The Sutton Academy

Knowledge Rich Curriculum Plan

Year 9 Prime – Algebraic Expressions

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
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 $(2x^3)^5$ • Students will know how to simplify algebraic expressions with a mixture of the index laws.	**Algebraic Expression –** A collection of variables and/or integers without an equal's sign. It cannot be solved. **Index laws** are the rules for simplifying expressions involving powers of the same base number.	• Students need to know how to simplify algebraic expressions by collecting like terms. • Students need to know how to simplify simple algebraic expressions by multiplying or dividing.	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 and double 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 single brackets by multiplying an algebraic term over a bracket. E.g. $x(x - 4)$ • Students will know how to expand single brackets by multiplying multiple terms over a bracket. e.g. $2ab(4a + b)$ • 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. $x(x + 3) + x(2x + 4)$ • Students will know how to form an expression which involves expanding a single bracket. • Students will know how to expand double brackets. • Students will know how to form an expression which involves expanding double brackets.	**Expand –** in maths, expand means multiply out **Quadratic –** involving a squared algebraic term but no other power higher than 2	• Students need to know how to multiply and divide algebraic expressions including use of index laws. • 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. **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 expand triple brackets.	• Students will know how to expand a double bracket with an extra term on the outside. E.g. $2(x + 5)(x - 4)$ or $x(x + 3)(x - 2)$ • Students will know how to expand triple brackets. E.g. $(x + 6)(x + 5)(x - 4)$ **Opportunity for challenge:** • Students will know how to expand triple brackets involving powers. E.g. $(x + 5)^3$ or $(x - 3)(x + 1)^2$	**Cubic –** involving a cubed algebraic term but no other power higher than 3	• Students need to know how to expand double brackets.	**Expanding Three Brackets – Steps to Success** **Step 1:** Expand out the first two brackets and simplify your answer **Step 2:** Put your answer back into a bracket and put the third bracket next to it **Step 3:** Expand the resulting two brackets by multiplying the first term in the first bracket by both parts of the second bracket, followed by the second term in the first bracket by both parts of the second bracket and then finally the third part of the first bracket by the third part of the second bracket **Step 4:** Simplify your answer	

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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 numerical factors. • 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.	<u>How do we factorise linear expressions?</u> **Step 1:** Identify the highest common factor of the terms, and write it in front of brackets. **Step 2:** In order to find the expression within the brackets, divide the terms by the highest common factor. **Step 3:** Rewrite your expression with the highest common factor outside the brackets and your new expression within the brackets.	
To learn how to factorise simple quadratic expressions 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 how to use the difference of two squares to factorise expressions such as $x^2 - 4$. • 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 $9x^2 - 4$.		• Students need to know how to factorise expressions into single brackets.	<u>Steps to Success – Factorising Quadratics</u> **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 factorise harder quadratic expressions into double brackets.	• Students will know how to factorise quadratic expressions of the form $ax^2 + bx + c$ where a is greater than 1. • Students will know that they can check their answers by expanding the brackets in their answer.		• Students need to know how to factorise quadratic expressions of the form $ax^2 + bx + c$ where a is 1.	<u>Factorising quadratics in the form $ax^2 + bx + c$ where a > 1</u> Step 1: Find the two numbers that multiply together to give the product of a and c and sum to b. We will call the two numbers we find 'd' and 'e'. Step 2: Rewrite the factorised expression as $ax^2 \pm dx \pm ex + c$ Step 3: Draw a line down the centre of the new expression, splitting it in half Step 4: Factorise either side of the line into single brackets Step 5: Check that the two brackets match and then copy this bracket as one of your brackets. The other bracket comprises of the parts you brought outside of the brackets when you factorised.	
To learn how to factorise harder quadratic expressions into double brackets. (2nd lesson)	• Students will know how to factorise quadratic expressions of the form $ax^2 + bx + c$ where a is greater than 1. • Students will know that they can check their answers by expanding the brackets in their answer.		• Students need to know how to factorise quadratic expressions of the form $ax^2 + bx + c$ where a is 1.	<u>Factorising quadratics in the form $ax^2 + bx + c$ where a > 1</u> Step 1: Find the two numbers that multiply together to give the product of a and c and sum to b. We will call the two numbers we find 'd' and 'e'. Step 2: Rewrite the factorised expression as $ax^2 \pm dx \pm ex + c$ Step 3: Draw a line down the centre of the new expression, splitting it in half Step 4: Factorise either side of the line into single brackets Step 5: Check that the two brackets match and then copy this bracket as one of your brackets. The other bracket comprises of the parts you brought outside of the brackets when you factorised.	

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To learn how to simplify algebraic fractions.	• Students will know how to simplify algebraic fractions by cancelling out terms from the numerator and denominator, without factorising. • Students will know how to simplify algebraic fractions by factorising the numerator/denominator into single brackets and then simplifying by cancelling out common factors. • Students will know how to simplify algebraic fractions by factorising the numerator/denominator into double brackets and then simplifying by cancelling out common factors. • Students will know how to simplify algebraic fractions by factorising the numerator/denominator into a mixture of brackets and then simplifying by cancelling out common factors.		• Students need to know how to factorise expressions into single and double brackets. • Students need to know how to simplify fractions.	**Steps to Success - Simplifying algebraic fractions** We simplify algebraic fractions in the same way as we simplify numerical fractions – by finding common factors and dividing both the numerator and denominator by the common factor **Step 1: Factorise** everything you can **Step 2:** Cancel out any brackets that are common to both the numerator and denominator **Step 3:** Check whether there is a common numerical factor in all parts of the numerator and denominator – if there is, divide by this factor **Step 4:** Double check your answer is in its simplest form	
To learn how to add and subtract algebraic fractions.	• Students will know how to add algebraic fractions with a numerical denominator. • Students will know how to subtract algebraic fractions with a numerical denominator. **Opportunity for challenge:** • Students will know how to add or subtract algebraic fractions with an algebraic denominator.		• Students need to know how to multiply, add and subtract algebraic expressions. • Students need to know how to add and subtract fractions.	**How do we add and subtract algebraic fractions?** We add and subtract algebraic fractions in the same way as we add and subtract numerical fractions: **Step 1:** Find a common denominator, if the denominator is algebraic multiply the two denominators together using brackets. **Step 2:** Keep your fractions equivalent – whatever you have done to the numerator you must also do to the denominator. **Step 3:** Expand out anything that needs expanding on the numerator. **Step 4:** Add the numerators, remember the denominator stays the same. **Step 5:** Simplify your answer if you can.	
To learn how to substitute numbers into expressions and formulae.	• Students will know how to substitute positive and negative integers into formulae. • Students will know how to substitute positive and negative numbers into worded formulae.	**Substitution** - replacing letters with numbers in algebraic expressions or equations	• Students need to know how to use the order of operations.	**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. $2(4x + 6) = 10$	**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.	

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	• Students will know that they can get positive and negative solutions. • 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 expressions non-integer solutions.			**Steps to Success – Solving equations with brackets** **Step 1:** Expand the bracket. **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 with unknowns on both sides. E.g. $2x + 6 = 4x - 8$ • Students will know how to solve equations involving brackets on both sides. **Opportunity for challenge:** • Students will know how to solve equations involving fractions 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. • Students will know how to form equations using multiple expressions to solve a problem. E.g. Age problems with three people. **Opportunity for challenge:** • Students will know how to form and solve equations involving angles. • Students will know how to form and solve equations involving area and perimeter.		• Students need to know how to solve equations. • Students need to know how to identify expressions and equations. • Students need to know how to form expressions	**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. **Steps to Success – Forming and solving equations involving area and perimeter** **Step 1:** Read the question carefully. **Step 2:** Form an expression for the area or perimeter. **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. **Steps to Success – Forming and solving equations involving shapes** **Step 1:** Read the question carefully. **Step 2:** Form an expression for the total of the angles. **Step 3:** Form the equation with knowledge using angle facts. **Step 4:** Solve the equation. **Step 5:** Double check that you have found what the question is asking for. Sometimes substitution is needed.	

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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. $r = 4p - h$ • Students will know how to rearrange formulae involving powers and roots to change in the subject. **Opportunity for challenge:** • Students will know how to rearrange formulae involving fractions to change the subject. • Students will know how to rearrange formulae with factorisation	**Rearrange –** change the position of. **Formula –** A mathematical relationship or rule expressed in symbols. Example $A=\pi r^2$ **The subject of a formula** - is the variable that can be recognised as on its own on one side of the equation.	• 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 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. $2x + 8 \leq 10$ • Students will know how to solve linear inequalities with two signs. • 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 inequalities which involve multiplying or dividing by a negative coefficient.	**Inequality –** a symbol which makes a non-equal comparison between two numbers or other mathematical expressions e.g. >, <, ≥ and ≤ **Satisfies –** meet the expectations **Represent** - show **Range** - vary or extend between specified limits.	• Students will know how to list some integers that satisfy an inequality. E.g. x>4 or x≤9. • Students will know how to draw inequalities on number lines IF STUDENTS GET THIS WRONG IT MUST BE ADDRESSED IN THE PRIOR KNOWLEDGE CONSOLIDATION.	**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. **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 3					