Neatness
Always use a sharp pencil and ruler Axes written in pen
Plot your points and remember to draw the line!

GCSE HIGHER YEAR 9 SUMMER TERM UNIT 6 GRAPHS: LINEAR, REAL LIFE, QUADRATIC,CUBIC, CIRCLE

Linear Graph

Straight line graph.

The general equation of a linear graph is

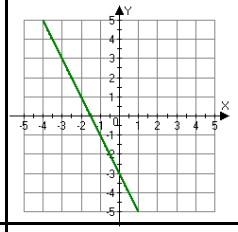
$$y = mx + c$$

where m **is the gradient** and c **is the y-intercept**.

The **equation** of a linear graph can contain an **x-term**, a **y-term** and a **number**.

Example:

Other examples:



$x = y$

$y = 4$

$x = -2$

$y = 2x - 7$

$y + x = 10$

$2y - 4x = 12$

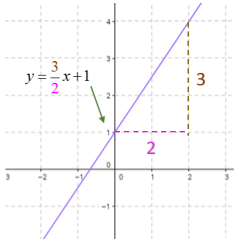
Plotting Linear Graphs

Method 1: **Table of Values**
Construct a table of values to calculate coordinates.

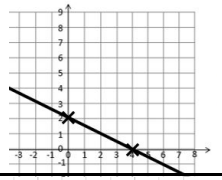
Method 2: **Gradient-Intercept Method** (use equation in the form $y = mx + c$)
1. Plots the y-intercept
2. Using the gradient, plot a second point.
3. Draw a line through the two points plotted.

Method 3: **Cover-Up Method** (use equation is in the form $ax + by = c$)
1. Cover the $x$term and solve the resulting equation. Plot this on the $x - axis$.
2. Cover the $y$term and solve the resulting equation. Plot this on the $y - axis$.
3. Draw a line through the two points plotted.

x	-3	-2	-1	0	1	2	3
y= x +3	0	1	2	3	4	5	6



$2x + 4y = 8$

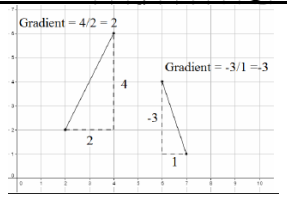


Gradient

The gradient of a line is how **steep** it is.

Gradient = $\frac{Change\ in\ y}{Change\ in\ x} = \frac{Rise}{Run}$

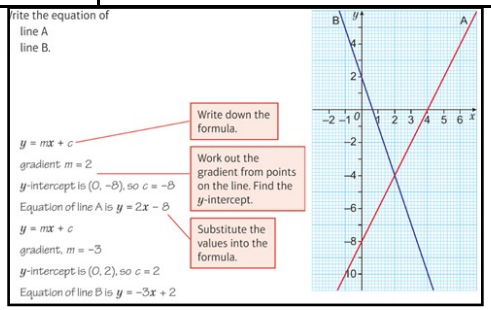
The gradient can be positive (sloping upwards) or negative (sloping downwards)



VOCABULARY

Plot, straight line, linear,

gradient, intercept, reciprocal



Finding the **Equation of a Line <u>given a point and a gradient</u>**	**Substitute** in the **gradient (m)** and **point (x,y)** in to the equation and **solve for c**. $y = mx + c$	Find the equation of the line with gradient **4** passing through **(2,7).** $y = mx + c$ $7 = 4 \times 2 + c$ $c = -1$ $y = 4x - 1$
Finding the **Equation of a Line <u>given two points</u>**	Use the two points to **calculate the gradient**. Then **repeat the method above** using the gradient and either of the points.	Find the equation of the line passing through (6,11) and (2,3) $m = \frac{11-3}{6-2} = 2$ $y = mx + c$ $11 = 2 \times 6 + c$ $c = -1$ $y = 2x - 1$

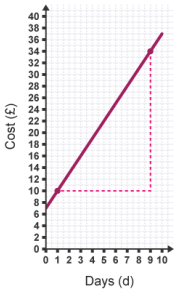
Parallel Lines	If two lines are **parallel**, they will have the **same gradient**. The value of m will be the same for both lines.	Are the lines $y = 3x - 1$ and $2y - 6x + 10 = 0$ parallel? Answer: Rearrange the second equation in to the form $y = mx + c$ $2y - 6x + 10 = 0 \rightarrow y = 3x - 5$ Since the two gradients are equal **(3),** the lines are parallel.
Perpendicular Lines	If two lines are **perpendicular**, the **product** of their **gradients** will always equal **-1**. The gradient of one line will be the **negative reciprocal** of the gradient of the other line. You may need to rearrange equations of lines to compare gradients (they need to be in the form $y = mx + c$)	Find the equation of the line perpendicular to $y = 3x + 2$ which passes through (6,5) Answer: As they are perpendicular, the gradient of the new line will be $-\frac{1}{3}$ as this is the negative reciprocal of 3. $y = mx + c$ $5 = -\frac{1}{3} \times 6 + c$ $c = 7$ $y = -\frac{1}{3}x + 7$ OR $3x + x - 7 = 0$

Real Life Graphs

Graphs that are supposed to model some real-life situation.

The actual meaning of the values depends on the labels and units on each axis.

The **gradient** might have a contextual meaning.
The **y-intercept** might have a contextual meaning.
The **area** under the graph might have a contextual meaning.



A graph showing the cost of hiring a ladder for various numbers of days.

The gradient shows the cost per day. It costs £3/day to hire the ladder.

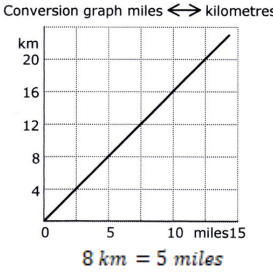
The y-intercept shows the additional cost/deposit/fixed charge (something not linked to how long the ladder is hired for). The additional cost is £7.

Conversion Graph

A line graph to **convert one unit to another**.

Can be used to convert units eg. (miles and kilometres) or currencies ($ and £)

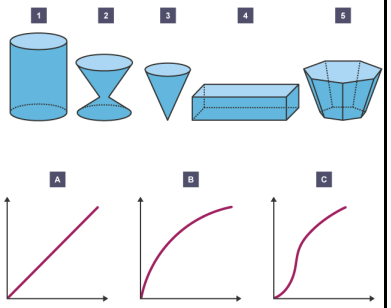
Find the value you know on one axis, read up/ across to the conversion line and read the equivalent value from the other axis.



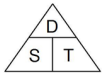
There are no lines on the picture. You must remember to draw yours from each scale to the graph line.

Depth of Water in Containers

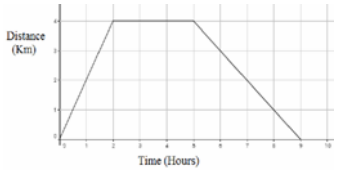
Graphs can be used to show how the depth of water changes as different shaped containers are filled with water at a constant rate.



Distance-Time Graphs



You can find the **speed** from the **gradient** of the line **(Distance ÷ Time)**
The steeper the line, the quicker the speed.
A **horizontal** line means the object is not moving (**stationary**).



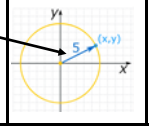
VOCABULARY

gradient, intercept, convert, equation, value, substitute, quadratic, curve, minimum, maximum, turning point, parabola, asymtotes,

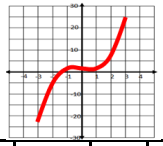
Equation of a Circle

The equation of a **circle**, **centre (0,0), radius r**, is:

$$x^2 + y^2 = r^2$$



Sketch the graph of $y = x^3 - x + 1$,

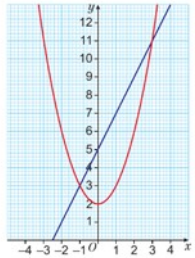


x	-3	-2	-1	0	1	2	3
y	-23	-5	1	1	1	7	25

When drawing graphs always draw a table and then substitute values for X to find the Y value

Challenge

The graphs of $y = x^2 + 2$ and $y = 2x + 5$ are plotted on the grid.



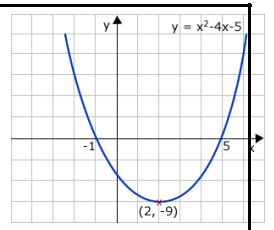
Give the coordinates of the two points of intersection of these graphs.

Ans: (-1,3) and (3,11)

Quadratic Graph

A '**U-shaped**' curve called a **parabola**.
The equation is of the form $y = ax^2 + bx + c$ where a, b and c are numbers, $a \neq 0$

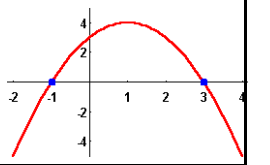
If, $a < 0$ the parabola is **upside down**.



Roots of a Quadratic

A root is a **solution**.

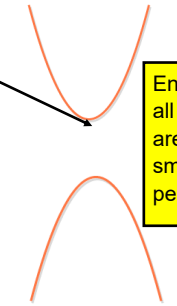
The roots of a quadratic are the **x-intercepts of the quadratic graph**.



Turning Point of a Quadratic

A turning point is the **point where a quadratic turns**.

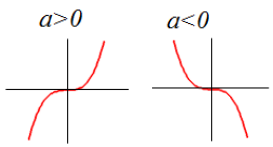
On a **positive parabola**, the turning point is called a **minimum**.
On a **negative parabola**, the turning point is called a **maximum**.



Ensure that all curves are drawn smoothly in pencil.

Cubic Graph

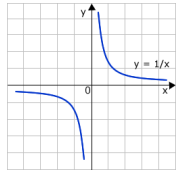
The equation is of the form $y = ax^3 + k$ where k **is an number**.
If $a > 0$ the curve is **increasing**.
If $a < 0$ the curve is **decreasing**.



Reciprocal Graph

The equation is of the form $y = \frac{A}{x}$

where A **is a number** and $x \neq 0$
The graph has **asymptotes** on the **x-axis and y-axis**.



Sketch the graph of $y = x^2 + 4$, $-3 \leq x \leq 3$

x	-3	-2	-1	0	1	2	3
y	13	8	5	4	5	8	13