Y10 Maths Knowledge Organiser Higher Tier: Linear graphs

What must I be able to do?

New content:

- ☐ Solve simultaneous linear equations using a graphical method
  - ➢ Sparx U836
- ☐ Draw and interpret parallel lines
  - ➢ Sparx U898
- ☐ Draw and interpret perpendicular lines
  - ➢ Sparx U898

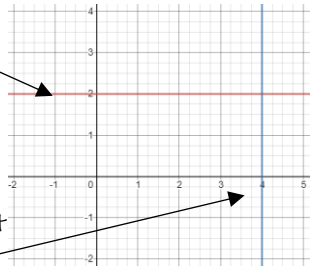
Key vocabulary

Simultaneous equations	Two equations which have two unknowns. A single solution is true for both equations.
Linear graph	A linear equation with 2 variables, usually x and y. When plotted it will form a straight line.
Gradient	The steepness of a graph.
Intercept	The point at which a graph crosses the y-axis.

Horizontal and vertical lines

Horizontal: y = constant

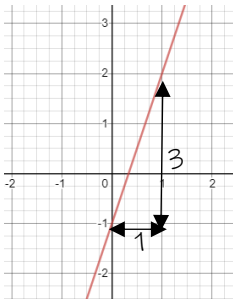
e.g. y=2



Vertical: x = constant

e.g. x=4

Finding the equation of a graph



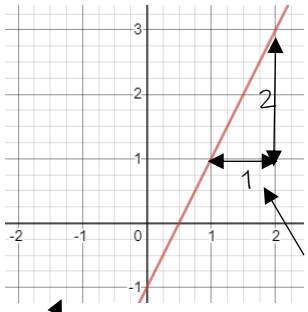
The general form of the equation of a straight line graph is y = mx + c where m is the gradient and c is the y-intercept.

Gradient is 3 ÷ 1 = 3 so m = 3

It crosses at (0, -1) so c = -1

So the equation is y = 3x - 1

Calculating the gradient



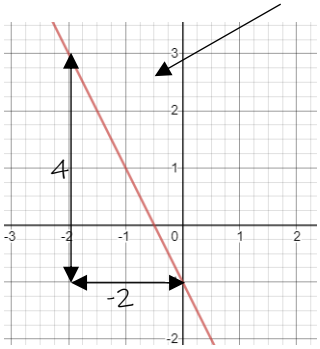
Draw a right angled triangle between 2 points.

The gradient equals: change in y / change in x

e.g. 2 ÷ 1 = 2

The gradient is 2

This graph slopes up from left to right so the gradient is positive. If it sloped up from right to left the gradient would be negative.



e.g. 4 ÷ -2 = -2

The gradient is -2

Plotting graphs

From a table – substitute each x value into the equation to generate each coordinate to plot. e.g. y =2x + 1

When x = 0, y = 2 x 0 + 1 = 1

When x = 2, y = 2 x 2 + 1 = 5

x	0	1	2	3
y	1	3	5	7

When x = 1, y = 2 x 1 + 1 = 3

When x = 3, y = 2 x 3 + 1 = 7

Coordinates to plot at (0, 1), (1, 3), (2, 5) and (3, 7). Join with a straight line.

Gradient/intercept – first ensure the equation of the line is in the form y = mx + c. e.g. y = 4x + 2. We know m = 4 and c = 2.

Plot the intercept at (0, 2). As the gradient is 4, it will travel 4 units upwards for each unit to the right. So 4 units up and 1 to the right of (0, 2) is (1, 6). The next is (2, 10). Plot and join up with a straight line.

Not the intercept as not in the form y = mx + c

Cover up – similar to table but used when in the form ax + by = c.

e.g. 3x + 2y = 6.

Put x = 0. So 2y = 6 Therefore y = 3

Put y = 0. So 3x = 6. Therefore x = 2

x	0	2
y	3	0

Gives the coordinates (0, 3) and (2, 0)

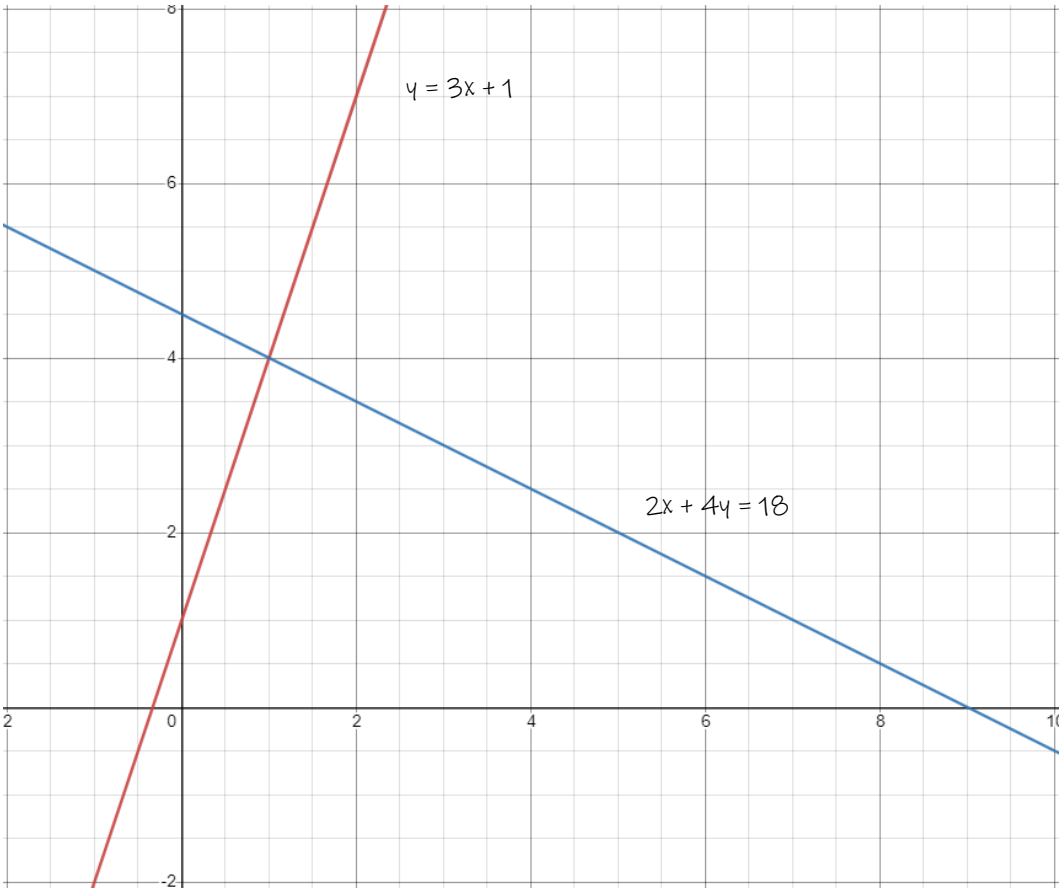
Simultaneous equations

By the end of the GCSE course you will also be able to solve simultaneous equations using an algebraic method but this particular method focuses on using graphs to solve them.

e.g. $y = 3x + 1$

$2x + 4y = 18$

We need to plot both graphs onto the same axis using the usual methods.



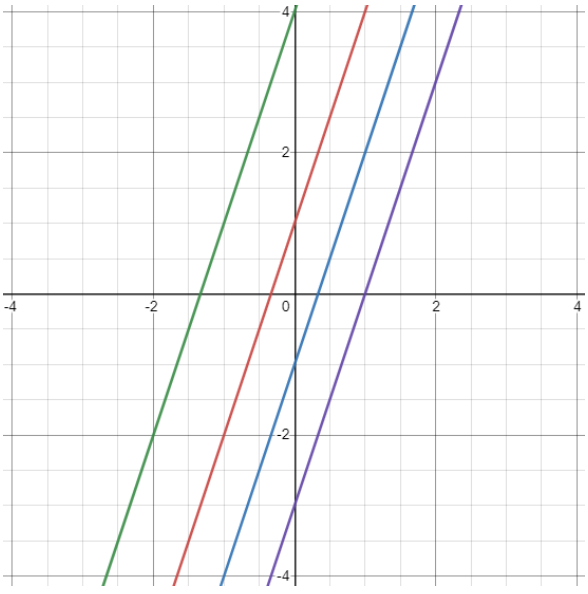
The single point where the two graphs cross is the solution to the simultaneous equations

$x = 1$

$y = 4$

Parallel lines

2 or more linear graphs which are parallel will have the same gradient.



These 4 graphs all have a gradient of 3 and are the graphs

$y = 3x + 4$

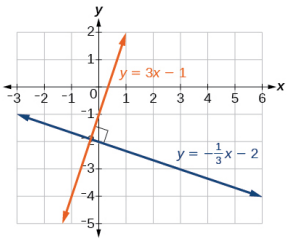
$y = 3x + 1$

$y = 3x - 1$

$y = 3x - 3$

Any other graph with a gradient of 3 will also be parallel to these

Perpendicular lines



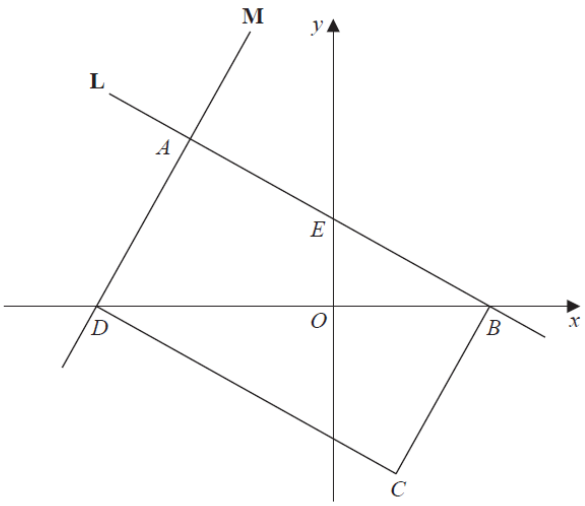
If two graphs are perpendicular then they meet at right angles to each other (90°).

Their gradients have the relationship: gradient of line 1 × gradient of line 2 = - 1

e.g. $y = 3x - 1$ and $y = -\frac{1}{3}x - 2$ are perpendicular to each other because $3 \times -\frac{1}{3} = -1$

Problem solving with linear graphs

As well as being able to draw and use linear graphs, you may need to problem solve using facts about the graphs.



ABCD is a rectangle.

A, *E* and *B* are points on the straight line **L** with equation $x + 2y = 12$
A and *D* are points on the straight line **M**.

$AE = EB$

Find an equation for **M**.

E is the point on $x + 2y = 12$ where $x = 0$. So E is the coordinate (0, 6).

B is the point on $x + 2y = 12$ where $y = 0$. So B is the coordinate (12, 0).

As AE = EB, E is the midpoint of AB. If from E to B we see a change in x values from 0 to 12 (+12), and a change in y values from 6 to 0 (-6), the change from E to A must be the opposite. Therefore the coordinate of A is (-12, 12).

As the shape is a rectangle, the sides are perpendicular and so we know a fact about the gradients.

Rearranging the equation of line L to find the gradient:

$x + 2y = 12$

$2y = -x + 12$

$y = -\frac{1}{2}x + 6$ Therefore the gradient of the line L is $-\frac{1}{2}$. To find the gradient of the line M we need to solve $-\frac{1}{2} \times m = -1$

Therefore the gradient of line M is 4 as $-\frac{1}{2} \times 4 = -1$.

The equation of line M is $y = mx + c$, but $m = 4$ and we know it passes through the point (-12, 12)

$12 = 4 \times -12 + c$

$c = 60$

Therefore an equation for the line M is $y = 4x + 60$

GLUE

HERE