Substitution

Substitution means putting numbers in place of letters to calculate the value of an **expression** or to find the value of a letter in a **formula**

Example
Evaluate the expression when a = 9 into

3a − 7	a^2
3 x 9 − 7	9 x 9 = 81
27 − 7 = 20	

We can use substitution to find out whether two expressions are equal
Examples: If c = 4 find the value of:

(a) $3c^2$	(b) $(3c)^2$
$(3 \times 4)^2$ =	3×4^2 =
$12^2 = 144$	3 x 16 = 48

Both expressions are not equal

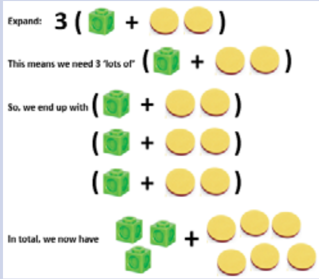
An **Expression** contains letters and can also contain numbers and symbols
Eg 4b , xy, 9a – 2b

A **Formula** contains letters, an equal sign and also numbers and symbols
Eg y = mx + c, E = ½ mv^2

Expanding

Expanding Brackets – When you '**expand**' brackets you are multiplying out

Expand
3(x + 2) →



Expand 4(2x + 3) = 2x + 3 = 8x + 12
2x + 3
2x + 3
2x + 3

We need 4 'lots of' $(2x + 3)$

Factorising

Factorising- When you '**factorise**' you are aiming to split an expression into **equal groups**. This is done by looking for the highest common factor for all terms.

Factorise: $\mathbf{12x + 32}$

3x+8	3x+8	3x+8	3x+8

The highest common factor (the largest number that would go into both of them) for $12x$ and 32 is 4, therefore, we can share this in to 4 equal groups.

We now have 4 'lots of' $3x + 8$.

In Maths we would write this as $\mathbf{4\ (3x + 8)}$

Notation

Notation	How to say it
$a^2 \equiv a \times a$	"a squared"
$a^3 \equiv a \times a \times a$	"a cubed"
$a^4 \equiv a \times a \times a \times a$	"a to the power of 4"
$a^5 \equiv a \times a \times a \times a \times a$	"a to the power of 5"

Singular: **Index**
Plural: **Indices**

The laws of indices

Multiplying two powers

$$b^3 \times b^4$$
$$\equiv b \times b \times b \times b \times b \times b \times b$$
So $\boldsymbol{b^3 \times b^4 \equiv b^7}$

Raising a power

$$(b^2)^3 \equiv b^2 \times b^2 \times b^2$$
$$\equiv b \times b \times b \times b \times b \times b$$
$$\equiv b^6$$
So $\boldsymbol{(b^2)^3 \equiv b^6}$

Dividing two powers with the same base

Example
$$\frac{c^5}{c^3} \equiv \frac{c\times c\times c\times c\times c}{c\times c\times c} \equiv \frac{c\times c\times c\times c\times c}{c\times c\times c} \equiv c^2$$
So $\boldsymbol{\frac{c^5}{c^3} \equiv c^2}$

Since $\frac{c}{c} = 1$

Solving equations

An Equation is where two expressions are equal to each other
Example
$3x + 5 = 11$ $\quad\quad$ $6y - 2 = 2y + 7$

Inverse means the opposite. For example adding is the inverse of subtracting. Multiplying is the inverse of dividing

Equations must always be balanced. Whatever happens to one side, must happen to the other

To **Solve** means to find the solution. (answer)

Solve

$2x + 1 = 9$
$-1 \quad -1$
$2x = 8$
$\div 2 \quad \div 2$
$x = 4$

Changing the subject

If you are asked to change the subject of a formula you are being asked to rearrange it.

We use the same rules as when we solve equations – it is all about inverse operations.

$+ \Leftrightarrow -$ $\quad$ $\times \Leftrightarrow \div$ $\quad$ $\sqrt{a} \Leftrightarrow a^2$

Example

$F = ma$ — ***Make m the subject of the formula***

$\frac{F}{a} = \frac{ma}{a}$ — ***Divide both sides by a***

$\frac{F}{a} = m$

Example

$v = u + at$ — ***Make a the subject***

$-u \quad -u$ — ***Subtract u from both sides***

$\frac{v-u}{t} = \frac{at}{t}$ — ***Divide both sides by t***

$\frac{v-u}{t} = a$

Inequalities

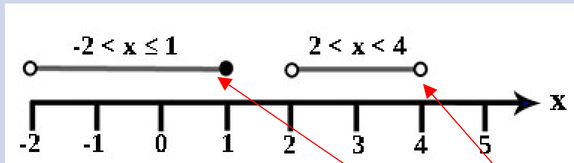
Inequality means where things are not equal

- $=$ Equal to
- $<$ Less than
- $\leq$ Less than or equal to
- $>$ Greater than
- $\geq$ Greater than or equal to

Integers are whole numbers.
e.g 5, 1, -2,

Not integers 0.3, $\frac{1}{2}$, -0.04

If $x > 3$ the integers are 4,5,6…
If $x \geq 3$ the integers are 3,4,5,6…



Solid dot includes that integer ≤
Empty dot does not include that integer <