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Year 10 Maths

Unit 5: Algebra

MATHOPEDIA

writing algebra...

$4 \times a$	is written:	$4a$
$a \times 1$	is written:	a
$b \times a$	is written:	ab
$a \times a$	is written:	a^2
$a \div 5$	is written:	$\frac{a}{5}$

Write the number first

We don't write 1a

Write the variables in alphabetical order

Write divide as a fraction, from top to bottom

types of algebra...

In algebra we use letters to represent 'mystery numbers'.
We call the letters: **variables**.

The smallest 'building block' of algebra is called a **term**.
e.g. $5a$, $2gh$, x^2, 7, $-4p$

A term which doesn't have a letter (a variable) is called a **constant term**.

e.g. 9, -2, $\frac{1}{3}$, 0.7

Terms are the simplest type of **expression**.
They can also be used to create more complex expressions.

e.g. $4a + 2b$, $\frac{x+y}{2}$, $5x^2 + 3x - 9$, $6(x-8)$

A number at the start of a term is called a **coefficient**.
e.g. In the expression $5x + 3y$, the coefficient of x is 5.

An **equation** is a statement involving an equals symbol (=).
e.g. $2 + 5 = 8 - 1$, $3x + 4 = 25$

An **identity** is a statement that is always true. (It links two equivalent expressions - the same thing, just written differently.)
Sometimes for an identity we use a special triple equals symbol: ≡
e.g. $a + a + a \equiv 3a$, $2(x+3) \equiv 2x + 6$, $4p + 2p + p \equiv 7p$

writing expressions...

EXAMPLE:
Write an expression for
(a) 5 more than n

n + 5

(b) 5 less than n

n – 5

(c) 6 lots of n

6n

'5 more' means add 5

'5 less' means subtract 5

'lots of' suggests multiplication

substitution...

When we replace a variable (letter) with a number (its **value**), we call this **substituting**.

EXAMPLE:
*Find the **value** of* $3a + 2$
when $a = 5$.

Replace the a with the 5

Then work out the answer

$3\boldsymbol{a} + 2$
= 3 x **5** + 2
= 17

EXAMPLE:
Evaluate $2m - 5c$
when $m = 8$ *and* $c = 2$.

Replace both m and c with their values

$2\boldsymbol{m} - 5\boldsymbol{c}$
= 2 x **8** – 5 x **2**
= 16 – 10
= 6

negative numbers...

EXAMPLE: Work out

(a) $-5+8$

$-5+8=3$

Start at – 5 and add on 8

(b) $-5-8$

$-5-8=-13$

Subtracting 8 goes further into the negatives

(c) -4×3

(d) 4×-3

(e) -4×-3

$-4\times 3=-12$

$4\times -3=-12$

$-4\times -3=12$

Multiplying a positive and negative gives a negative answer. Multiplying two negatives gives a positive answer.

(f) $-20\div 5$

(g) $-20\div -5$

$-20\div 5=-4$

$-20\div -5=4$

The same rule works for dividing

(h) $7+-5$

(i) $7--5$

$7+-5$
$=7-5$
$=2$

$7--5$
$=7+5$
$=12$

+ – can be replaced with –

– – can be replaced with +

Positive divided by negative is negative

more substitution...

EXAMPLE:
Find the value of $\frac{20}{m}$ *when* $m=-5$

$20\div -5$
$=-4$

EXAMPLE:
Find the value of $3a+b$ *when* $a=-6$ *and* $b=-2$

3 x -6 = -18 and 6 + – 2 is the same as 6 – 2

$3\boldsymbol{a}+\boldsymbol{b}$
$=3\times \mathbf{-6}+\mathbf{-2}$
$=-18\ -\ 2$
$=-20$

EXAMPLE: If $x=-3$, *find the value of* $4x^2$

$4\boldsymbol{x}^2$
$=4\times(\mathbf{-3})^2$
$=4\times\ 9$
$=36$

–3 x –3 = 9 (If using a calculator, make sure you include the brackets)

A **formula** is another special type of equation.
It is used for working something out.
e.g.

$$P = 2a + 2b$$

P is the **subject** of this formula

This formula is **in terms of** a and b

The plural is **formulas**, or **formulae**.

formulas...

EXAMPLE: Use the formula $H = 20 - 2m$ to find the value of H when $m = 7$.

$$H = 20 - 2m$$
$$= 20 - 2 \times 7$$
$$= 20 - 14$$
$$= 6$$

Substitute the value 7 for m

EXAMPLE: The formula $V = IR$ is used in Physics to find a voltage (V) using the current (I) and resistance (R). Find the voltage if I=6 and R=3.

Don't be put off by the complicated-looking question...

$$V = IR$$
$$= 6 \times 3$$
$$= 18 \quad \text{(volts)}$$

...just use the formula!