The Sutton Academy

Knowledge Rich Curriculum Plan

Year 10 Higher + – Number 1

Lesson	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
To learn how to interpret fractional and negative indices.	• Students will know how to simplify complex multi-step numerical expressions using the index laws. • Students will know how to interpret the power of 0. • Students will know how to evaluate negative powers. • Students will know how to evaluate fractional powers where the power is a unit fraction (e.g. 1/2, 1/3) • Students will know how to evaluate more difficult fractional powers where the power is a non-unit fraction (e.g. 2/3) • Students will know how to evaluate a mixture of negative and fractional powers. • Students will know how to evaluate a mixture of negative and fractional powers to a fractional base. E.g. $\left(\frac{3}{2}\right)^{-2}$ or $\left(\frac{16}{25}\right)^{\frac{3}{2}}$	**Reciprocal** – The reciprocal of a number is 1 divided by the number	• Students need to how to use a mixture of the index laws.	**Steps to success – Negative indices** • To evaluate a negative power, first take the reciprocal, the index changes sign, then calculate it. **Steps to Success - Fractional indices** • A power of $\frac{1}{2}$ means that you find the square root of the base. • 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 calculate with numbers written in standard form	• Students will know how to adjust a number written in the form a x 10^n where a > 10 or a ≤ 0 so that it is written in standard form (in the form a x 10^n where 1 ≤ a < 10) • Students will know how to compare and order numbers written in standard form and how the x10^n affects the size of one number compared with another. • Students will know that to add and subtract numbers written in standard form.	**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 ≤ a < 10	• Students need to know how to convert ordinary to standard form. • Students need to know how to write standard form as ordinary numbers.	**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' by 10, *n* times. When *n* is negative divide the 'a' by 10, *n* times. **Steps to Success - Adding and subtracting numbers in standard form** **Step 1:** Write the numbers as ordinary numbers by multiplying or dividing by powers of 10. **Step 2:** Add or subtract the numbers using the column method. **Step 3:** Convert your answer into standard form, if necessary.	
To learn how to calculate with numbers written in standard form.	• Students will know how to multiply numbers in standard form. • Students will know how to divide numbers in standard form. • Students will know how to solve more complex non-calculator standard form problems including substitution problems and worded problems.		• Students need to know how to convert from standard form to ordinary numbers and vice versa. • Students need to know the index laws for multiplication and division.	**Steps to Success – Multiplying numbers in standard form** **Step 1:** Multiply the 'a' for each number written in standard form. **Step 2:** Multiply the two 10^n parts. Remember that we will need to add 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. **Steps to Success – Dividing numbers in standard form** **Step 1:** Divide the 'a' for each number written in standard form. **Step 2:** Divide the two 10^n parts. Remember that we will need to subtract 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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To learn how to solve problems involving numbers written in standard form.	• Students will know how to carry out basic calculations with numbers written in standard form using a calculator and interpret a calculator display where answers are given in standard form or as ordinary numbers that need converting to standard form. • Students will know how to solve more complex problems with numbers written in standard form both with a calculator (as appropriate).		• Students need to know how to convert from standard form to ordinary numbers and vice versa.		
To learn how to simplify, multiply and divide 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 how to multiply surds in the form $\sqrt{a} \times \sqrt{b}$ • Students will know how to multiply surds in the form $a\sqrt{b} \times c\sqrt{d}$ • Students will know how to simplify their answers once they have multiplied surds. • Students will know how to divide surds in the form $\sqrt{a} \div \sqrt{b}$ • Students will know how to divide surds in the form $\frac{\sqrt{a}}{\sqrt{b}}$ • Students will know how to divide surds in the form $a\sqrt{b} \div c\sqrt{d}$ • Students will know that $(\sqrt{a})^2 = a$ • Students will know how to solve problems involving multiplying and dividing surds.	**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 without any repeating pattern	• Students need to know how to calculate squares and square roots.	**Steps to Success – Simplifying Surds** **Step 1:** Find a factor pair for the number in the root. 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. **Steps to Success – Multiplying Surds** **Step 1:** Multiply integers by integers. **Step 2:** Multiply roots by roots. **Step 3:** Combine the answer and simplify where possible. **Steps to Success – Dividing Surds** **Step 1:** Divide integers by integers. **Step 2:** Divide roots by roots. **Step 3:** Combine the answer and simplify where possible.	
To learn how to expand brackets with surds.	• Students will know that to add and subtract surds we use similar rules to collecting like terms and that therefore $\sqrt{a} + \sqrt{a} = 2\sqrt{a}$ etc. • Students will know how to add and subtract surds. • Students will know how to expand single brackets with surds, including where simplification of surds is required. • Students will know how to expand and simplify double brackets with surds including where resulting surds need simplifying. They will know how to do this where the numerator is an integer, single surd or an expression involving surds and/or integers. • Students will know how to solve problems involving the expanding of single or double brackets with surds.	**Expand –** multiply out	• Students need to know how to expand single brackets with algebraic terms. • Students need to know how to expand double brackets with algebraic terms.	**Steps to Success – Adding and Subtracting Surds** **Step 1:** Ensure the number under the root is the same, if not simplify each of the surds as much as possible. **Step 2:** Collect any roots with the same number 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!*** **Steps to Success – Expanding single brackets involving 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 involving 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. **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.	

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To learn how to rationalise denominators.	• Students will know how to rationalise the denominator when a single surd is in the denominator. • Students will know how to rationalise the denominator when the denominator has two parts separated by a + or a - E.g. $\frac{5}{\sqrt{2}+1}$ or $\frac{\sqrt{2}+3}{\sqrt{3}-1}$ etc. **Opportunity for challenge:** • Students will know how to solve more complex, multi-step, exam style problems involving surds.	**Rationalise –** to make something rational **Rational number** – numbers that can be written as a fraction where both the numerator and the denominator are integers, and the denominator is not zero. **Denominator –** the bottom number in a fraction	• Students need to know how to expand single and double brackets with surds. • Students need to know how to simplify surds.	**Steps to Success – Rationalising the denominator with a single surd in the denominator** **Step 1:** Multiply the numerator and denominator by the surd that is in the denominator. This will keep your fraction equivalent. **Step 2:** Simplify the answer as fully as possible. **Steps to Success – Rationalising the denominator with a more complex denominator** **Step 1:** Multiply the numerator and denominator by the entire denominator but change the sign. **Step 2:** Expand out the numerator and simplify **Step 3:** Expand out the denominator and simplify **Step 4:** Check if your final answer can be simplified (remember to check you have simplified all of the surds as fully as possible!)	
Exam Preparation 1					