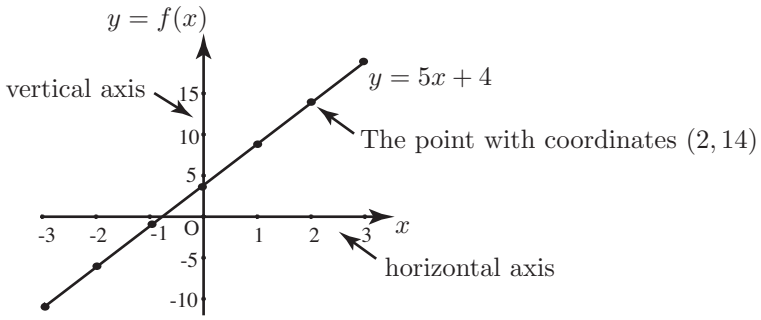
1. The graph of a function

Consider the function $f(x) = 5x + 4$.

We can choose several values for the input and calculate the corresponding outputs. We have done this for integer values of x between -3 and 3 and the results are shown in the table.

x	-3	-2	-1	0	1	2	3
$f(x)$	-11	-6	-1	4	9	14	19

To plot the graph we first draw a pair of **axes** - a vertical axis and a horizontal axis. These are drawn at right-angles to each other and intersect at the **origin** O as shown below.



Each pair of input and output values can be represented on a graph by a single point. The input values are measured along the horizontal axis and the output values along the vertical axis. A uniform scale is drawn on each axis sufficient to accommodate all the required points. The points plotted in this way are then joined together, in this case by a straight line. This is the graph of the function. Each point on the graph can be represented by a pair of **coordinates** in the form $(x, f(x))$. Each axis should be labelled to show its variable.

2. Dependent and independent variables

The horizontal axis is often called the x axis. The vertical axis is commonly referred to as the y axis. So, we often write the function above, not as $f(x) = 5x + 4$, but rather as

$$y = 5x + 4$$

Since x and y can have a number of different values they are variables. Here x is called the **independent variable** and y is called the **dependent variable**. Knowing or choosing a value of the independent variable, x, the function allows us to calculate the corresponding value of the dependent variable, y. To show this dependence we often write $y(x)$. This notation simply means that y depends upon x. Note that it is the independent variable which is the input to the function and the dependent variable which is the output.

Example

Consider the function given by $y = 2t^2 + 1$, for values of t between -2 and 2.

a) State the independent variable.

b) State the dependent variable.

c) Plot a graph of the function.

Solution

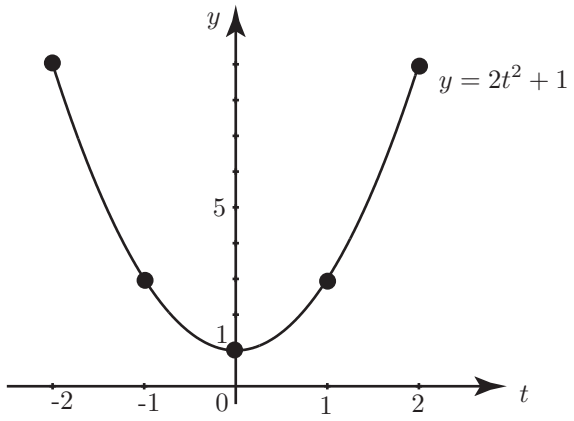
a) The independent variable is t.

b) The dependent variable is y.

c) A table of input and output values should be constructed first. Such a table is shown below.

t	-2	-1	0	1	2
y	9	3	1	3	9

Each pair of t and y values in the table is plotted as a single point. The points are then joined with a smooth curve to produce the required graph as shown below.



Exercises

1. Plot a graph of each of the following functions. In each case state the dependent and independent variables.

a) $y = f(x) = 3x + 2$, for x between -2 and 5, b) $y = f(t) = 6 - t^2$, for t between 1 and 5.

Answers

1. a) dependent variable is y, independent variable is x.

b) dependent variable is y, independent variable is t.