The Sutton Academy

Knowledge Rich Curriculum Plan

Year 9 Core – Algebraic Expressions

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
To learn how to simplify algebraic expressions.	• Students will know how to collect like terms involving multiple terms. E.g. $2x + 7y + 4x + 6y = 6x + 13y$ • Students will know how to collect like terms involving powers. E.g. $4x + 5x^2 - x + 6x^2 = 3x + 11x^2$ • Students will know how to collect like terms with composite variables. e.g. $2ab + 3ab = 5ab$ • Students will know how to multiply with single terms such as $y \times y \times y = y^3$. • Students will know how to multiply algebraic expressions involving multiple letters and integers. E.g. $4 \times b \times c = 4bc$ or $4b \times 3c = 12bc$ • Students will know how to multiply algebraic expressions involving the same letter. E.g. $5 \times g \times g = 5g^2$ • Students will know how to divide simple algebraic expressions. E.g. $\frac{4t}{2} = 2t$ *or* $\frac{6t}{2t} = 3$	**Algebraic Expression –** A collection of variables and/or integers without an equal's sign. It cannot be solved.	• Students need to know how to collect like terms with single terms such as $y + y + y = 3y$. • Students need to know how to collect like terms with terms multiplied by an integer bigger than one. e.g $2b + 3b = 5b$	**Steps to Success – Collecting Like Terms** **Step 1:** Identify the "like terms" within the expression. You need to allocate a shape/colour to each variable with the same exponent. Ensure that you include the sign in front of the term in your shape. **Step 2:** Simplify each of the "like terms". If there is no coefficient in front of the variable, the coefficient is 1. **Step 3:** Rewrite the simplified expression. (Remember to write them in order) **Simplifying expressions involving multiplication** **Step 1:** Multiply the coefficients of the variables **Step 2:** Multiply the variables – remember to add the powers for any variables represented by the same letter **Simplifying expressions involving division** **Step 1:** Divide the coefficients of the variables **Step 2:** Divide the variables – remember to subtract the powers for any variables represented by the same letter	
To learn how to use index laws.	• Students will know how to simplify algebraic expressions involving multiplication by correctly applying the index laws. E.g. $x^3 \times x^2$ or $2x^3 \times 4x^2$ • Students will know how to simplify algebraic expressions involving division by correctly applying the index laws. E.g. $x^5 \div x^2$ or $10x^5 \div 2x^2$ • Students will know how to simplify algebraic expressions involving brackets by correctly applying the index laws. E.g. $(x^3)^5$ or $(2x^3)^5$ **Opportunity for challenge:** • Students will know how to simplify algebraic expressions with a mixture of the index laws.	**Index laws** are the rules for simplifying expressions involving powers of the same base number.	• Students need to know how to multiply and divide simple algebraic terms. • Students need to know how to square and cube integers.	When we **multiply** numbers or letters with powers we add the powers, but only when the base number or letter is the same!!! When we **divide** numbers or letters with powers we subtract the powers, but only when the base number or letter is the same!!! When there is a number inside a bracket with powers and another power on the outside, we **multiply** the powers	
To learn how to expand single brackets.	• Students will know how to expand single brackets by multiplying a single integer term over a bracket. E.g. $2(x + 3)$ • Students will know how to expand multiple single brackets and simplify the answer by collecting like terms with a mixture of positive and negative values. • Students will know how to expand multiple single brackets involving index laws and then collect the like terms. E.g. $x(x + 3) + x(2x + 4)$ **Opportunity for challenge:** • Students will know how to form an expression which involves expanding a single bracket.	**Expand –** in maths, expand means multiply out	• Students need to know how to multiply and divide algebraic expressions. • Students need to know how to collect like terms.	**Steps to Success - How do we expand single brackets?** **Step 1** – Multiply the expression within the brackets by the expression outside the bracket. In order to expand the full, bracket, make sure to multiply the entire expression rather than just one term within the expression. Remember if there are indices involved that when we multiply we add them. **Step 2** – Check whether your answer can be simplified Collect any like terms to simplify the answers.	This lesson should be prior knowledge before double brackets.

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To learn how to expand double brackets.	• Students will know that when expanding double brackets, they must multiply every term in the first bracket by every term in the second bracket and then simplify by collecting like terms. • Students will know how to expand double brackets. **Opportunity for challenge:** • Students will know how to form an expression which volves expanding double brackets.	**Quadratic –** involving a squared algebraic term but no other power higher than 2	• Students need to know how to collect like terms. • Students need to know how to multiply algebraic terms.	**How do we expand double brackets?** **Step 1 –** Multiply all terms in the second bracket by the first term in the first bracket and write these terms down. **Step 2 –** Multiply all terms in the second bracket by the second term in the first bracket and write these down. You should now have four terms written down. **Step 3 –** Collect like terms and write your answer, ensuring that you take care with the signs!	
To learn how to factorise expressions into single brackets.	• Students will know how to factorise algebraic expressions into a single bracket by taking out common algebraic factors. • Students will know how to factorise algebraic expressions into a single bracket by taking out multiple common factors. • Students will know that they can check their answers by expanding the bracket in their answer.	**Factorise –** put back into brackets by bringing common factors outside **Highest Common Factor** – the largest number that both or all of the numbers can be divided by	• Students need to know how to multiply and divide algebraic expressions including use of index laws.	**Steps to Success – Factorising expression into a single bracket** **Step 1:** Identify the highest common factor of the terms and write it in front of brackets. **Step 2:** Figure out what you multiply the HCF with to get the first term of the expression given in the question. This will be the first term that you place inside the bracket. **Step 3:** Figure out what you multiply the HCF with to get the second term of the expression given in the question. This will be the second term that you place inside the bracket.	
To learn how to factorise into double brackets.	• Students will know how to factorise quadratic expressions of the form $ax^2 + bx + c$ where a is 1. • Students will know that they can check their answers by expanding the brackets in their answer. **Opportunity for challenge:** • Students will know how to use the difference of two squares to factorise expressions such as $x^2 - 4$.		• Students need to know how to factorise expressions into single brackets.	**Steps to Success – Factorising Quadratics** **Step 1:** In order to factorise quadratics, we need to find two numbers where the sum is the coefficient of the x term and the product is the number within the expression. **Step 2:** Once you have found these numbers, a and b, they are then substituted into brackets as follows: (x ± a)(x ± b) **You can check your answer by expanding the brackets.**	
To learn how to substitute numbers into expressions and formulae.	• Students will know how to substitute positive and negative integers into simple algebraic expressions. • Students will know how to substitute positive and negative integers into simple formulae. • Students will know how to positive and negative numbers into worded formulae. **Opportunity for challenge:** • Students will know how to substitute positive and negative numbers into kinematics formulae.	**Substitution** - replacing letters with numbers in algebraic expressions or equations	• Students need to able to use BIDMAS. •	**Steps to Success - Substitution** **Step 1:** Write the **expression** out with the calculation symbols in all of the correct places. **Step 2: Substitute** the values for each letter into the correct place in the calculation. **Step 3:** Calculate the answer remembering to follow **BIDMAS.**	
To learn how to solve linear equations.	• Students will know how to solve simple two step linear equations with one unknown to find an integer solution. e.g. $2x + 3 = 15$ • Students will know how to solve two step linear equations involving fractions. E.g. $\frac{x}{2} + 3 = 4$ • Students will know how to solve equations involving a bracket. E.g. $2(4x + 6) = 10$ • Students will know that they can get positive and negative solutions. • Students will know how to expressions non-integer solutions.	**Solve –** find an answer **Equation –** a mathematical statement where two algebraic expressions are equal **Linear Equation –** an equation where the highest power of x is 1	• Students need to know how to solve one step linear equations.	**Steps to Success – Solving two step linear equations** **Step 1:** Determine what operation needs to happen first. Do this by going in reverse BIDMAS order. **Step 2:** Carry out the inverse operation across both sides of the equation to keep it balanced. This is usually an addition or subtraction. **Step 3:** Repeat steps one and two until the value of the letter is found. **Steps to Success – Solving equations with brackets** **Step 1:** Expand the bracket.	

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				Step 2: Determine what operation needs to happen first. Do this by going in reverse BIDMAS order. **Step 3:** Carry out the inverse operation across both sides of the equation to keep it balanced. This is usually an addition or subtraction. **Step 4:** Repeat steps two and three until the value of the letter is found.	
To learn how to solve linear equations with unknowns on both sides.	• Students will know how to solve equations which involve expressions over a fraction. E.g. $\frac{2x+3}{4} = 12$ • Students will know how to solve equations with unknowns on both sides. E.g. $2x + 6 = 4x - 8$ **Opportunity for challenge:** • Students will know how to solve equations involving brackets on both sides.		• Students need to know how to solve two-step linear equations.	**Steps to Success – Solving equations with unknowns on both sides** **Step 1:** Select the smallest value of x. **Step 2:** Carry out the inverse operation with the smallest x across both sides of the equation to keep it balanced. **Step 3:** Determine what operation needs to happen first. Do this by going in reverse BIDMAS order. **Step 4:** Carry out the inverse operation across both sides of the equation to keep it balanced. This is usually an addition or subtraction. **Step 5:** Repeat steps two and three until the value of the letter is found.	
To learn how to form and solve linear equations.	• Students will know how to write simple expressions based on worded scenarios. • Students will know how to write expressions based on multi-step events. • Students will know how to form and solve simple equations based on worded scenarios. **Opportunity for challenge:** • Students will know how to form equations using multiple expressions to solve a problem. E.g. Age problems with three people.		• Students need to know how to solve equations. • Students need to know how to identify expressions and equations.	**Steps to Success – Forming and solving equations** **Step 1:** Read the question carefully. **Step 2:** Form an expression for the question. This may be in parts to begin with. **Step 3:** Form the equation. **Step 4:** Solve the equation. **Step 5:** Double check that you have found what the question is asking for. Sometimes substitution is needed.	
To learn how to change the subject of a formula.	• Students will know how to rearrange one step formulae to change the subject. E.g. $t = 4g$ • Students will know how to rearrange two step formulae to change the subject. E.g. $r = 4p - h$ **Opportunity for challenge:** • Students will know how to rearrange formulae involving powers and roots to change in the subject.	**Rearrange –** change the position of **Change the subject** - rewrite the equation so that a different letter is isolated on one side of the equal's sign **Formulae –** mathematical relationships or rules expressed in symbols, letter and/or numbers. E.g. $A=\pi r^2$ **Inverse –** opposite	• Students need to know how to solve linear equations. • Students need to know how to use inverse operations.	**Steps to Success – Rearranging formulae** **Step 1:** Highlight the letter that you want to isolate. **Step 2:** Determine what operation needs to happen first in order to leave this letter on it own. Do this by going in reverse BIDMAS order. **Step 2:** Carry out the inverse operation across both sides of the formula to keep it balanced. **Step 3:** Repeat steps one and two until the letter is isolated.	
To learn how to represent and interpret inequalities on number lines.	• Students will know how to use inequality signs to show inclusive and exclusive inequalities. • Students will know how to list some integers that satisfy an inequality. E.g. $x > 4$ or $x \leq 9$. • Students will know how to list integers that satisfy an inequality. e.g. $-2 \leq x < 3$	**Integer –** whole number **Inequality –** a symbol which makes a non-equal comparison between two numbers or/and letters e.g. >, <, ≥ and ≤ **Satisfies –** meet the expectations	• Students need to know the meanings behind inequality notation - >, <, ≥ and ≤ .	**Steps to Success – Drawing inequalities on a number line with one limit** **Step 1:** Identify the limit of the inequality and draw a circle above this number. **Step 2:** If the limit is **less than or equal to** or a **greater than or equal to**, colour in the circle.	

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	• Students will know how to represent inequalities on a number line. • Students will know how to write linear inequalities to represent a set shown on a number line such as $x < 5$ and $2 \leq x < 7$.	Represent - show		**Step 3:** Identify if the inequality is a greater than or less than. If it is a greater than, draw the arrow pointing to the right. If it is a less than, draw the arrow pointing to the left. **Steps to Success – Drawing inequalities on a number line with two limits** **Step 1:** Identify the limits of the inequality and draw a circle above both numbers. **Step 2:** If the first sign is **less than or equal**, colour in the first circle. **Step 3:** IF the second sign is **greater than or equal to**, colour in the second circle. **Step 4:** Connect the circles with a single straight line. **Steps to Success – Writing inequalities from a number line with one limit** **Step 1:** Write down the letter. **Step 2:** If the circle is not coloured in then the limit is **less than** or **greater then**. If the circle is coloured in, then the limit is **less than or equal to** or a **greater than or equal to**. Write the sign to the right of your letter. **Step 3:** Identify the limit of the inequality by looking at the number which the circle is above. Write this number down on the right of your inequality sign. **Step 4:** Double check that your inequality makes sense for the diagram you have. **Steps to Success – Writing inequalities from a number line with two limits** **Step 1:** Write down the letter. **Step 2:** If the first circle is not coloured in then the limit is **less than**. If the first circle is coloured in, then the limit is **less than or equal to**. Write the sign to the left of your letter – pointing it to the left. **Step 3:** If the second circle is not coloured in then the limit is **less than**. If the second circle is coloured in, then the limit is **less than or equal to**. Write the sign to the right of your letter – pointing it to the left. **Step 4:** Identify the limits of the inequality by looking at the numbers which each circle is above. Write these numbers down. The smallest number should be on the left and the biggest number should be on the right. **Step 5:** Double check that your inequality makes sense for the diagram you have.	
To learn how to solve linear inequalities.	• Students will know that the solution to solving a linear inequality will actually give a range of possible solutions. • Students will know how to solve simple one step linear inequalities. • Students will know how to solve two step linear inequalities. E.g. $2x + 8 \leq 10$	Range - vary or extend between specified limits.	• Students need to know how to solve one and two step linear equations.	**Steps to Success – Solving two step linear inequalities** **Step 1:** Determine what operation needs to happen first. Do this by going in reverse BIDMAS order. **Step 2:** Carry out the inverse operation across both sides of the inequality to keep it balanced. This is usually an addition or subtraction.	

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	• Students will know how to solve inequalities and then represent the solution on a number line. **Opportunity for challenge:** • Students will know how to solve linear inequalities with two signs.			**Step 3:** Repeat steps one and two until the value of the letter is found. **Step 4:** Double check that your answer has the inequality in it.	
Mini-Assessment 5					