Year 8 Knowledge Organiser - Expressions and equations

Objectives

Understand and use factors

Use and interpret algebraic notation, including coefficients written as fractions rather than as decimals

Simplify and manipulate algebraic expressions by taking out common factors and simplifying expressions involving sums, products and powers, including the laws of indices

Solve linear equations with the unknown on both sides of the equation

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 equals 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

Factorise – the reverse of expanding brackets

Coefficient – a value that is being multiplied by a variable

Algebraic notation...

≡ is the identity symbol and is used to show equivalent expressions/terms

$a \times a \equiv a^2$

$a \times b \equiv ab$

$a \times a \times b \equiv a^2b$

(variables multiplied together are written in alphabetical order)

$0.25 \times a \times a \equiv \frac{1}{4} a^2$

The number being multiplied by the letter is called a **coefficient**.

Note: The number comes before the variable.

If your coefficient is not an integer, write it as a fraction rather than a decimal.

Solving linear equations...

The aim is to get the unknown on its own.
Tip: Always show a full written method, lining up your equals signs down the page.

$2c + 10 = 4c + 2$

$10 = 4c + 2 - 2c$

$10 - 2 = 4c - 2c$

$8 = 2c$

$8/2 = c$

$4 = c$ or $c = 4$

Start by moving your smallest quantity of variable.

Remember to use the inverse!

Then move the value from that side to join the other.

Common factors...

12 and 18
Factors of 12: 1, 12, 2, 6, 3, 4
Factors of 18: 1, 18, 2, 9, 3, 6
Common factors: 1, 2, 3, 6
HCF: 6

8y and 20y
Factors of 8y: 1, 8y, y, 8, 2, 4y, 2y, 4
Factors of 20y: 1, 20y, y, 20, 2, 10y, 2y, 10, 4, 5y, 4y, 5
Common factors: 1, y, 2, 2y, 4, 4y
HCF: 4y

Factors come in pairs and multiply together to give you the original number.

Terms have factors just like numbers!

Think about the highest value which will divide exactly into both terms to get your HCF

Factorising...

1) Find the HCF of both terms in the expression
2) Place this outside your brackets
3) Work out what you need to multiply the HCF by to get back to the original terms in the expression

$12y + 8$ → $4(3y + 2)$
HCF = 4 | $4 \times 3y = 12y$ | $4 \times 2 = 8$

Multiply expressions with indices

$4b \times 3a$
$\equiv 4 \times b \times 3 \times a$
$\equiv 4 \times 3 \times b \times a$
$\equiv 12ab$

$5t \times 9t$
$\equiv 5 \times t \times 9 \times t$
$\equiv 5 \times 9 \times t \times t$
$\equiv 45t^2$

$2b^4 \times 3b^2$
$\equiv 2 \times b \times b \times b \times b \times 3 \times b \times b$
$\equiv 2 \times 3 \times b \times b \times b \times b \times b \times b$
$\equiv 6b^6$

There are often misconceptions with this calculation but break down the powers

Addition/ Subtraction laws for indices

$3^5 \times 3^2 \rightarrow 3^7$
$= (3 \times 3 \times 3 \times 3 \times 3) \times (3 \times 3)$

The base number is all the same so the terms can be simplified

Addition law for indices

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

$3^5 \div 3^2 \rightarrow 3^3$

$\frac{3 \times 3 \times 3 \times \cancel{3} \times \cancel{3}}{\cancel{3} \times \cancel{3}} \rightarrow \frac{3^3}{3^0} \rightarrow \frac{3^3}{1}$

Subtraction law for indices

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

Divide expressions with indices

$\frac{24}{36} \rightarrow \frac{\cancel{2} \times \cancel{2} \times 2 \times \cancel{3}}{\cancel{2} \times \cancel{3} \times 2 \times \cancel{3}} \rightarrow \frac{2}{3}$

$\frac{5a^3b^2}{15ab^6} \rightarrow \frac{\cancel{5} \times \cancel{a} \times a \times a \times \cancel{b} \times \cancel{b}}{3 \times \cancel{5} \times \cancel{a} \times \cancel{b} \times \cancel{b} \times b \times b \times b \times b \times b} \rightarrow \frac{a^2}{3b^4}$

Cross cancelling factors shows cancels the expression

$\frac{23a^7y^2}{5db^6}$ This expression cannot be divided (cancelled down) because there are no common factors or similar terms