The Sutton Academy

Knowledge Rich Curriculum Plan

Year 9 Prime – Calculations, HCF/LCM, Standard Form and Surds.

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
To learn how to calculate with negative numbers.	• Students will know how to add and subtract with negative numbers using a number line. E.g. $4 - 7$ or $-3 + 5$ • Students will know how to add and subtract with negative numbers using a number line. E.g. $4 - -7$ or $-3 + -5$ • Students will know how to multiply a positive number to a negative number. • Students will know how to multiply two negative numbers together. • Students will know how to divide when one number is positive and one is negative. • Students will know how to divide when both numbers are negative. • Students will know how to solve real life problems involving adding, subtracting, multiplying and dividing of negative numbers. **Avoid using terminology such as 2 negatives make a positive. Make sure students understand why.**	**Negative –** Less than zero **Integer –** a whole number	• Students need to know how to order positive and negative numbers. • Students need to know how to add, subtract, multiply and divide positive integers.	**Adding and Subtracting Negative Numbers** Think of positive numbers as **hot** and negative numbers as **cold**. **Adding a negative number** is like adding cold air to a room — it makes the room colder. So, the number goes **down**. **Subtracting a negative number** is like removing cold air from a room — it makes the room warmer. So, the number goes **up**.	
To learn how to multiply decimals.	• Students will know how to multiply decimals by integers. • Students will know how to multiply a decimal by a decimal. • Students will know how to solve multi-step problems involving multiplication of decimals.	**Decimal –** a number whose whole number part and the fractional part is separated by a decimal point Use a spider diagram to show different words which mean to multiply. E.g. product	• Students need to know how to multiply and divide by powers of 10. • Students need to know how to multiply 2-digit and 3-digit integers by a 2-digit integer using column multiplication.	**Step 1:** Multiply each number by powers of ten to transform it from a decimal to an integer **Step 2:** Multiply the two integers using column multiplication **Step 3:** Adjust your answer by dividing by the powers of 10 that you multiplied by at the start (for example if you multiplied one number by 10 and the other by 100 you would need to divide by 1000 (10 x 100)	
To learn how to divide with decimals.	• Students will know how to divide a decimal by an integer using short division. • Students will know how to divide a decimal by a decimal. • Students will know that they will not need to make any extra adjustments to their answer as its equivalent to the original divide. • Students will know how to solve simple real-life problems involving the division of decimals.	Use a spider diagram to show different words which mean to divide. E.g. share	• Students need to know how to divide 2-digit and 3-digit integers by a 1-digit integers using short division. • Students need to know how to divide 2-digit and 3-digit integers by 2-digit integers using short division. • Students need to know how to multiply by powers of 10.	**Step 1:** Write the question as a fraction. **Step 2:** Multiply both the numerator and denominator by an appropriate power of ten to eliminate the decimal in the denominator but keep the fraction equivalent to the original question. **Step 3:** Divide the numerator by the denominator using the bus stop method where necessary.	

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To learn how to use numerical index laws.	• Students will know how to use the basic index law for multiplication with an integer base. • Students will know how to use the basic index law for division with an integer base. • Students will know how to use the basic index law for brackets with an integer base. • Students will know how to interpret the power of 0. • Students will know how to use the basic index laws involving negative powers. • Students will know how to use a mixture of the index laws within the same problem. Show students how it works rather than just using tricks.	**Indices –** plural of index, in maths, an index, or a power, is the small floating number that goes next to a number or letter	• Students need to know how to find the value of a number raised to an integer power	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 **Negative Indices - Steps to Success** To find the value of any number raised to a negative power, find the answer if the power was positive and then find the **reciprocal** of your answer, algebraically this can be written as: $a^{-b} = \frac{1}{a^b}$	
To learn how to evaluate negative and fractional indices.	• Students will know how to evaluate negative powers such as $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$. • Students will know that to evaluate a negative power they must use the reciprocal of the number. • Students will know how to evaluate fractional powers such as $4^{\frac{1}{2}} = \sqrt{4} = \pm 2$. • Students will know that the denominator of the fractional power corresponds to the root. **Opportunity for challenge:** • Students will know how to evaluate more difficult fractional powers such as $8^{\frac{2}{3}} = (\sqrt[3]{8})^2 = 2^2 = 4$, starting with the root first. • Students will know that the numerator of the fractional power corresponds to the power.	**Reciprocal** – The reciprocal of a number is 1 divided by the number	• Students need to know how to find roots of numbers • Students need to know how to find the reciprocal of an integer.	**Fractional Indices - Steps to Success** A power of $\frac{1}{2}$ means that you actually find the square root. A power of $\frac{1}{3}$ is cube root, and A power of $\frac{1}{4}$ is 4th root, and so on! When the power is a fraction with a **numerator** that isn't 1, we have to find the root indicated by the **denominator** and then raise the answer to the power of the numerator. Algebraically this can be written as: $a^{\frac{b}{c}} = (\sqrt[c]{a})^b$	
To learn how to round to significant figures and estimate answers	• Students will know how to round to a given number of significant figures. • Students will know that to estimate a calculation they must first round each number to 1sf. • Students will know how to estimate the solution to a simple calculation. E.g. 483×52 • Students will know how to estimate calculations involving fractions when the denominator rounds to an integer. • Students will know how to estimate calculations involving fractions when the denominator rounds to 0.5.	**Rounding –** making a number simpler but keeping its value close to what it was. **Significant –** important **One significant figure** –the first non-zero digit which has the most value **Estimate –** an approximate calculation of the value of something	• Students need to know how to round to the nearest 10, 100 and 1000. Students need to know how to round to the nearest decimal place.	**Steps to Success - Rounding** **Step 1:** Identify which number you are rounding to. **Step 2:** Look at the number to the right of the one identified. If it is below 5, then we keep the identified digit the same. If it is 5 or more, then we round up the identified digit. **Step 3:** Round down by cutting off the values to the right. Round up by adding one to the identified value.	

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	• Students will know how to estimate calculations involving fractions when the denominator rounds to a decimal such as 0.1 or 0.2. **Opportunity for challenge:** • Students will know how to use estimation in real-life problems			**Step 4:** Check your answer – Does it have a similar value to the number you started with? **Steps to Success - Estimation** **Step 1:** Round the values in the question to **1 significant figure.** **Step 2:** Use BIDMAS to calculate the answer making sure to show each step.	
To learn how to determine bounds and error intervals.	• Students will know how to find the upper and lowers bounds of numbers given to varying degrees of accuracy. • Students will know that the upper bound is rounded and they would actually everything up to but not including the upper bound. • Students will know how to use inequality notation to specify simple error intervals due to rounding. • Students will know how to use inequality notation to specify simple error intervals due to truncation. **Opportunity for challenge:** • Students will know how to find the upper and lower bounds to solve a problem involving calculations.	**Error interval** – an expression written using inequalities that shows the range of possible values that a number could have been before it was rounded or truncated. **Inequality –** a symbol which makes a non-equal comparison between two numbers or other mathematical expressions e.g. >, <, ≥ and ≤ **Truncated –** cut off. In maths, if a number has been truncated it has been cut off without considering how the number should be rounded.	• Students need to know how to round to varying degrees of accuracy. • Students need to know how to use inequality notation.	**Steps to Success – Finding Upper and Lower Bounds** **Step 1:** List the values with the same degree of accuracy that would come before and after the number that has been rounded with the number in the question in the middle. **Step 2:** Find the midpoint of the lowest value and the value that has been rounded – this is the lower bound. **Step 3:** Find the midpoint of the highest value and the value that has been rounded – this is the upper bound. **Steps to Success – Writing error intervals** **Step 1:** List the values with the same degree of accuracy that would come before and after the number that has been rounded with the number in the question in the middle **Step 2:** Find the midpoint of the lowest value and the value that has been rounded – this is the lower bound **Step 3:** Find the midpoint of the highest value and the value that has been rounded – this is the upper bound **Step 4**: Input the Upper and lower bound into the forma UB	
To learn how to find the HCF and LCM of two numbers using Venn diagrams.	• Students will know how to find the highest common factor of two numbers by using the product of prime factors and a Venn diagram. • Students will know that to find the highest common factor from a Venn diagram they must find the product of the numbers contained within the overlap. • Students will know that if there is a single integer contained within the overlap of a Venn diagram then	**Prime** –numbers, that have only two factors: 1 and the number itself. **Product** – multiplication **Product of Primes** – a product in which every factor is a prime number	• Students will need to know how to find the HCF and LCM from lists • Students need to know how to write a number as a product of its prime factors	**Steps for Success – Product of prime factors** **Step 1:** To construct a factor tree, think of 2 numbers which multiply together to make the integer in the question. **Step 2:** Draw two branches coming down from the integer, and at the end of the branches write the two factors that you chose.	

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	that number is the highest common factor of the two numbers. • Students will know that if there are no numbers contained within the overlap then the highest common factor of the two numbers is 1. • Students will know how to find the lowest common multiple of two numbers by using the product of prime factors and a Venn diagram. Students will know that to find the lowest common multiple from a Venn diagram the must find the product of all the numbers contained within the whole Venn diagram. • Students will know how to find the HCF and LCM of three numbers using a Venn diagram.	Highest Common Factor – the largest number that both or all of the numbers can be divided by Lowest Common Multiple – the smallest number that is in both numbers' times tables		**Step 3:** If a factor is prime, then circle it. If a factor is not prime, then repeat the process until each number at the end of each branch is prime. **Step 4:** Write the prime factors as a product in index form. **Steps for Success – Finding the HCF and LCM from Venn diagrams.** **Step 1:** Find the product of prime factors for both numbers. **Step 2:** Now draw a Venn diagram where each circle represents each number. **Step 3:** Cross off a common factor from both lists and place the number in the overlap/intersection of the Venn diagram. Repeat this until there are no common factor left. **Step 4:** Place any remaining numbers from the lists into the circle that represents that number. **Step 5:** To find the **HCF**, we multiply the numbers in the intersection (these are the factors that are common between both numbers). To find the **LCM** we multiply all of the numbers in the Venn diagram together.	
To learn how to use HCF and LCM to solve problems.	• Students will know how to solve problems using the HCF and LCM in a real-life context such as lights flashing at particular intervals. • Students will know how to solve problems using the HCF and LCM in a real-life context involving time such as buses in a station at a particular time. • Students will know how to solve problems such as how many packs of burgers and buns are needed if the same amount of each is wanted. **Opportunity for challenge:** • Students will know how to solve how to find the HCF and LCM from two numbers that are written in their prime decomposition format.		• Students need to know how to find the HCF and LCM of two numbers using lists. • Students need to know how to find the HCF and LCM of two numbers from Venn diagrams.		
To learn how to calculate with numbers written in standard form	• Students will know to multiply numbers in standard form. • Students will know how to divide numbers in standard form. • Students will know that to add and subtract numbers written in standard form. • Students will know how to solve more complex problems with numbers written in standard form both with and without a calculator (as appropriate)		• Students will need to know how to convert from standard form to ordinary numbers and vice versa. Students will need to know basic index laws *IF STUDENTS STRUGGLE THIS IS WHERE THE PRIOR KNOWLEDGE CONSOLIDATION SLIDE IS ESSENTIAL. YOU MUST NOT MOVE*	**Multiplying numbers written in standard form – Steps to Success** **Step 1:** Multiply the 'a' for each number written in standard form **Step 2:** Multiply the two 10^n parts, remember when multiplying with powers it is the same as adding the powers **Step 3:** Put the two parts back together **Step 4:** If necessary, check your answer is written in standard form, if not you will need to adjust your answer	

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			ON UNTIL STUDENTS ARE CONFIDENT WITH THIS	**Dividing numbers written in standard form – Steps to Success** **Step 1:** Divide the 'a' for each number written in standard form **Step 2:** Divide the two 10^n parts, remember when dividing with powers it is the same as subtracting the powers **Step 3:** Put the two parts back together **Step 4:** If necessary, check your answer is written in standard form, if not you will need to adjust your answer **Adding and subtracting numbers written in standard form – Steps to Success** **Step 1:** Write the numbers as ordinary numbers **Step 2:** Add or subtract the numbers using column addition/subtraction **Step 3:** Write your answer in standard form if necessary **Step 4:** Check your answer is written in standard form, if not you will need to adjust your answer	
To learn how solve problems involving standard form	• Students will know how to convert in and out of standard form using a calculator. • Students will know how to adjust standard form • Students will know how to solve problems involving standard form.		• Students need to know how to input powers and fractions on a calculator.		
To learn how to simplify and multiply surds.	• Students will know why a surd is irrational. • Students will know the difference between rational and irrational numbers. • Students will know how to recognise and identify surds. • Students will know how to simplify surds by breaking it down into two factors, one of which is a square number. • Students will know that in order to fully simplify surds they must use the biggest square number factor possible. • Students will know how to multiply surds. • Students will know how to multiply surds with integers. • Students will know how to multiply surd and integer products. **Opportunity for challenge:** • Students will know how to simplify surds which are already a product of a surd and an integer.	**Surd –** a square root which cannot be reduced to a whole number. Surds are irrational numbers. **Irrational Numbers** – Numbers which, when written in decimal form, would go on forever.	• Students will need to know their square numbers and the corresponding roots.	**How do we simplify Surds?** **Step 1:** Find a factor pair for the number being square rooted. One of the numbers in the factor pair must be a square number. **Step 2:** Rewrite the surd as $\sqrt{factor\ a} \times \sqrt{factor\ b}$ **Step 3:** Square root the number that can be square rooted **Step 4:** Rewrite the answer in the form $c\sqrt{b}$ where c is the square root of factor a **How do we Multiply surds?** **Step 1:** Multiply integers by integers **Step 2:** Multiply roots by roots **Step 3:** Combine the answer and simplify where possible	

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To learn how to divide, add and subtract surds.	• Students will know how to divide surds. • Students will know how to divide surd and integer products. • Students will know how to add by simplifying the surds so that the root is the same number. • Students will know how to subtract surds by simplifying them so that the root is the same number. • Students will know that we can only add and subtract surds where the root is the same.		• Students will need to know how to simplify surds.	**How do we divide Surds?** **Step 1:** Divide integers by integers **Step 2:** Divide roots by roots **Step 3:** Combine the answer and simplify where possible **How do we add and subtract Surds?** **Step 1:** Ensure the number under the square root is the same, if not simplify the surds as much as possible **Step 2:** Collect any roots with the same number under the square root together like you would with algebra (for instance $3\sqrt{a} + 5\sqrt{a} = 8\sqrt{a}$) **Remember you can only collect the same roots together!**	
To learn how to expand brackets with surds	• Students will know how to expand single brackets with surds **Opportunity for challenge:** • Students will know how to expand double brackets with surds	**Expand –** open up or make bigger, expanding a bracket means we need to multiply each term in the bracket by the expression outside the bracket	• Students will need to know how to multiply surds • Students will need to know how to expand single brackets involving algebra.	**Steps to success – Expanding Single Brackets with Surds** **Step 1:** Using the rules for multiplying with surds, multiply everything on the outside of the bracket by everything on the inside of the bracket, remember to apply the rules of negatives. **Step 2:** Check whether any of your products can be simplified. If they can you must simplify them. **Steps to success – Expanding Double Brackets with Surds** **Step 1:** Using the rules for multiplying with surds, multiply the first term in the first bracket by each of the terms in the second bracket. **Step 2:** Using the rules for multiplying with surds, multiply the second term in the first bracket by each of the terms in the second bracket.	

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				Step 3: Check whether any of the square roots or surds that have been produced can be simplified and simplify where possible **Step 4:** Collect like terms together using the rules for adding and subtracting surds.	
Mini-Assessment 1					