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| **UNIT 2: Expressions, substituting into simple formulae, expanding and factorising** |

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**SPECIFICATION REFERENCES**

N1 order positive and negative integers, decimals and fractions; use the symbols =, ≠, <, >, ≤, ≥

N3 recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals

A1 use and interpret algebraic notation, including:

* + *ab* in place of *a* × *b*
	+ 3*y* in place of *y* + *y* + *y* and 3 × *y*
	+ *a*2 in place of *a* × *a*, *a*3 in place of *a* × *a* × *a*, *a*2*b* in place of *a* × *a* × *b*
	+  in place of *a* ÷ *b*
	+ coefficients written as fractions rather than as decimals
	+ brackets

A2 substitute numerical values into formulae and expressions, including scientific formulae

A3 understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors

A4 simplify and manipulate algebraic expressions … by:

* collecting like terms
* multiplying a single term over a bracket
* taking out common factors …
* simplifying expressions involving sums, products and powers, including the laws of indices

A5 understand and use standard mathematical formulae; rearrange formulae to change the subject

A6 know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments

A7 where appropriate, interpret simple expressions as functions with inputs and outputs

A21 translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation and interpret the solution

**PRIOR KNOWLEDGE**

Students should have prior knowledge of some of these topics, as they are encountered at Key Stage 3:

* the ability to use negative numbers with the four operations and recall and use hierarchy of operations and understand inverse operations;
* dealing with decimals and negatives on a calculator;
* using index laws numerically.

**KEYWORDS**

Expression, identity, equation, formula, substitute, term, ‘like’ terms, index, power, collect, substitute, expand, bracket, factor, factorise, linear, simplify

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| **2b. Expressions and substitution into formula**(A2, A4, A5, A6, A7, A21) | **Teaching time**4-6 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Multiply a single number term over a bracket;
* Write and simplify expressions using squares and cubes;
* Simplify expressions involving brackets, i.e. expand the brackets, then add/subtract;
* Argue mathematically to show algebraic expressions are equivalent;
* Recognise factors of algebraic terms involving single brackets;
* Factorise algebraic expressions by taking out common factors;
* Write expressions to solve problems representing a situation;
* Substitute numbers into simple algebraic expressions;
* Substitute numbers into expressions involving brackets and powers;
* Substitute positive and negative numbers into expressions;
* Derive a simple formula, including those with squares, cubes and roots;
* Substitute numbers into a (word) formula;

**POSSIBLE SUCCESS CRITERIA**

Expand and simplify 3(*t* – 1).

Understand 6*x* + 4 ≠ 3(*x* + 2).

Argue mathematically that 2(*x* + 5) = 2*x* + 10.

Evaluate the expressions for different values of *x*: 3*x*2 + 4 or 2*x*3.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Forming and solving equations involving algebra and other areas of mathematics such as area and perimeter.

**COMMON MISCONCEPTIONS**

3(*x* + 4) = 3*x* + 4.

The convention of not writing a coefficient with a single value, i.e. *x* instead of 1*x*, may cause confusion.

Some students may think that it is always true that *a* = 1, *b* = 2, *c* = 3.

If *a* = 2 sometimes students interpret 3*a* as 32.

Making mistakes with negatives, including the squaring of negative numbers.

**NOTES**

Students will have encountered much of this before and you may wish to introduce solving equations using function machines.

Provide students with lots of practice.

This topic lends itself to regular reinforcement through starters in lessons.

Use formulae from mathematics and other subjects, expressed initially in words and then using letters and symbols.

Include substitution into the kinematics formulae given on the formula sheet, i.e. *v* = *u* + *at*,
*v*2 – *u*2 = 2*as*, and *s* = *ut* +  *at*2.