



# Year 7 Knowledge Organiser -

## Substitution and formulae

$$E = mc^2$$

Objectives

Substitute numerical values into formulae and expressions

Understand and use standard mathematical formulae

### Key Vocabulary

- Variable – an unknown value, represented by a letter
- Term – a single number or variable, or numbers or variables multiplied or divided by each other (positive or negative)
- Expression – two or more terms added and/or subtracted
- Equation – an expression that contains an equal symbol
- Formula – a relationship or rule
- Like Terms - terms that have the same variables and powers
- Inverse – reverse or opposite of a function
- Expand – to multiply each term in the bracket by the expression outside the bracket
- Substitute – swap a variable for a numerical value

### What is a formula?

A formula is a fact or rule that uses mathematical symbols.

It will usually have:

- An equals sign (=)
- Two or more **variables** (x, y, etc) that stand in for values we don't know yet

It shows us how things are related to each other.

### Useful mathematical formulae

$$A = l \times w$$

$$V = l \times w \times d$$

$$a^2 + b^2 = c^2$$

$$A = \frac{1}{2} b \times h$$

Do you know what each of them mean?  
Research them if not sure!

$$S = \frac{D}{T}$$

$$A = \pi r^2$$

To convert temperatures between Celsius (C) and Fahrenheit (F), use the formula  $F = 1.8C + 32$

### Example

A taxi company charges £2.00 per journey plus 30 pence per mile.

- a Write down an equation for £T, the total cost of a journey of m miles.
- b How much would it cost to travel 5 miles?
- c If I am charged £4.70 for my journey, how far did I travel?

- a Total cost is £2 + £0.30 per mile  
 $T = 2 + 0.3m$
- b  $T = 2 + 0.3 \times 5 = 2 + 1.5 = 3.5$   
My journey cost £3.50
- c  $4.7 = 2 + 0.3m$       Subtract 2  
 $2.7 = 0.3m$           Divide by 0.3  
 $9 = m$   
The journey was 9 miles.



### Basic substitution

Evaluate  $4c$ , when  $c=7$

If  $c = 7$ , this means the expression is asking for 4 'lots of' 7, or

$$4c = 4(7) = 28$$

Evaluate  $2a+5$ , when  $a=4$

If  $a = 4$ , this means the expression is asking for 2 'lots of' 4 plus 5, or

$$2a+5 = 2(4)+5 = 8+5 = 13$$

### Harder Substitution

$6(x^2 + 4)$  ← remember this means x squared, plus 4, all multiplied by 6

If  $x = 3$ ,

$$6(x^2 + 4) = 6((3)^2 + 4) = 6(9 + 4) = 6(13) = 78$$

If  $x = -2$ ,

$$6(x^2 + 4) = 6((-2)^2 + 4) = 6(4 + 4) = 6(8) = 48$$

### Substitution Examples

If  $x = 5$

$4x$	$4 \times 5$	20
$3x + 9$	$(3 \times 5) + 9$	24
$2(6x - 4)$	$2(6 \times 5 - 4)$ $2(30 - 4)$	52

If  $x = 10$  and  $y = 3$

$2x + y$	$(2 \times 10) + 3$	23
$xy$	$10 \times 3$	30
$\frac{1}{2}xy$	$\frac{1}{2} \times 10 \times 3$	15
$xy^2$	$10 \times 3^2$	90
$4x^2y$	$4 \times 10^2 \times 3$	1200