Algebraic Manipulations and Equations

Substitution	Substitute positive and negative integers and decimals into expressions and formulae. Use varying types of formulae e.g. SDT, DMV.	Real life formula; cross curricular links with science. Calculating BMI/ medicines.
Expanding Single Brackets	Expand single brackets and simplify when adding or subtracting two brackets. Include fractions, decimals, perimeter and area.	
Factorising Single Brackets	Factorise fully using both numerical and algebraic values, into single brackets for two or more terms in an expression. Include fractions, decimals and area.	
Solving Linear Equations and Inequalities	Solve equations and inequalities with an unknown on one or both sides and brackets. Ensure that the highest value unknown appears on either side of the equation.	Solving equations to help understand the world around us. Solving problems before money is wasted

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Expanding Double Brackets	Expand and simplify double brackets when the coefficient of x is 1 or greater. Include fractions, decimals, perimeter and area.	CGI of quadratic paths such as fireballs and arrows in game of thrones
Factorising Quadratics	Factorise quadratic expressions where the coefficient of x is 1. Include area finding missing expressions for lengths.	CGI of quadratic paths such as fireballs and arrows in game of thrones
Solving Linear Equations and Inequalities	Solve equations and inequalities with an unknown on one or both sides and brackets. Ensure that the highest value unknown appears on either side of the equation.	Solving equations to help understand the world around us. Solving problems before money is wasted
Change the Subject	Rearrange to change the subject, with the subject appearing once only.	Cross curricular - links to science

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Factorising Quadratics	Factorise quadratic expressions where the coefficient of x is 1. Include area finding missing expressions for lengths.	CGI of quadratic paths such as fireballs and arrows in game of thrones
Expanding Triple Brackets	Expand and simplify triple brackets when the coefficient of x is 1 or greater. Include fractions and decimals.	
Solving Linear Equations and Inequalities	Solve equations and inequalities with an unknown on one or both sides and brackets. Ensure that the highest value unknown appears on either side of the equation.	Solving equations to help understand the world around us. Solving problems before money is wasted
Change the Subject	Rearrange to change the subject, with the subject appearing once only.	Cross curricular - links to science

Key Knowledge/Prior Learning KS2/3 and Retrieval and Suggested Starters

- Basic algebraic notation e.g ab in place of a x b
- Simplifying expressions inc multiplying and dividing
- Collecting like terms
- Expanding single brackets.
- Simplifying expressions
- Multiplying and dividing terms
- Indices
- Expanding single brackets

KS3 National Curriculum – what students will be practicing and Key Questions

- Substitute numerical values into formulae and expressions, including scientific formulae
- Understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors
- Simplify and manipulate algebraic expressions to maintain equivalence by:
    - collecting like terms
    - multiplying a single term over a bracket
    - taking out common factors
- expanding products of 2 or more binomials
- Solving equations where the unknown appears on one and both sides. Ensure the highest value appears on both sides of the equation to strengthen understanding.
- Change the subject by rearranging formulae

Specific Ambitious Knowledge

- Methods of expanding double brackets:
  FOIL
  Grid
  Distributive Law (Partitioning)
  Column Method
  By inspection

- Methods to factorise:
  factor tables,
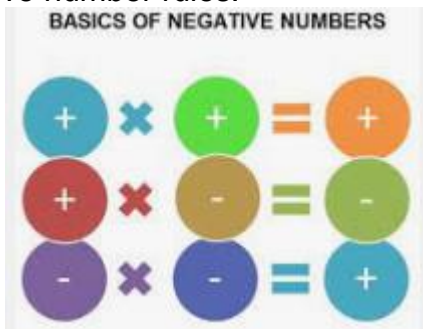 Grids,
  Partitioning

Key Vocabulary/Literacy Opportunities
- Integer
- Expressions
- Formulae
- Substitute
- Expand
- Simplify
- Factorise
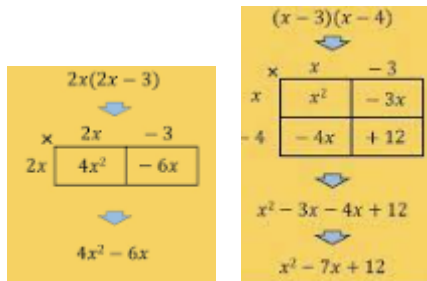- Coefficient
- Identity
- Quadratic

Key Formulae/Knowledge

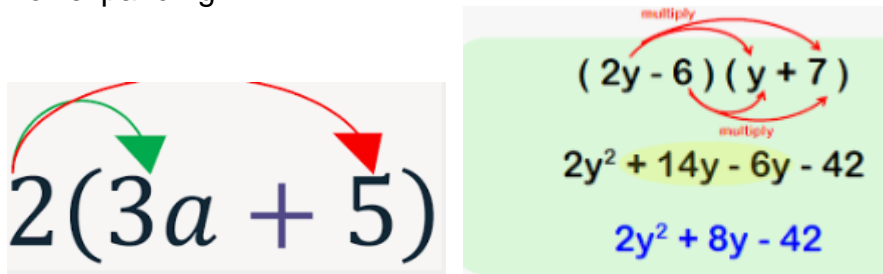When collecting like terms – adding different powers together

Expanding:

Negative number rules:

BASICS OF NEGATIVE NUMBERS

$$(+) \times (+) = (+)$$
$$(+) \times (-) = (-)$$
$$(-) \times (-) = (+)$$

Grid method expanding

$2x(2x - 3)$

×	$2x$	-3
$2x$	$4x^2$	$-6x$

$4x^2 - 6x$

$(x - 3)(x - 4)$

×	x	-3
x	x^2	$-3x$
-4	$-4x$	$+12$

$x^2 - 3x - 4x + 12$

$x^2 - 7x + 12$

Foil expanding

$2(3a + 5)$

$(2y - 6)(y + 7)$

multiply

multiply

$2y^2 + 14y - 6y - 42$

$2y^2 + 8y - 42$

Column method expanding

$$(x+4)(2x+3)$$

$$
\begin{array}{r}
x \quad +4 \\
\times \quad 2x \quad +3 \\
\hline
+3x \quad +12 \\
2x^2 + 8x \\
\hline
2x^2 + 11x \quad +12
\end{array}
$$

Partitioning

$$(x+4)(2x+3)$$

$$x(2x+3) \quad +4(2x+3)$$

$$2x^2 + 3x + 8x + 12$$

$$2x^2 + 11x + 12$$

Factorising

Factorising into single

Factorise:

$$9x + 12$$

1) Find the HCF of the terms.

2) Divide each term by the HCF.

$$\frac{9x}{3} = 3x \qquad \frac{12}{3} = 4$$

$$3(3x + 4)$$

The HCF must be outside the brackets for full marks

Factorising quadratics methods:

$$x^2 - x - 30 = \underbrace{x^2 - 6x}_{group} + \underbrace{5x - 30}_{group}$$

$$= x(x-6) + 5(x-6)$$

$$= (x-6)(x+5)$$

Add and Times

Factor $x^2 + 11x + 24$

The goal: Find two numbers
That multiply to form 24
and add to form 11.

Factors of 24:

	Added
1·24	1+24 = 25
2·12	2+12 = 14
3·8	3+8 = 11 These are the factors
4·6	4+6 = 10

Grid method

$10x^2 - 34x + 12$

$2(5x^2 - 17x + 6)$

Two numbers that multiply to 30	Two numbers that add to -17
a · c	b
-1 · -30	-31
-2 · -15	-17

$(x - 3)$

	x	-3
$5x$	$5x^2$	$-15x$
-2	$-2x$	6

$= 2(5x - 2)(x - 3)$

Maths in Context 9 Historical, Real Life and Student Thinking Points)

Projects/Enrichment/Investigations

- Number square problems https://nrich.maths.org/2821   (Inc other nrich problems).
- Calculating BMI investigations