

Maths Knowledge Organiser

Year 9 Algebra part 1



Simplify by collecting like terms

Like terms are terms who's variable (letter) are the same

These are like terms $\rightarrow e \quad 5e \quad -3e \quad \frac{2}{3}e$

These are **not** like terms $\rightarrow 6t \quad t^2 \quad 5ty \quad 8y$

To simply identify and collect

$$4a + 7b - a - 3b \equiv 3a + 4b$$

$$5a^2 - 3a - 4 + a \equiv 5a^2 - 2a - 4$$

Factorising - single bracket

This is the process to putting brackets into expressions, find the highest common factors first

HCF of $6x$ and 10 is 2

HCF of $12x$ and $4xy$ is $4x$

HCF of $10t^2$ and $15tr$ is $5t$

Place the HCF on the outside and divide to calculate inside

$$10t^2 + 15t = 5t(2t + 3)$$

$$12x + 4xy = 4x(3 + y)$$

Solving equations and inequalities

Use inverse operations (opposites) and balancing to find the value of the unknown (letter)

$$\begin{array}{l} \frac{3x-4}{5} < 4 \\ \times 5 \qquad \qquad \qquad \times 5 \\ 2x-4 < 20 \\ +4 \qquad \qquad \qquad +4 \\ 2x < 24 \\ \div 2 \qquad \qquad \qquad \div 2 \\ x < 4 \end{array}$$

Equations are done in the exact same way they will just have an equals (=) sign in the questions

Rearranging formula

Use inverse operations (opposites) and balancing to make another variable the subject

Make x the subject:

$$\begin{array}{l} \frac{3x-4}{5} = y \\ \times 5 \qquad \qquad \qquad \times 5 \\ 2x-4 = 5y \\ +4 \qquad \qquad \qquad +4 \\ 2x = 5y+4 \\ \div 2 \qquad \qquad \qquad \div 2 \\ x = \frac{5y+4}{2} \end{array} \qquad \begin{array}{l} 3(2x+5) = y \\ \text{Expand} \\ 6x+15 = y \\ -15 \qquad \qquad \qquad -15 \\ 6x = y-15 \\ \div 6 \qquad \qquad \qquad \div 6 \\ x = \frac{y-15}{6} \end{array}$$

Expanding brackets

This is the process to remove brackets by multiplying - use the grid method to help

$$5r(3r-6) \rightarrow \begin{array}{|c|c|c|} \hline \times & 3r & -6 \\ \hline 5r & 15r^2 & -30r \\ \hline \end{array} = 15r^2 - 30r$$

$$(3x+2)(2x-5) \rightarrow \begin{array}{|c|c|c|} \hline \times & 2x & -5 \\ \hline 3x & 6x^2 & -15x \\ \hline +2 & +4x & -10 \\ \hline \end{array} = 6x^2 - 11x - 10$$

Factorising - double bracket

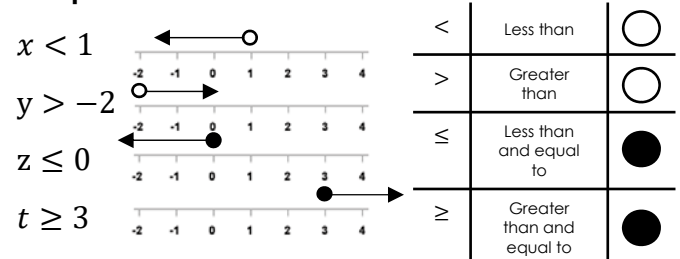
When there is no highest common factor we use double brackets

Split the middle term into its product/sum pair

$$6x^2 - x - 15 \quad \text{Multiply} = -90 \quad \text{Sum} = -1 \quad -10 \text{ and } 9$$

$$6x^2 - 10x + 9x - 15 = 2x(3x-5) + 3(3x-5) \rightarrow (2x+3)(3x-5)$$

Inequalities on a number line



Solve quadratic equations

Quadratic equations are equations with more than one solution

Ensure equation equals zero

Factorise and solve each bracket

$$x^2 + 5x + 6 = 0$$

$$(x+3)(x+2) = 0$$

$$x+3=0 \quad x+2=0$$

$$x = -3 \quad x = -2$$

Maths Knowledge Organiser

Year 9 Algebra part 2



Index law

$$x^0 = 1$$

$$x^n \times x^m = x^{n+m}$$

$$x^n \div x^m = x^{n-m}$$

$$(x^n)^m = x^{nm}$$

$$x^{-n} = \frac{1}{x^n}$$

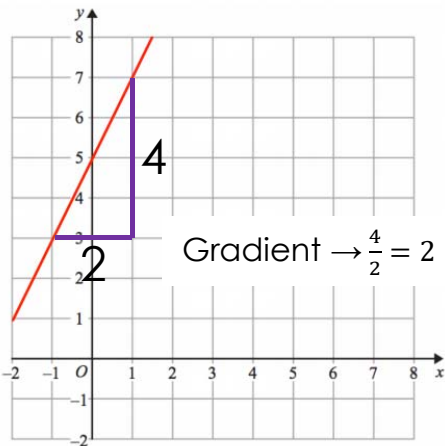
$$x^{\frac{n}{m}} = \sqrt[m]{x^n}$$

Straight lines

Every straight line can be written in the form $y = mx + c$

m – is the gradient (steepness)

c – is the y-intercept



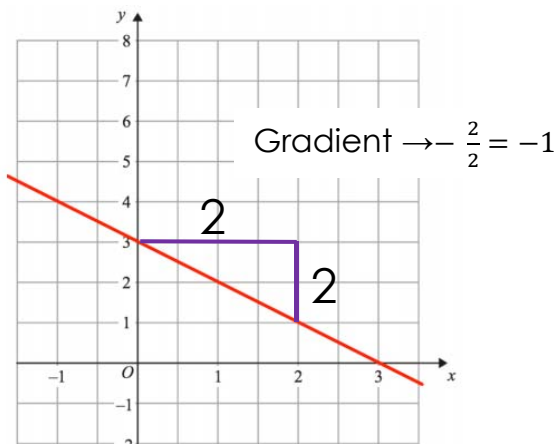
Gradient $\rightarrow (1,7)(-1,3)$

$$\frac{\text{Difference in } y}{\text{Difference in } x} = \frac{3-7}{-1-1} = \frac{-4}{-2} = 2$$

Y-intercept \rightarrow Where it crosses y axis

$(0,5)$

Equation $\rightarrow y = 2x + 5$



Gradient $\rightarrow (0,3)(2,1)$

$$\frac{\text{Difference in } y}{\text{Difference in } x} = \frac{1-3}{2-0} = \frac{-2}{2} = -1$$

Y-intercept \rightarrow Where it crosses y axis

$(0,3)$

Equation $\rightarrow y = -1x + 3$

Plotting graphs

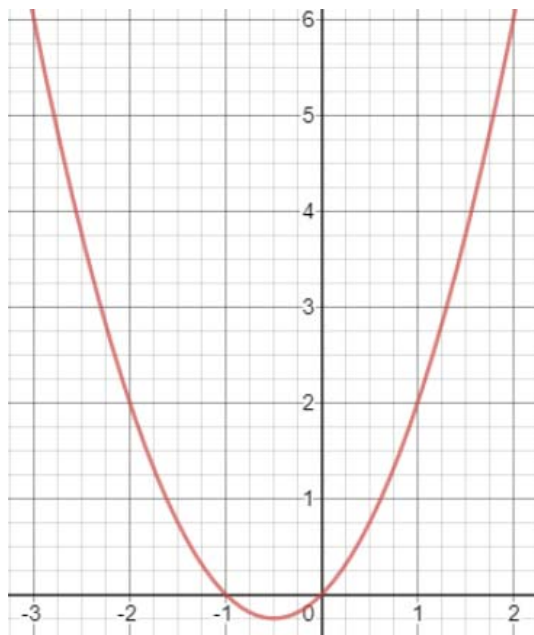
Use a xy table

x coordinates come from x axis on graph

y coordinates come from the equation

$$y = x^2 + x$$

x	-2	-1	0	1	2
y	2	0	0	2	6



Types of Graphs

Linear
(straight line)

$$y = mx + c$$



Positive Grad

$$y = -mx + c$$



Negative Grad

Quadratic

$$y = \dots x^2 + \dots$$



Positive x^2

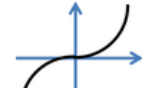
$$y = -\dots x^2 + \dots$$



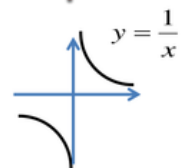
Negative x^2

Cubic

$$y = \dots x^3 + \dots$$



Reciprocal



$$\begin{array}{ccc}
 & 3(2x + 5) = y & \\
 \text{Expand} \swarrow & & \searrow \text{Expand} \\
 & 6x + 15 = y & \\
 -15 \swarrow & & \searrow -15 \\
 & 6x = y - 15 & \\
 \div 6 \swarrow & & \searrow \div 6 \\
 & x = \frac{y - 15}{6} &
 \end{array}$$

Solving equations and inequalities

Use inverse operations (opposites) and balancing to find the value of the unknown (letter)

$$\frac{3x - 4}{5} < 4$$