The Sutton Academy

Knowledge Rich Curriculum Plan

Year 9 Support – Powers and Roots and Calculations.

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
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. **Opportunity for challenge:** • Students will know how to interpret the power of 0. • Students will know how to use the basic index laws involving negative powers. Show students how it works rather than just using tricks.	**Index** – An index, or a power, is the small floating number that goes next to a number or letter	• Students should already know how to find powers and roots of integer numbers.	**Steps to success – Index Laws** There are four index laws that we use to simplify expressions or write a number as a single power: • When the bases are the same and you're multiplying, add the indices. • When the bases are the same and you're dividing, subtract the indices. • When there are brackets, multiply the indices.	
To learn how to use the order of operations.	• Students will know that division and multiplication are interchange operations. • Students will know that when a calculation has only addition and subtract involved that they must calculate from left to right. • Students will know how to apply the order of operations to complete simple calculations using BIDMAS. E.g. $3 + 10 \div 5$ or $4 \times (2 + 3)$ • Students will know how to apply the order of operations to calculations involving indices. E.g. $5 + 4^2 \div 8$ • Students will know how to apply the order of operations to calculations involving several steps. E.g. $(6 + 5) \times 4^2 \div 8$ **Opportunity for challenge:** • Students will know how to place brackets in a calculation to obtain a certain answer. They will not think that division comes before multiplication or addition comes before subtraction.		• Students need to know how to calculate powers and roots of integer numbers.	**Steps to Success - BIDMAS** **Step 1:** Prioritise any calculation involving brackets. **Step 2:** Next we prioritise any calculation involving indices. **Step 3:** Then Prioritise any calculation involving multiplication; and division. **Step 4:** Finally, prioritise any calculation involving addition and subtraction (You MUST answer these going left to right.)	
To learn how to convert between standard form and ordinary numbers.	• Students will know that a number written in standard form is written as $a \times 10^n$, where $1 \leq a < 10$. • Students will know how to write large in the form $a \times 10^n$, where $1 \leq a < 10$. • Students will know how to write small numbers in the form $a \times 10^{-n}$, where $1 \leq a < 10$. • Students will know how to convert large numbers written in standard form back into ordinary numbers. • Students will know how to convert small number written in standard form back into ordinary numbers. **Opportunity for challenge:** • Students will know how to order numbers given in standard form by converting to them into ordinary numbers.	**Standard form -** a way of writing down very large or very small numbers easily, a number is written in standard form when it is written in the form a x 10^n where $1 \leq a < 10$	• Students need to know how to multiply and divide by powers of 10. • Students need to know how to calculate numbers with integer powers.	**Steps to Success - Writing numbers in standard form** **Step 1:** To write a number in standard form put the decimal point after the first significant figure. This will give you 'a' between 1 and 10. **Step 2:** Work out how many times you would have to multiply or divide that number by 10 to get the original number. **Step 3:** Write this after your number as x10^n where n is positive if the number needs multiplying by 10 and negative if we need to divide the number by 10. The value of n tells us how many times we need to multiply or divide by 10. **Steps to Success - Converting numbers out of standard form** To convert a number that is written in the form $a \times 10^n$ out of standard form, when n is positive multiply the 'a'	

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				by 10, *n* times. When *n* is negative divide the 'a' by 10, *n* times.	
To learn how to round to the nearest 10, 100, 1000 and to a given number of decimal places.	• Students will know how to round to the nearest 10. • Students will know how to round to the nearest 100. • Students will know how to round to the nearest 1000. • Students will know how to round to the nearest 10, 100, 1000. • Students will know how to round to the nearest whole number. • Students will know how to round to a given number of decimal places • Students will know to identify the number they are rounding to, look at the number to the right of it and decide whether to round up or down. • Students will know to round up if the digit to the right is 5-9. • Students will know to round down if the digit to the right is 0-4. • Students will know that to round up they must add one to the number they are rounding to. • Students will know that to round down they must not subtract one from the number they are rounding to. • Students will know that their rounded value will be similar to their original value – they can use this to check answers.	**Rounding –** making a number simpler but keeping its value close to what it was. The result is less accurate, but easier to use	• Students need to know how to identify the value of a digit within a number.		
To learn how to round to a given number of significant figures and estimate.	• Students will know how to round integers and decimals to one and two significant figures. • Students will know that to estimate a calculation you need to round 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. **Opportunity for challenge:** • Students will know how to estimate calculations involving fractions when the denominator rounds to 0.5.	**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. • Students will need to know how to round to one significant figure. • Students will need to know how to carry out calculations using the order of operations.	**Steps to Success – Significant figures** **Step 1:** Determine the cut-off point. Draw a line after the desired number of significant figures. **Step 2:** Look at the first digit after the cut-off point. If it is below 5, then we keep the cut-off digit the same.If it is 5 or more, then we round up the cut-off digit. **Step 3** : Add any necessary 0's, delete any unnecessary 0's. **Steps to Success - Estimation** **Step 1:** Round the values in the question to 1 significant figure **Step 2:** Put the rounded numbers into the equation **Step 3:** Calculate the answer	

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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 want to include every number up to but not including the upper bound. **Opportunity for challenge:** • Students will know how to use inequality notation to specify simple error intervals due to rounding.	**Upper bound** – an element greater than or equal to all the elements in a given set **Lower bound** – an element less than or equal to all the elements in a given set **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 ≤	• Students need to know how to round to varying degrees of accuracy. •	**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.	
To learn how to use a calculator.	• Students will know that a calculator uses the order of operations. • Students will know how to input fractions into the calculator. • Students will know how to convert fractions to decimals using the standard to decimal button. • Students will know how to calculate numbers with powers. • Students will know how to calculate the roots of numbers. • Students will know how to use a calculator to solve more complex problems involving a mixture of fractions, powers and root. • Students will know how to write the values from the calculator display. • Students will know how to rounded their answers to a given degree of accuracy. • Students will know how to convert in and out of standard form using a calculator.		• Students need to know how to calculator to solve simple calculations with all 4 operations. • Students need to know how to round to varying degrees of accuracy.		
To learn how to find lowest common multiple and highest common factor of two numbers using lists.	• Students will know how to list all the factors of a number systematically, starting with 1 and itself. • Students will know how to select the correct number from a list of numbers when given descriptions of a number such as 'a factor of ', 'an even factor of', etc. • Students will know how to find the highest common factor (HCF) of two numbers by listing. • Students will know how to find the HCF of three numbers. • Students will know how to list multiples of a numbers, starting with the number itself. • Students will know how to select the correct number from a list of numbers when given descriptions of a number such as 'a multiple of', 'an odd multiple of', etc. • Students will know how to find the lowest common multiple (LCM) of two numbers by listing. • Students will know how to find the LCM of three numbers.	**Common –** shared. **Factor –** A factor is a number that divides into a given number without leaving a remainder **Highest Common Factor** – the largest number that both or all of the numbers can be divided by **Multiple –** A multiple is a number in the given number's multiplication tables **Lowest Common Multiple** – the smallest number that is in both numbers' times tables	• Students need to know how to divide integers.	**Steps to Success – Highest Common Factor (HCF) from lists** **Step 1:** List all the factors of both the numbers. **Step 2:** Identify the largest number they both have in common, this is the Highest common factor. **Steps to Success- Lowest Common Factor (LCM) from lists** **Step 1:** List the first 5-10 multiples of both numbers. **Step 2:** Identify the first multiple that is in both multiplication tables, this is the Lowest Common Multiple.	

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	Opportunity for challenge: • Students will know how to solve real-life HCF problems.				
To learn how to find the product of prime factors.	• Students will recognise and recall the first 10 prime numbers. • Students will know how to identify prime numbers from a list by eliminating values known to be non-prime e.g. even numbers (apart from 2) or multiples of 5. • Students will know how to find the product of prime factors for positive integers. • Students will know that the product of prime factors is unique for every number. • Students will know that to check the product of prime factors they multiply their prime factors together and they should get the original number. • Students will know that it doesn't matter which way you break the number down into prime factors the result should be the same. • Students will know how to find the product of prime factors giving their answer in index form.	**Prime Number** – a number that has exactly 2 factors - 1 and the number itself. **Product** – in maths, a product is the result of multiplication **Product of Primes** – a product in which every factor is a prime number	• Students need to identify prime numbers from a list • Students need to know how to express numbers in index form.	**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. **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.	
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. • Students will know that if there is a single integer contained within the overlap of a Venn diagram then 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 they must find the product of all the numbers contained within the whole Venn diagram.	**Venn diagram** - a diagram representing mathematical or logical sets pictorially as circles or closed curves within an enclosing rectangle (the universal set), common elements of the sets being represented by intersections of the circles.	• Students need to know how to find the product of prime factors.	**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.	
Mini-Assessment 2					