STRAIGHT LINE GRAPHS

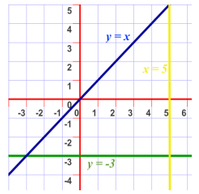
The general equation for a straight line graph is

$$y = mx + c$$

m: the gradient of the line; c: where the line intercepts the y-axis

Check that you can:

- plot coordinates in the 4 quadrants
- recognise simple straight line graphs such as $x = 5$, $y = -3$ and $y = x$
- substitute values into an equation.



Drawing straight line graphs

Examples Draw the following graphs a) $y = x - 2$ b) $y = 2x + 1$

1)Draw a table of values and choose three values for x

x	0	1	2
z			

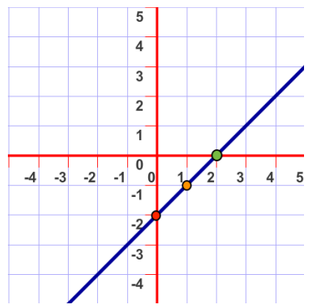
2)Substitute these x values into $y = x - 2$ to find the y values.

If $x = 0$ then $y = 0 - 2 = -2$
If $x = 1$ then $y = 1 - 2 = -1$
If $x = 2$ then $y = 2 - 2 = 0$

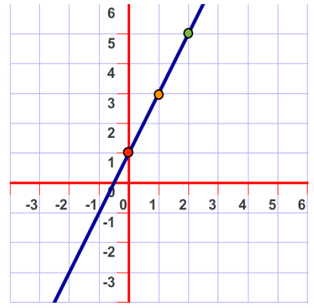
x	0	1	2
z	-2	-1	0

3)Plot the points *(0, -2)* *(1, -1)* and *(2, 0)* and connect them with a straight

$y = x - 2$



$y = 2x + 1$



1)Draw a table of values and choose three values for x

x	0	1	2
z			

2)Substitute these x values into $y = 2x + 1$ to find the y values.

If $x = 0$ then $y = 2 \times 0 + 1 = 1$
If $x = 1$ then $y = 2 \times 1 + 1 = 3$
If $x = 2$ then $y = 2 \times 2 + 1 = 5$

x	0	1	2
z	1	3	5

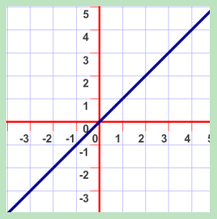
3) Plot the points *(0, 1)* *(1, 3)* and **(2, 5)** and connect them with a straight line.

Remember **the name of the line (the equation) tells us the relationship between the x coordinate and the y coordinate i.e. what needs to be done to x in order to get y.**

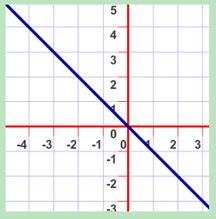
The gradient (m)

This tells us how steep the line is.

If the line goes up from left to right then the gradient is positive



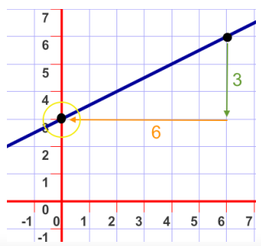
If the line goes down from left to right then the gradient is negative



If the m in $y = mx + c$ is the gradient then the gradient of the line $y = 3x - 4$ is 3 and the gradient of the line $y = -2x + 3$ is -2.

Finding the equation of the line

1) Find the gradient $m = \frac{\text{differemce in } y}{\text{difference in } x} = \frac{3}{6} = \frac{1}{2}$
2) Find where the line intercepts the y-axis (i.e. when x=0) $c = 3$
3) Substitute the value of m and c into $y = mx + c$ $y = \frac{1}{2}x + 3$



Determining if a point lies on a line

We do this by substituting the x and y coordinates into the equation of the line.

E.g. 1) Determine if the point (*2, 7*) lies on the line $y = 3x + 1$.
Substitute $x = 2$ into $y = 3x + 1$.
$y = 3 \times 2 + 1$
$y = 6 + 1$
$y = 7$ ✓ (*2, 7*) does lie on the line $y = 3x + 1$.

E.g. 2) Determine if the point (*2,-5*) lies on the line $y = 2x - 7$.
Substitute $x = 2$ into $y = 2x - 7$.
$y = 2 \times 2 - 7$
$y = 4 - 7$
$y \neq -3$ ✗
(2, -5) does not lie on the line $y = 2x - 7$.

Finding the gradient

Gradient = $\frac{\text{differemce in } y}{\text{difference in } x}$

$\text{Gradient} = \frac{\text{differemce in } y}{\text{difference in } x} = \frac{4}{2} = 2$

$\text{Gradient} = \frac{\text{differemce in } y}{\text{difference in } x} = \frac{4}{8} = \frac{1}{2}$

$\text{Gradient} = \frac{\text{differemce in } y}{\text{difference in } x} = \frac{-4}{2} = -2$

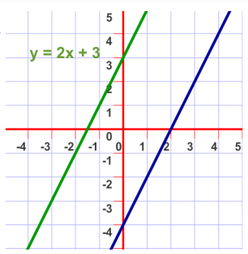
1)Choose two points on the line and form a right-angled triangle.
2) Use their coordinates to find the difference in y (height of triangle) and the difference in x (base of triangle).
3) Use $\text{Gradient} = \frac{\text{differemce in } y}{\text{difference in } x}$

Remember you don't always need to see the graph to find the gradient, m can be found if the coordinates of any two points on the line are known.

Parallel lines

Parallel lines have the same gradient.
$y = 3x + 5$ and $y = 3x - 9$ are parallel as m=3 in both equations.

We can find the equation of a line if we know the equation of a line that is parallel to that line.
Example Find the equation of the blue line.



1)Find the gradient m, of the parallel line from its equation. If $y = 2x + 3$ then $m = 2$
2)Find where the blue line intercepts the y-axis i.e. when $x = 0$ to give $c = -4$
3)Substitute the value of m and c into $y = mx + c$ to give

$$y = 2x - 4$$

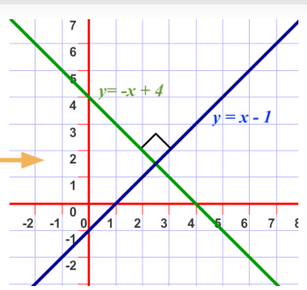
Perpendicular lines

Perpendicular lines cross at right-angles (90º).
When you multiply the gradients of two perpendicular lines the result is always -1.

$m_1 \times m_2 = -1$

$y = x - 1$ and $y = -x + 4$ are perpendicular as
$m_1 = 1$ and $m_2 = -1$ and $1 \times -1 = -1$.

$y = 2x + 3$ and $y = 5 - \frac{x}{2}$ are perpendicular as
$m_1 = 2$ and $m_2 = -\frac{1}{2}$ and $2 \times -\frac{1}{2} = -1$.



Remember **in order to determine if two lines are parallel or perpendicular to one another, make sure the equations of both lines are in the form $y = mx + c$. If they are not in this form then the equations will need to be rearranged.**