

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.

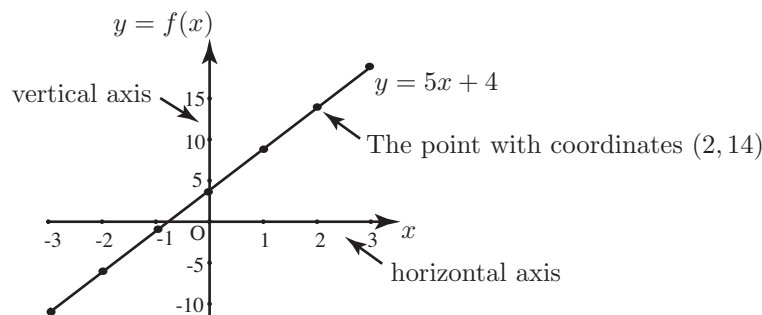
1. The graph of a function

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 .

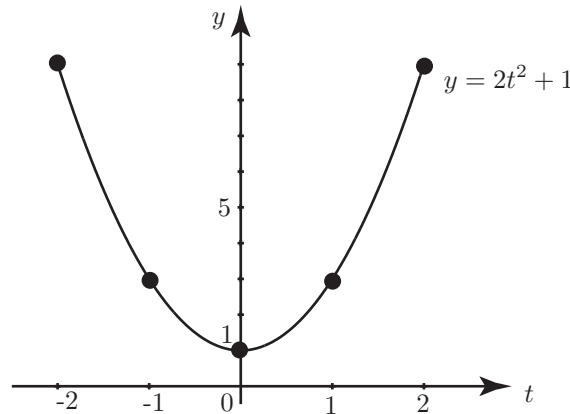
- a) State the independent variable.
- b) State the dependent variable.
- c) Plot a graph of the function.

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 .