ALGEBRA

Equations, formulae, expressions and identities

Pupils should learn to:	As outcomes, Year 7 pupils should, for example:

Use letter symbols and distinguish their different roles in algebra

Use, read and write, spelling correctly:
algebra, unknown, symbol, variable… equals… brackets…
evaluate, simplify, substitute, solve…
term, expression, equation… squared… commutative…

Reinforce the idea of an **unknown**. Answer questions such as:
- 5 + □ = 17
- 3 × □ – 5 = 7
- ▼ + ♦ = 4. What numbers could ▼ and ♦ be?
- The product of two numbers is 24. What could they be?

Know that letters are used to stand for numbers in algebra. Begin to distinguish between different uses of letters.
For example:
- In the equation $3n + 2 = 11$, n is a particular unknown number, but in the equation $a + b = 12$, a and b can take many different values.

Recognise algebraic conventions, such as:
- $3 \times n$ or $n \times 3$ can be thought of as '3 lots of n', or $n + n + n$, and can be shortened to $3n$.
- In the expression $3n$, n can take any value, but when the value of an expression is known, an equation is formed, i.e. if $3n$ is 18, the equation is written as $3n = 18$.

Understand the meaning of and begin to **use simple expressions with brackets,** e.g. $3(n + 2)$ meaning $3 \times (n + 2)$, where the addition operation is to be performed first and the result of this is then multiplied by 3.

Use the equals sign appropriately and correctly.
- Recognise that if $a = b$ then $b = a$, and that $a + b = c$ can also be written as $c = a + b$.
- Avoid errors arising from misuse of the sign when setting out the steps in a calculation, e.g. incorrectly writing
  $38 + 29 = 38 + 30 = 68 – 1 = 67$

Use letter symbols to write expressions in meaningful contexts.
For example:

add 7 to a number	$n + 7$
subtract 4 from a number	$n – 4$
4 minus a number	$4 – n$
a number multiplied by 2 and then 5 added	$(n \times 2) + 5$ or $2n + 5$
a number divided by 2	$n \div 2$ or $n/2$
a number plus 7 and then multiplied by 10	$(n + 7) \times 10$ or $10(n + 7)$
a number multiplied by itself	$n \times n$ or n^2

Understand the difference between expressions such as:

$2n$ and $n + 2$	$3(c + 5)$ and $3c + 5$
n^2 and $2n$	$2n^2$ and $(2n)^2$

Link to formulating expressions and formulae (pages 122–5).

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Equations, formulae, expressions and identities

As outcomes, Year 8 pupils should, for example:	As outcomes, Year 9 pupils should, for example:

Year 8

Use vocabulary from previous year and extend to:
algebraic expression, formula, function…
partition, multiply out… cubed, to the power of…

Know that an algebraic expression is formed from letter symbols and numbers, combined with operation signs such as +, –, ×, ( ), ÷ and /.

Use letter symbols in different ways and begin to distinguish their different roles. For example:

- In the equation $4x + 3 = 47$, x is a particular unknown number.
- In the formula $V = IR$, V, I and R are variable quantities, related by the formula.
  In the formula $F = {}^{9C}\!/_{5} + 32$, once C is known, the value of F can be calculated.
- In the function $y = 3x - 4$, for any chosen value of x, the related value of y can be calculated.

Know how multiplication and division are represented in algebraic expressions. For example:

- $2 \times n$ is written as $2n$.
- $p \times q$ is written as pq.
- $a \times (b + c)$ is written as $a(b + c)$.
- $(x + y) \div z$ is written as $\frac{x + y}{z}$.

Use the equals sign appropriately and correctly.

- Know that the symbol = denotes equality.
- Avoid misuse of the equals sign when working through a sequence of steps, e.g. incorrectly writing $56 + 37 = 56 + 30 = 86 + 7 = 93$.
- Avoid interpreting the equals sign as 'makes', which suggests it means merely the answer to a calculation, as in $3 \times 2 + 7 = 13$.

Begin to interpret the equals sign more broadly, including in equations with expressions on each side. For example:

- Recognise equalities in different forms, such as:
  $a + b = c + d$ $\quad$ $8 = 15 - 3x$
  and know that they can be written as:
  $a + b = c + d$ or $c + d = a + b$
  $8 = 15 - 3x$ or $15 - 3x = 8$
- Know that expressions such as $2a + 2$ and $2(a + 1)$ always have the same value for any value of a.

Link to constructing and solving equations (pages 122–5).

Year 9

Use vocabulary from previous years and extend to:
identity, identically equal, inequality… subject of the formula… common factor, factorise… index law…
linear, quadratic, cubic… and the identity sign (≡).

Explain the distinction between equations, formulae and functions. For example:

- In the equation $5x + 4 = 2x + 31$, x is a particular unknown number.
- In the formula $v = u + at$, v, u, a and t are variable quantities, related by the formula. Once the values of three of the variables are known, the fourth value can be calculated.
- In the function $y = 8x + 11$, for any chosen value of x, the related value of y can be calculated.

Know that an inequality or ordering is a statement that one expression is greater or less than another. For example:

- $x \geq 1$ means that x is greater than or equal to 1.
- $y \leq 2$ means that y is less than or equal to 2.

An inequality remains true if the same number is added to or subtracted from each side, or if both sides are multiplied or divided by the same positive number. Multiplying or dividing by a negative number reverses the sense of the inequality.

Know the meaning of an identity and use the ≡ sign.
In an identity, the expressions on each side of the equation always take the same value, whatever numbers are substituted for the letters in them; the expressions are said to be identically equal.
For example:

- $4(a + 1) \equiv 4a + 4$ is an identity, because the expressions $4(a + 1)$ and $4a + 4$ always have the same value, whatever value a takes.

Link to constructing and solving equations (pages 122 to 4-129).