Coordinates and linear graphs

How to plot vertical lines and recognise their equations.
How to plot horizontal lines and recognise their equations.
How to use the equation of a line to produce coordinates.
How to draw the graph of a sloping line, given a rule or equation.

Check that you can:

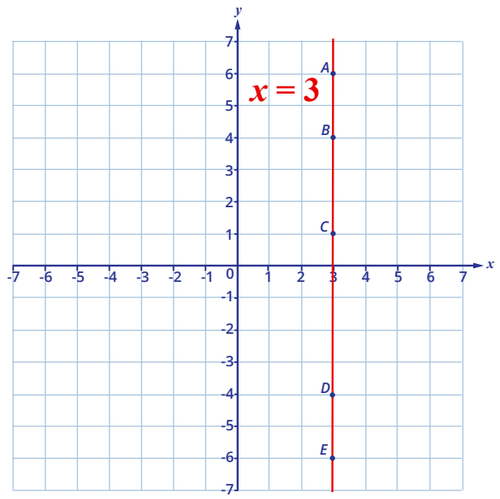
- write the coordinates of a point plotted on a graph
- plot the coordinates of a point on a graph
- substitute values into an equation to find a solution.

Graphs of vertical lines

If we plot the following pairs of coordinates using one set of axes;
A (3, 6)
B (3, 4)
C (3, 1)
D (3, −4)
E (3, −6)
they all lie on the same vertical straight line on the graph.

The x-coordinate is 3 for every point on the line.

$x = 3$ is known as the **equation of the line**.
The equation is written on the line as a label.
Notice that the line with equation 'x = number' is **vertical** (but the x-axis is **horizontal**).

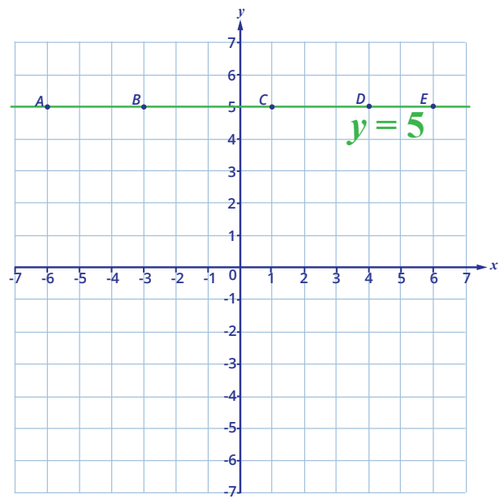


Graphs of horizontal lines

If we plot the following pairs of coordinates using one set of axes;
A (−6, 5)
B (−3, 5)
C (1, 5)
D (4, 5)
E (6, 5)
they all lie on the same horizontal straight line on the graph.

The y-coordinate is 5 for every point on the line.

$y = 5$ is known as the **equation of the line.**
The equation is written on the line as a label.
Notice that the line with equation 'y = number' is **horizontal** (but the y-axis is **vertical**).



Remember!

When plotting the equation of a line, always check that the line is straight! If it is not, there may be an error in finding the coordinates or in plotting the points.

Graphs of sloping lines

We can complete the following table to find the value of y for the equation $y = 2x + 1$:

x	0	1	2	3
$y = 2x + 1$	**1**	**3**	**5**	**7**

To find each missing value of y, substitute the corresponding value of x into the equation $y = 2x + 1$:
In algebra, remember that $2x$ is the same as $2 \times x$.
E.g. when $x = 0$, $y = 2 \times 0 + 1 = 0 + 1 = 1$.

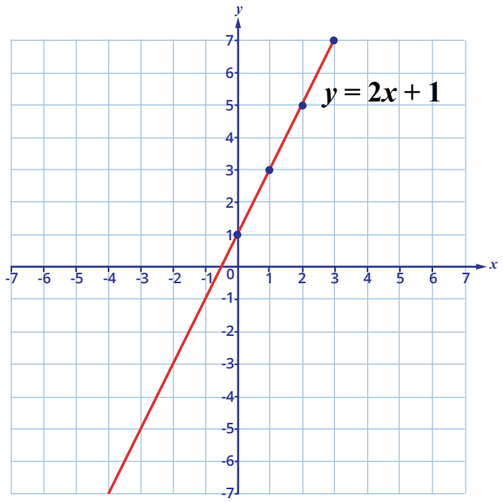
We can now plot the coordinates of the four points we have found:
(0, 1) (1, 3) (2, 5) (3, 7).

The points are joined to draw the graph of the line with equation $y = 2x + 1$.

Always check that the line is straight! If it is not, there may be an error in finding the coordinates or in plotting the points.

Notice how the line has been extended beyond the points given in the table. (The table could have included different x-values, but the line would have been the same).

Lines with equations which include both x and y are neither vertical nor horizontal. They are sloping lines.

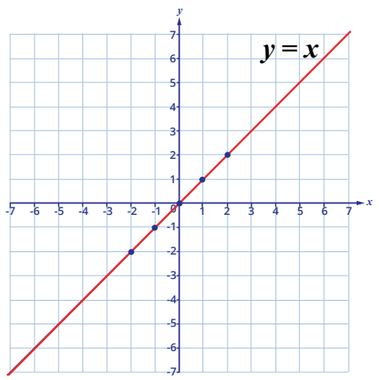


Two very important lines

It is very useful to be familiar with the lines with equations $y = x$ and $y = -x$.

For the equation $y = x$, the x- and y-coordinates are equal for every point.

(−2, −2) (−1, −1) (0, 0) (1, 1) (2, 2)



For the equation $y = -x$, the x value is multiplied by −1. The x and y-coordinates always have opposite signs.

(−2, 2) (−1, 1) (0, 0) (1, −1) (2, −2)