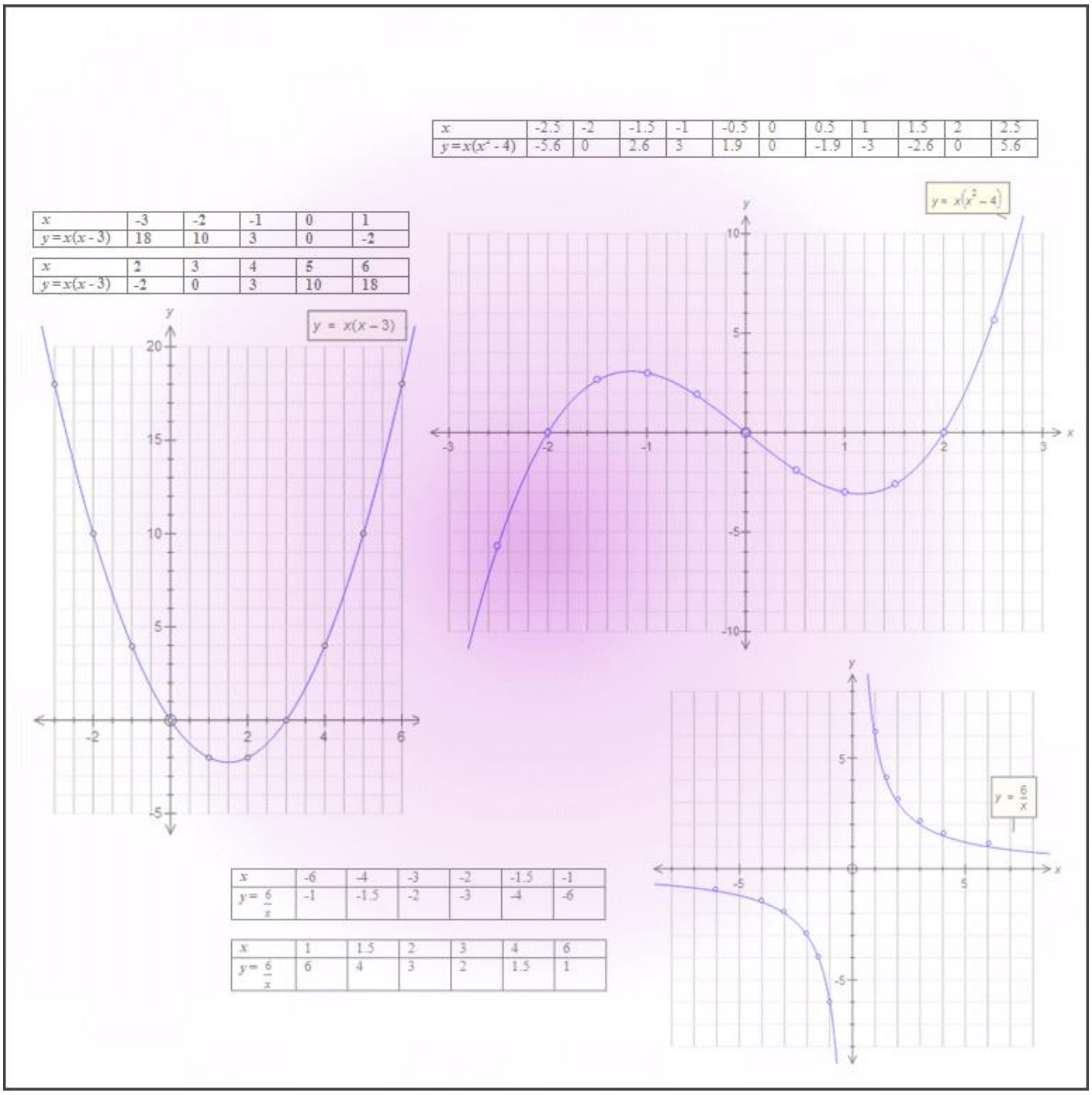
M.K. HOME TUITION

Mathematics Revision Guides
Level: GCSE Higher Tier

PLOTTING GRAPHS OF FUNCTIONS



Version: 1.2 Date: 21-04-2013

PLOTTING GRAPHS OF FUNCTIONS.

Graphs of functions of the form $y = f(x)$ can easily be plotted by computing values for the function.

Plotting graphs of linear functions (recalled).

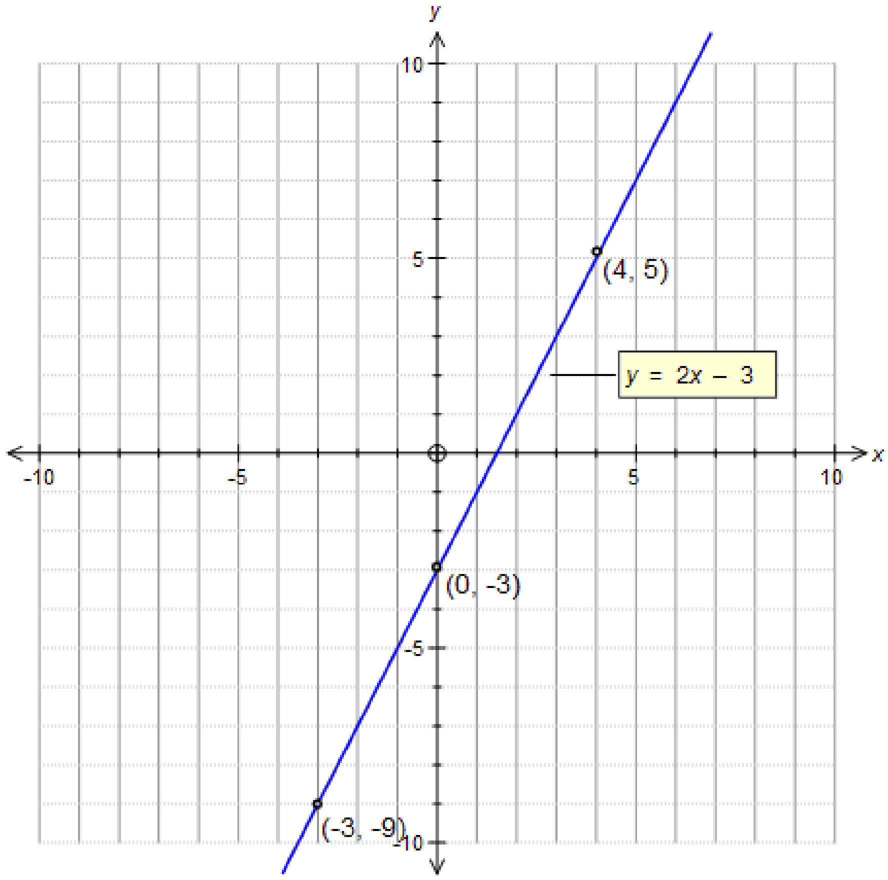
There are two main ways of plotting a graph of a linear function.
We can produce a table of three values by substituting certain values for x, as in the examples below.

Example (1): Plot the graph of $y = 2x - 3$ for values of x between –3 and 5.

We first substitute three values of x into the equation and tabulate the result:

x	-3	0	4
y	-9	-3	5

Then, we plot the three points and draw the straight line passing through them, as in the diagram below.



Although two points are sufficient to define a linear graph, it is good practice to plot three, because it would show up any errors in calculating the values of y.

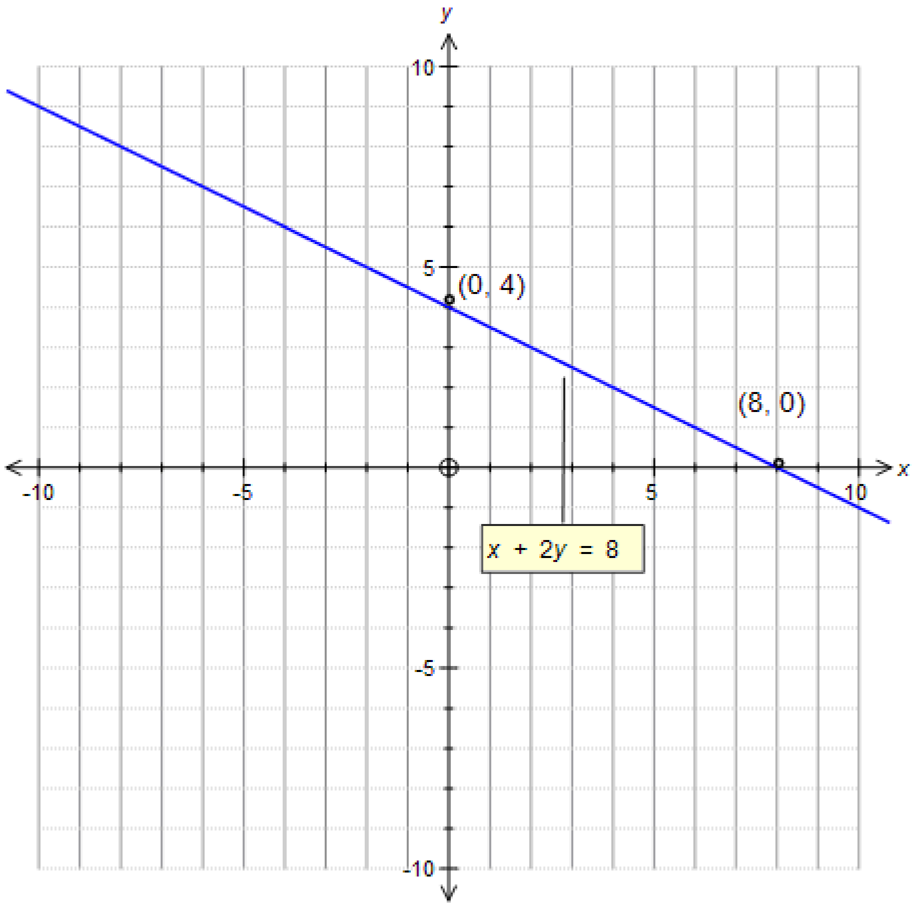
If the three points are not on a straight line, then it is time to check the calculated values of y !

Sometimes the equation might be given in a different form, such as the next example:

Example (2): Plot the graph of $x + 2y = 8$ for values of x between –5 and 15.

Here the easier method of plotting the graph is to substitute $x = 0$ and $y = 0$ into the equation.
When $x = 0$, $2y = 8$, and $y = 4$, so we plot the point (0, 4) – the y-intercept.
When $y = 0$, $x = 8$ and therefore we plot the point (8, 0) – the x-intercept.

Joining the two points gives the graph below.



Non-linear functions.
This group includes quadratics, reciprocals, cubics and trigonometric functions. To plot graphs of such functions, it is necessary to set up tables of values of y against x ,and then connect the points with a **smooth** curve.

Example (3). Plot the graph of $y = x(x - 3)$ for x from -3 to 3, in steps of 1 unit.

x	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**
$(x - 3)$	-6	-5	-4	-3	-2	-1	0	1	2	3
$y = x(x - 3)$	**18**	**10**	**3**	**0**	**-2**	**-2**	**0**	**3**	**10**	**18**

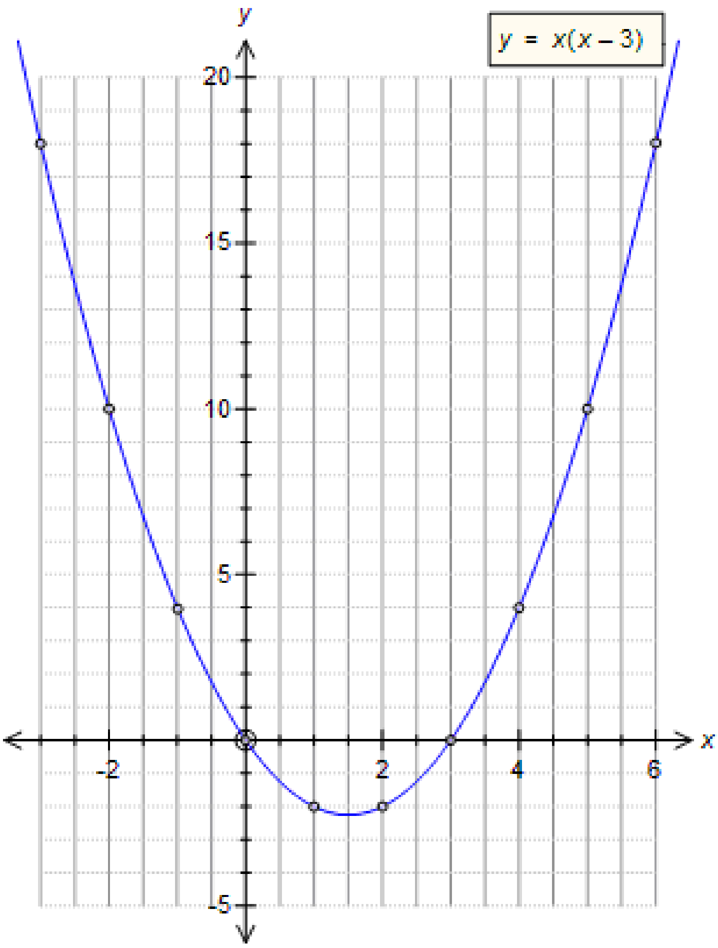
This is a quadratic graph, and so will have a ‘bucket’ shape.

We therefore plot the points (-3, 18), (-2, 10), (-1, 3), (0, 0), (1, -2) and so forth, finally drawing a smooth curve through them all.

Any computing errors will betray themselves by points being off the path of the expected curve.

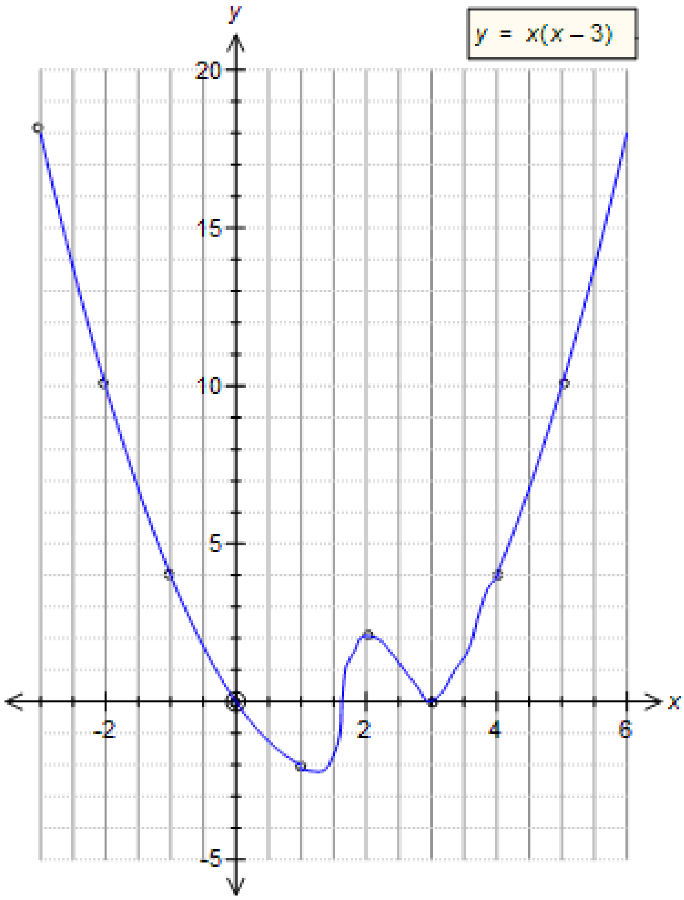
Notice how the points (1, -2) and (2, -2) are still connected by a curve, and not a straight line segment !

A way of avoiding such an error would be to plot an extra point at (1.5, -2.25).



Another horror would be an attempt to plot a curve through an obviously incorrect point.

Here, the point (2, -2) has been incorrectly plotted as (2, 2), giving a graph with more twists and bends than is should have.

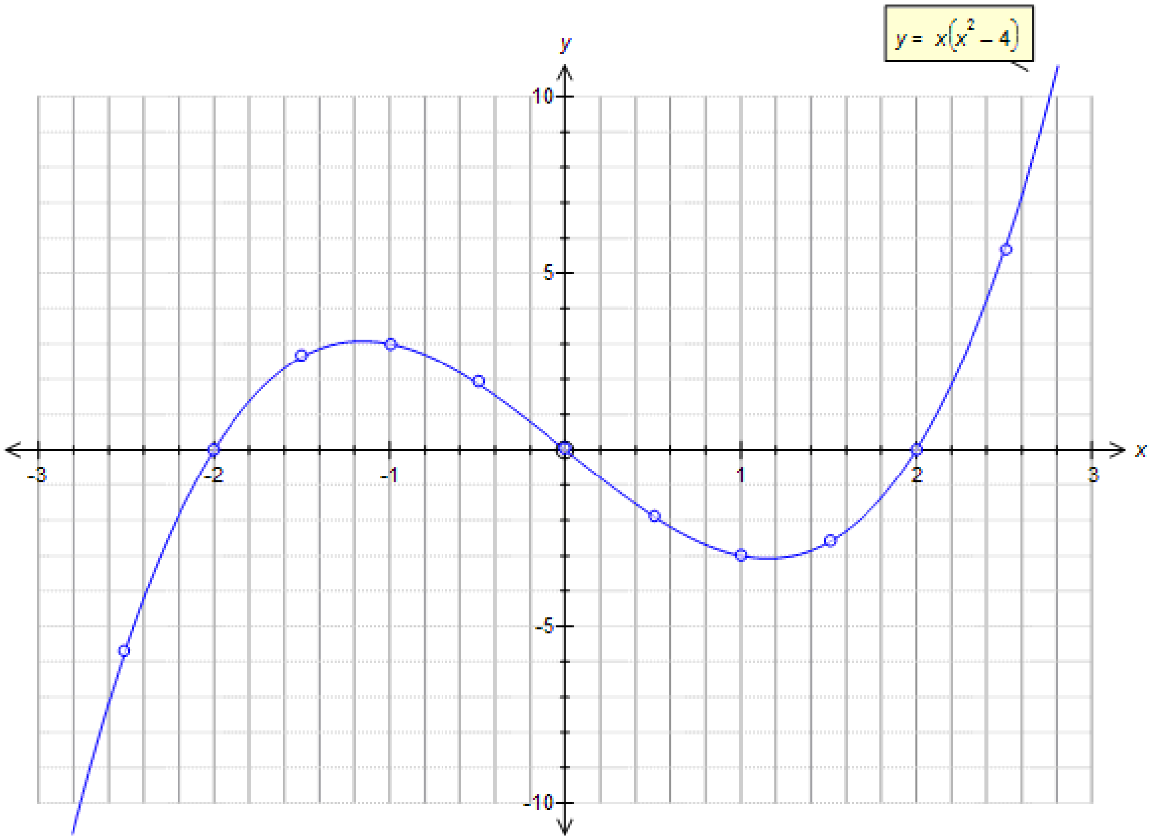


Example (4). Plot the graph of $y = x(x^2 - 4)$ for x from -2.5 to 2.5 in steps of 0.5, using a calculator.

Round your results to 1 decimal place.

x	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5
$y = x(x^2 - 4)$	-5.6	0	2.6	3	1.9	0	-1.9	-3	-2.6	0	5.6

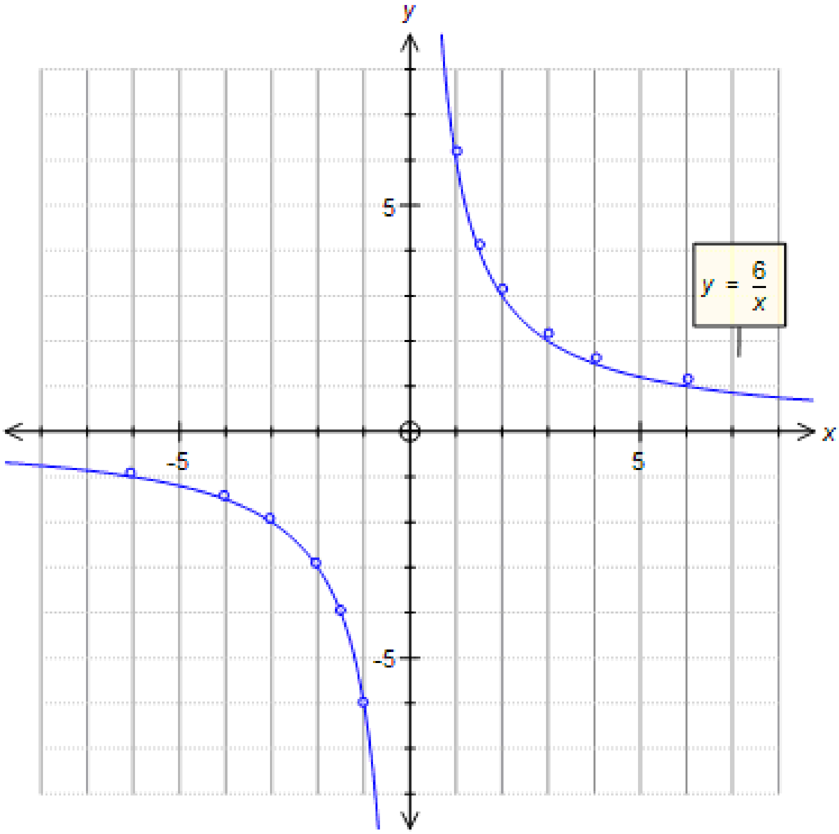
(Intermediate calculations not shown)



The resulting graph is a cubic, and has the characteristic 'double bend' shape.

Example 4. Plot the graph of $y = \frac{6}{x}$ for $x = \pm\{1, 1.5, 2, 3, 4, 6\}$

x	-6	-4	-3	-2	-1.5	-1	1	1.5	2	3	4	6
$y = \frac{6}{x}$	-1	-1.5	-2	-3	-4	-6	6	4	3	2	1.5	1



The graph is a reciprocal graph, consisting of two separate and unconnected parts.

In fact, the function $y = \frac{6}{x}$ is undefined when $x = 0$.