The Sutton Academy

# Knowledge Rich Curriculum Plan

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

| Lesson/Learning Sequence | Intended Knowledge:<br>*Students will know that…* | Tiered Vocabulary | Prior Knowledge:<br>*In order to know this, students need to already know that…* | Assessment |
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| **To learn how to calculate with negative numbers.** | • Students will know how to add and subtract with negative numbers using a number line.<br>• Students will know how to multiply a positive number to a negative number.<br>• Students will know how to multiply two negative numbers together.<br>• Students will know how to divide when one number is positive and one is negative.<br>• Students will know how to divide when both numbers are negative.<br>• Students will know how to solve real-life problems involving negative numbers.<br>Avoid using terminology such as 2 negatives make a positive. | **Negative –** Less than zero<br>**Integer –** a whole number | • Students need to know how to order positive and negative numbers.<br>• Students need to know how to add and subtract positive integers.<br>• Students need to know how to multiply and divide positive integers. | Mini-Assessment 1 |
| **To learn how to multiply decimals.** | • Students will know how to multiply decimals by firstly multiplying the decimals by a power of 10 to produce integer values.<br>• Students will know how to multiply their new integer values using the column method.<br>• Students will know how to lastly divide by the same powers of 10 as used in their first step to produce their decimal product.<br>• Students will know how to solve real life problem involving the multiplication of decimals using the column method- money problems.<br>• 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 | • Students need to know how to multiply and divide by powers of 10.<br>• Students need to know how to multiply integers using column multiplication. | Mini-Assessment 1 |
| **To learn how to divide with decimals.** | • Students will know how to divide a decimal by an integer using short division.<br>• Students will know how to divide a decimal by an integer using long division.<br>• Students will know how to divide a decimal by a decimal by firstly multiplying both numbers by a matching power of 10.<br>• Students will know that the power of 10 needs to at least make that the decimal you are dividing by an integer value.<br>• Students will know how to divide their resulting values to produce an overall answer to the problem without needing to make any extra adjustments.<br>• Students will know how to solve multi-step problems involving division of decimals | | • Students need to know how to divide integers using short division.<br>• Students need to know how to divide integers using long division.<br>• Students need to know how to multiply by powers of 10. | Mini-Assessment 1 |
| **To learn how to use numerical index laws.** | • Students will know how to use the basic index law for multiplication with an integer base.<br>• Students will know how to use the basic index law for division with an integer base.<br>• Students will know how to use the basic index law for brackets with an integer base.<br>• Students will know how to interpret the power of 0.<br>• Students will know how to use the basic index laws involving negative powers.<br>• Students will know how to use a mixture of the index laws within the same problem.<br>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 | Mini-Assessment 1 |
| **To learn how to evaluate negative and fractional indices.** | • Students will know how to evaluate negative powers such as $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$.<br>• Students will know that to evaluate a negative power they must use the reciprocal of the number.<br>• Students will know how to evaluate fractional powers such as $4^{\frac{1}{2}} = \sqrt{4} = \pm 2$.<br>• Students will know that the denominator of the fractional power corresponds to the root.<br>• 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.<br>• 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<br>• Students need to know how to find the reciprocal of an integer | Mini-Assessment 1 |

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| **To learn how to round to significant figures and estimate answers** | • Students will know how to round to a given number of significant figures<br>• Students will know that nonzero digits are always significant<br>• Students will know that zeros between nonzero digits are always significant<br>• Students will know that leading zeros are never significant<br>• Students will know that trailing zeros are only significant if the number contains a decimal point<br>• Students will know that to estimate a calculation they must first round each number to one significant figure and then use the order of operations to calculate.<br>• Students will know how to estimate calculations involving fractions when the denominator rounds to an integer.<br>• Students will know how to estimate calculations involving fractions when the denominator rounds to a decimal such as 0.1 or 0.2.<br>• Students will know how to estimate roots<br>• Students will know how to use estimation in real-life problems. | **Significant –** sufficiently important to be worthy of attention<br>**Rounding –** making a number simpler but keeping its value close to what it was. The result is less accurate, but easier to use<br>**Significant figures** – the digits in a number that contribute to the degree of accuracy of the value and that we start counting significant figures at the first nonzero digit<br>**Estimate –** an approximate calculation or judgement of the value, number, quantity, or extent of something. | • Students should already know how to round to the nearest 10/100/1000 etc.<br>• Students should already know how to round to a given number of decimal places | Mini-Assessment 1 |
| **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.<br>• Students will know that the upper bound is rounded and they would actually everything up to but not including the upper bound.<br>• Students will know how to use inequality notation to specify simple error intervals due to rounding.<br>• Students will know how to use inequality notation to specify simple error intervals due to truncation.<br>• 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.<br>**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.<br>• Students need to know how to use inequality notation.<br>• | Mini-Assessment 1 |
| **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.<br>• 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.<br>• Students will know that if there are no numbers contained within the overlap then the highest common factor of the two numbers is 1.<br>• 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.<br>**Opportunity for challenge:**<br>• Students will know how to find the HCF and LCM of three numbers using a Venn diagram. | **Prime** – In maths, prime numbers are whole numbers greater than 1, that have only two factors: 1 and the number itself.<br>**Product** – in maths, a product is the result of multiplication<br>**Product of Primes** – a product in which every factor is a prime number<br>**Highest Common Factor** – the largest number that both or all of the numbers can be divided by<br>**Lowest Common Multiple** – the smallest number that is in both numbers' times tables | • Students need to know how to write a number as a product of its prime factors | Mini-Assessment 1 |

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| **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.<br>• 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.<br>• 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.<br>**Opportunity for challenge:**<br>• 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.<br>• Students need to know how to find the HCF and LCM of two numbers from Venn diagrams. | |
| **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 $1 \leq a < 10$.<br>• Students will know how to write large in the form $a \times 10^n$, where $1 \leq a < 10$.<br>• Students will know how to write small numbers in the form $a \times 10^{-n}$, where $1 \leq a < 10$.<br>• Students will know how to convert large numbers written in standard form back into ordinary numbers.<br>• Students will know how to convert small number written in standard form back into ordinary numbers.<br>• Students will know how to adjust a number written in the form $a \times 10^n$ where $a > 10$ or $a \leq 0$ so that it is written in standard form.<br>• Students will know how to compare numbers written in standard form and how the power of 10 affects the size of one number compared with another.<br>• 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.<br>• Students need to know how to calculate numbers with integer powers. | Mini-Assessment 2 |
| **To learn how to multiply and divide numbers written in standard form** | • Students will know that to multiply numbers written in standard form they must firstly convert the numbers into ordinary numbers, multiply the numbers and then convert the answer back into standard form.<br>• Students will know that the quickest way to multiply numbers written in the form $a \times 10^n \times b \times 10^n$, is to multiply *a* and *b* to get *ab*, then use index laws to combine the powers of 10 and then write the answer in standard form.<br>• Students will know that to divide numbers written in standard form they must firstly convert the numbers into ordinary numbers, divide the numbers and then convert the answer back into standard form.<br>• Students will know and understand that the quickest way to multiply numbers written in standard form we multiply together the 'a' in both number, multiply the 10^n and then combine the two answers<br>• Students will know that the quickest way to divide numbers written in the form $a \times 10^n \div b \times 10^n$, is to divide *a* by *b* to get $\frac{a}{b}$, then use index laws to combine the powers of 10 and then write the answer in standard form.<br>• Students will know to check their answer is in standard form and adjust it if necessary.<br>**Opportunity for challenge:**<br>• Students will know how to solve more complex multi-step problems using standard form. | | • Students need to know how to convert ordinary numbers in and out of standard form.<br>• Students need to know how to adjust a number to get it into standard form.<br>• Students need to know how to use basic index laws. | Mini-Assessment 2 |

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| **To learn how to add and subtract and solve problems involving standard form** | • Students will know that to add numbers written in standard form they must firstly convert the numbers into ordinary numbers, add the numbers and then convert the answer back into standard form.<br>• Students will know that to subtract numbers written in standard form they must firstly convert the numbers into ordinary numbers, subtract the numbers and then convert the answer back into standard form.<br>• Students will know how to convert in and out of standard form using a calculator.<br>• Students will know how to do calculations involving standard form. | | • Students should already know how to use a calculator efficiently | Mini-Assessment 1 |
| **To learn how to simplify and multiply surds.** | • Students will know that a surd is an irrational root of an integer.<br>• Students will know why a surd is irrational.<br>• Students will know the difference between rational and irrational numbers.<br>• Students will know how to recognise and identify surds.<br>• Students will know how to simplify surds by breaking it down into two factors, one of which is a square number.<br>• Students will know that in order to fully simplify surds they must use the biggest square number factor possible.<br>• Students will know how to multiply surds.<br>• Students will know how to multiply surds with integers.<br>• Students will know how to multiply surd and integer products.<br>**Opportunity for challenge:**<br>• 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.<br>**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.<br>• Students will need to know how to multiply algebraic expressions | Mini-Assessment 1 |
| **To learn how to divide, add and subtract surds.** | • Students will know how to divide surds.<br>• Students will know how to divide surd and integer products.<br>• Students will know how to add by simplifying them so that the root is the same number.<br>• Students will know how to subtract surds by simplifying them so that the root is the same number.<br>• 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. | Mini-Assessment 1 |
| **To learn how to expand brackets with surds** | • Students will know how to expand single brackets with surds<br>**Opportunity for challenge:**<br>• Students will know how to expand double brackets with surds | **Expand –** open up or make bigger, in maths, 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<br>• Students will need to know how to expand single brackets involving algebra | Mini-Assessment 1 |