

## Foundation SOW Progression

Patterns and Sequences		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Generate a sequence from a term-to-term rule</li> <li>• Understand the meaning of a position-to-term rule</li> <li>• Use a position-to-term rule to generate a sequence</li> <li>• Find the position-to-term rule for a given sequence</li> <li>• Use algebra to describe the position-to-term rule of a linear sequence (the <math>n</math>th term) Use the <math>n</math>th term of a sequence to deduce if a given number is in a sequence</li> </ul>	<ul style="list-style-type: none"> <li>• Describe how a sequence continues.</li> <li>• Recognise the sequences listed below</li> <li>• Generate linear sequences</li> <li>• Generate sequences with a given term-to-term rule</li> <li>• Generate simple sequences derived from diagrams and complete a table of results that describes the pattern shown by the diagrams</li> <li>• Generate a sequence where the <math>n</math>th term is given</li> <li>• Work out the value of the <math>n</math>th term of any sequence for any given value of <math>n</math></li> <li>• Work out an expression in terms of <math>n</math> for the <math>n</math>th term of a linear sequence by knowing that the common difference can be used to generate a formula for the <math>n</math>th term.</li> <li>• Solve simple problems involving arithmetic progressions</li> <li>• Work with Fibonacci-type sequences (rule will be given)</li> <li>• Know how to continue the terms of a quadratic sequence</li> <li>• Work out the value of a term in a geometrical progression of the form <math>rn</math> where <math>n</math> is an integer <math>&gt; 0</math></li> </ul>	

Algebraic Proficiency and Manipulation		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Know how to write products algebraically</li> <li>• Use fractions when working in algebraic situations</li> <li>• Identify common factors (numerical and algebraic) of terms in an expression</li> <li>• Factorise an expression by taking out common factors</li> <li>• Simplify an expression involving terms with combinations of variables (e.g. <math>3a^2b + 4ab^2 + 2a^2 - a^2b</math>)</li> <li>• Know the multiplication (division, power, zero) law of indices</li> <li>• Understand that negative powers can arise</li> <li>• Substitute positive and negative numbers into formulae</li> <li>• Be aware of common scientific formulae</li> <li>• Know the meaning of the 'subject' of a formula</li> </ul>	<p><u>Basic Algebra</u></p> <ul style="list-style-type: none"> <li>• Use notation and symbols correctly</li> <li>• Recognise that <math>x + 3</math> is an expression and <math>3a</math> is a term</li> <li>• Know the meaning of the word 'factor' for both numerical work and algebraic work.</li> <li>• Understand that algebra can be used to generalise the laws of arithmetic</li> <li>• Manipulate an expression by collecting like terms</li> <li>• Write expressions to solve problems</li> <li>• Write expressions using squares and cubes</li> <li>• Factorise linear algebraic expressions by taking out common factors</li> <li>• Multiply a single term over a bracket, for example, <math>a(b + c) = ab + ac</math></li> </ul>	<ul style="list-style-type: none"> <li>• understand and use number machines</li> <li>• interpret an expression diagrammatically using a number machine</li> <li>• interpret the operations in a number machine as an expression or function.</li> <li>• multiply two linear expressions, such as <math>(x \pm a)(x \pm b)</math> and <math>(cx \pm a)(dx \pm b)</math>, for example <math>(2x + 3)(3x - 4)</math></li> <li>• factorise quadratic expressions using the sum and product method, or by inspection (FOIL)</li> <li>• factorise quadratics of the form <math>x^2 + bx + c</math></li> <li>• factorise expressions written as the difference of two squares of the form <math>x^2 - a^2</math></li> </ul>

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<ul style="list-style-type: none"> <li>Change the subject of a formula when two steps are required</li> </ul>	<ul style="list-style-type: none"> <li>Know the meaning of and be able to simplify, for example <math>3x - 2 + 4(x + 5)</math></li> <li>Know the meaning of and be able to factorise, for example <math>3x^2y - 9y</math> or <math>4x^2 + 6xy</math></li> <li>Simplify algebraic expressions, for example by cancelling common factors</li> </ul> <p><u>Indices</u></p> <ul style="list-style-type: none"> <li>Recall squares of numbers up to <math>15 \times 15</math> and the cubes of 1, 2, 3, 4, 5 and 10, also knowing the corresponding roots</li> <li>Recognise the notation <math>\sqrt{25}</math></li> <li>Calculate and recognise powers of 2, 3, 4, 5</li> <li>Calculate and recognise powers of 10</li> <li>Use index laws for multiplication and division of integer powers with both letter and number base values</li> <li>Calculate with positive integer indices.</li> <li>Solve equations such as <math>x^2 = 25</math>, giving both the positive and negative roots.</li> </ul>	<ul style="list-style-type: none"> <li>understand and use formulae from maths and other subjects expressed initially in words and then using letters and symbols. For example formula for area of a triangle, area of a parallelogram, area of a circle, volume of a prism, conversions between measures, wage earned = hours worked <math>\times</math> hourly rate + bonus</li> <li>change the subject of a formula</li> <li>recognise that, for example, <math>5x + 5 = 16</math> is an equation, but <math>5x + 5 \equiv 5(x + 1)</math> is an identity</li> <li>show that two expressions are equivalent</li> <li>use identities including equating coefficients</li> </ul>
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Solving Equations		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>Identify the correct order of undoing the operations in an equation</li> <li>Solve linear equations with the unknown on one side when the solution is a negative number</li> <li>Solve linear equations with the unknown on both sides when the solution is a whole number</li> <li>Solve linear equations with the unknown on both sides when the solution is a fraction</li> <li>Solve linear equations with the unknown on both sides when the solution is a negative number</li> <li>Solve linear equations with the unknown on both sides when the equation involves brackets</li> <li>Recognise that the point of intersection of two graphs corresponds to the solution of a connected equation</li> <li>Check the solution to an equation by substitution</li> </ul>	<ul style="list-style-type: none"> <li>Solve simple linear equations by using inverse operations or by transforming both sides in the same way</li> <li>Solve simple linear equations with integer coefficients where the unknown appears on one or both sides of the equation or where the equation involves brackets.</li> <li>Substitute numbers into a formula.</li> <li>Use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols. For example, formula for area of a triangle, area of a parallelogram, area of a circle, volume of a prism, conversions between measures, wage earned = hours worked <math>\times</math> hourly rate + bonus</li> </ul>	<p><u>Simultaneous Equations</u></p> <ul style="list-style-type: none"> <li>solve simultaneous linear equations by elimination or substitution or any other valid method</li> <li>find approximate solutions using a graph</li> <li>set up a pair of simultaneous linear equations to solve problems</li> </ul> <p><u>Inequalities</u></p> <ul style="list-style-type: none"> <li>know the difference between <math>&lt;</math>, <math>\leq</math>, <math>\geq</math>, <math>&gt;</math> and <math>\neq</math></li> <li>solve simple linear inequalities in one variable</li> <li>represent the solution set of an inequality on a number line, knowing the correct conventions of an open circle for a strict inequality eg <math>x &lt; 3</math> and a closed circle for an inclusive inequality eg <math>x \leq 3</math></li> </ul>

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		<p><u>Algebra and Graphs</u></p> <ul style="list-style-type: none"> <li>• set up and solve simple linear expressions/equations in a variety of contexts</li> <li>• rearrange simple linear equations</li> <li>• set up simple linear equations to solve problems</li> <li>• interpret solutions of equations in context.</li> <li>• Find approximate solutions using a graph</li> </ul> <p><u>Solving Quadratic Equations</u></p> <ul style="list-style-type: none"> <li>• solve quadratic equations by factorising</li> <li>• read approximate solutions to a quadratic equation from a graph.</li> </ul>
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Mathematical Movement (Graphs)		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Know that graphs of functions of the form <math>y = mx + c</math>, <math>x \pm y = c</math> and <math>ax \pm by = c</math> are linear</li> <li>• Plot graphs of functions of the form <math>y = mx + c</math> (<math>x \pm y = c</math>, <math>ax \pm by = c</math>)</li> <li>• Understand the concept of the gradient of a straight line</li> <li>• Find the gradient of a straight line on a unit grid</li> <li>• Find the y-intercept of a straight line</li> <li>• Sketch a linear graph</li> <li>• Distinguish between a linear and quadratic graph</li> <li>• Plot graphs of quadratic functions of the form <math>y = x^2 \pm c</math></li> <li>• Sketch a simple quadratic graph</li> <li>• Plot and interpret graphs of piece-wise linear functions in real contexts</li> <li>• Plot and interpret distance-time graphs (speed-time graphs)</li> <li>• Find approximate solutions to kinematic problems involving distance and speed</li> </ul>	<p><u>Co-ordinates and Linear Graphs</u></p> <ul style="list-style-type: none"> <li>• Plot points in all four quadrants</li> <li>• Find and use coordinates of points identified by geometrical information, for example the fourth vertex of a rectangle given the other three vertices</li> <li>• Find coordinates of a midpoint, for example on the diagonal of a rhombus</li> <li>• Identify and use cells in 2D contexts, relating coordinates to applications such as Battleships and Connect 4</li> <li>• Recognise that equations of the form <math>y = mx + c</math> correspond to straight-line graphs in the coordinate plane with gradient <math>m</math> and y-intercept at <math>(0, c)</math>.</li> <li>• Complete tables of values and draw graphs of functions in which <math>y</math> is given explicitly or implicitly in terms of <math>x</math></li> <li>• Work out the equation of a straight line from a given point and a gradient or two points</li> <li>• Manipulate the equations of straight lines so that it is possible to tell whether lines are parallel or not</li> <li>• Show step-by-step deduction in solving a geometrical problem.</li> <li>• Identify parallel lines using <math>y=mx+c</math></li> </ul>	<p>(See above)</p> <p><u>Sketching Graphs</u></p> <ul style="list-style-type: none"> <li>• Draw, sketch, recognise and interpret linear functions</li> <li>• Draw, sketch, recognise and interpret graphs of the form <math>y = x^3 + k</math> where <math>k</math> is an integer</li> <li>• Draw, sketch, recognise and interpret the graph <math>y = \frac{1}{x}</math> with <math>x \neq 0</math></li> <li>• Find an approximate value of <math>y</math> for a given value of <math>x</math>, or the approximate values of <math>x</math> for a given value of <math>y</math>.</li> </ul> <p><u>Quadratics graphs</u></p> <ul style="list-style-type: none"> <li>• Calculate values for a quadratic and draw the graph</li> <li>• Draw, sketch, recognise and interpret quadratic graphs</li> <li>• Interpret quadratic graphs by finding roots, intercepts and turning points.</li> </ul>

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	<p><u>Real life graphs</u></p> <ul style="list-style-type: none"> <li>• Plot a graph representing a real-life problem from information given in words, in a table or as a formula</li> <li>• Identify the correct equation of a real-life graph from a drawing of the graph</li> <li>• Read and Interpret linear graphs representing real-life situations; for example, graphs representing financial situations (eg gas, electricity, water, mobile phone bills, council tax) with or without fixed charges, and also understand that the intercept represents the fixed charge or deposit</li> <li>• Plot and interpret distance-time graphs</li> <li>• Interpret line graphs from real-life situations, for example conversion graphs</li> <li>• Interpret graphs showing real-life situations in geometry, such as the depth of water in containers as they are filled at a steady rate</li> <li>• Interpret non-linear graphs showing real-life situations, such as the height of a ball plotted against time.</li> <li>• Interpret the meaning of the gradient as the rate of change of the variable on the vertical axis compared to the horizontal axis</li> </ul>	
<p><b>Numbers and the Number System</b></p>		
<p><b>Year 9</b></p>	<p><b>Year 10</b></p>	<p><b>Year 11</b></p>
<ul style="list-style-type: none"> <li>• Recall prime numbers up to 100</li> <li>• Understand the meaning of prime factor</li> <li>• Write a number as a product of its prime factors</li> <li>• Use a Venn diagram to sort information</li> <li>• Use prime factorisations to find the highest common factor of two numbers</li> <li>• Use prime factorisations to find the lowest common multiple of two numbers</li> <li>• Know how to identify any significant figure in any number</li> <li>• Approximate by rounding to any significant figure in any number</li> <li>• Write a large (small) number in standard form</li> <li>• Interpret a large (small) number written in standard form</li> </ul>	<p><u>Factors and Multiples</u></p> <ul style="list-style-type: none"> <li>• Identify multiples, factors and prime numbers from lists of numbers</li> <li>• Write out lists of multiples and factors to identify common multiples or common factors of two or more integers</li> <li>• Write a number as the product of its prime factors (Including using a calculator)</li> <li>• use formal (eg using Venn diagrams) and informal methods (eg trial and error) for identifying highest common factors (HCF) and lowest common multiples (LCM)</li> <li>• Work out a root of a number from a product of prime factors.</li> </ul>	

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	<ul style="list-style-type: none"> <li>• Identify all permutations and combinations and represent them in a variety of formats.</li> </ul> <p><u>Standard Form</u></p> <ul style="list-style-type: none"> <li>• Know, use and understand the term standard form</li> <li>• Write an ordinary number in standard form</li> <li>• Write a number written in standard form as an ordinary number</li> <li>• Order and calculate with numbers written in standard form</li> <li>• Solve simple equations where the numbers are written in standard form</li> <li>• Interpret calculator displays</li> <li>• Use a calculator effectively for standard form calculations</li> <li>• Solve standard form problems with and without a calculator.</li> </ul>	
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Calculating, Counting and Comparing		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Add or subtract from a negative number</li> <li>• Add (or subtract) a negative number to (from) a positive number</li> <li>• Add (or subtract) a negative number to (from) a negative number</li> <li>• Multiply with negative numbers</li> <li>• Divide with negative numbers</li> <li>• Know how to square (or cube) a negative number</li> <li>• Substitute negative numbers into expressions</li> <li>• Enter negative numbers into a calculator</li> <li>• Use a scientific calculator to calculate with fractions, both positive and negative</li> <li>• Interpret a calculator display when working with negative numbers</li> <li>• Understand how to use the order of operations including powers</li> <li>• Understand how to use the order of operations including roots</li> </ul>	<ul style="list-style-type: none"> <li>• Know and use the word integer and the equality and inequality symbols</li> <li>• Order positive and/or negative numbers given as integers</li> <li>• add, subtract, multiply and divide positive and negative numbers using both mental and written methods</li> <li>• Interpret a remainder from a division problem</li> <li>• Recall all positive number complements to 100</li> <li>• Recall all multiplication facts to <math>12 \times 12</math> and use them to derive the corresponding division facts</li> <li>• Perform money and other calculations, writing answers using the correct notation</li> <li>• Add, subtract, multiply and divide using commutative, <math>a + b = b + a</math> and <math>ab = ba</math>, associative <math>a + (b + c) = (a + b) + c</math>, and <math>a(bc) = (ab)c</math> and distributive <math>a(b + c) = ab + ac</math> laws</li> <li>• Understand and use inverse operations</li> <li>• Use brackets and the hierarchy of operations</li> </ul>	

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	<ul style="list-style-type: none"> <li>• Solve problems set in words.</li> <li>• Evaluate results obtained</li> </ul>	
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Checking approximating and estimating		
Year 8	Year 10	Year 11
<p>Retention of the key facts below is checked and emphasis is placed on problem solving and reasoning within this topic</p> <ul style="list-style-type: none"> <li>• Approximate by rounding to any number of decimal places</li> <li>• Know how to identify the first significant figure in any number</li> <li>• Approximate by rounding to the first significant figure in any number</li> <li>• Understand estimating as the process of finding a rough value of an answer or calculation</li> <li>• Use estimation to predict the order of magnitude of the solution to a (decimal) calculation</li> <li>• Estimate calculations by rounding numbers to one significant figure</li> <li>• Use cancellation to simplify calculations</li> <li>• Use inverse operations to check solutions to calculations</li> </ul>	<ul style="list-style-type: none"> <li>• Perform money calculations, writing answers using the correct notation</li> <li>• Round numbers to the nearest whole number, 10, 100 or 1000</li> <li>• Round numbers to a specified number of decimal places</li> <li>• Round numbers to a specified number of significant figures</li> <li>• Use inequality notation to specify error intervals due to truncation or rounding.</li> <li>• Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction.</li> </ul>	

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Exploring Fractions, Decimals and Percentages		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>Identify if a fraction is terminating or recurring</li> <li>Recall some decimal and fraction equivalents (e.g. tenths, fifths, eighths)</li> <li>Write a decimal as a fraction</li> <li>Write a fraction in its lowest terms by cancelling common factors</li> <li>Identify when a fraction can be scaled to tenths or hundredths</li> <li>Convert a fraction to a decimal by scaling (when possible)</li> <li>Write fractions as recurring decimals</li> <li>Use a calculator to change any fraction to a decimal</li> <li>Write a decimal as a percentage</li> </ul> <p>Write a fraction as a percentage</p>	<ul style="list-style-type: none"> <li>Identify equivalent fractions</li> <li>Simplify a fraction by cancelling all common factors, using a calculator where appropriate, for example, simplifying fractions that represent probabilities</li> <li>Convert between mixed numbers and improper fractions</li> <li>Order and compare fractions, including improper fractions.</li> <li>Compare fractions in statistics and geometry questions.</li> <li>Multiply and divide a fraction by an integer, by a unit fraction and by a general fraction</li> <li>Add and subtract fractions by writing them with a common denominator</li> <li>Add and subtract, multiply and divide mixed numbers</li> </ul>	

Calculating with Fractions, Decimals and Percentages		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>Recognise when a fraction (percentage) should be interpreted as a number</li> <li>Recognise when a fraction (percentage) should be interpreted as an operator</li> <li>Identify the multiplier for a percentage increase or decrease when the percentage is greater than 100%</li> <li>Use calculators to increase an amount by a percentage greater than 100%</li> <li>Solve problems involving percentage change</li> <li>Solve original value problems when working with percentages</li> <li>Solve financial problems including simple interest</li> <li>Understand the meaning of giving an exact solution</li> <li>Solve problems that require exact calculation with fractions</li> </ul>	<p><u>Basic Decimals</u></p> <ul style="list-style-type: none"> <li>Order positive and/or negative numbers given as decimals fractions.</li> <li>Add, subtract, multiply and divide decimals using both mental and written methods</li> <li>Interpret a remainder from a division problem</li> <li>convert between fractions and decimals using place value</li> <li>compare the value of fractions and decimals (terminating decimals and their fraction equivalents)</li> </ul> <p><u>Percentages</u></p> <ul style="list-style-type: none"> <li>Convert values between percentages, fractions and decimals in order to compare</li> <li>Use percentages in real-life situations and find the most appropriate method of calculation in a question; for example, 62% of £80 is <math>0.62 \times £80</math> and 25% of £80 is <math>£80 \div 4</math></li> </ul>	<p><u>Growth and Decay</u></p> <ul style="list-style-type: none"> <li>Solve problems involving repeated proportional change</li> <li>Use calculators to explore exponential growth and decay using a multiplier and the power</li> <li>Solve compound interest problems.</li> </ul>

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	<ul style="list-style-type: none"> <li>• Interpret percentage as the operator ‘so many hundredths of’</li> <li>• Work out the percentage of a shape that is shaded</li> <li>• Shade a given percentage of a shape</li> <li>• Calculate a percentage of a quantity (including percentages greater than 100%)</li> <li>• Work out one quantity as a percentage of another quantity</li> </ul> <p><u>Calculating with Percentages</u></p> <ul style="list-style-type: none"> <li>• Calculate a percentage increase or decrease</li> <li>• Solve percentage increase and decrease problems, for example, use <math>1.12 \times Q</math> to calculate a 12% increase in the value of Q and <math>0.88 \times Q</math> to calculate a 12% decrease in the value of Q</li> <li>• Calculate reverse percentages</li> <li>• Solve simple interest problems.</li> </ul> <p>PLEASE NOTE: compound interest is under the topic Growth and Decay</p>	
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Proportional Reasoning		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Identify ratio in a real-life context</li> <li>• Write a ratio to describe a situation</li> <li>• Identify proportion in a situation</li> <li>• Find a relevant multiplier in a situation involving proportion</li> <li>• Use fractions fluently in situations involving ratio or proportion</li> <li>• Understand the connections between ratios and fractions</li> <li>• Understand the meaning of a compound unit</li> <li>• Know the connection between speed, distance and time</li> <li>• Solve problems involving speed</li> <li>• Identify when it is necessary to convert quantities in order to use a sensible unit of measure</li> </ul>	<p><u>Ratio and Simple Proportion</u></p> <ul style="list-style-type: none"> <li>• Understand the meaning of ratio notation</li> <li>• Interpret a ratio as a fraction (Important for problem solving)</li> <li>• Understand that a line divided in the ratio 1 : 3 means that the smaller part is one-quarter of the whole</li> <li>• Make comparisons between two quantities and represent them as a ratio</li> <li>• Simplify ratios to their simplest form <math>a : b</math> where <math>a</math> and <math>b</math> are integers</li> <li>• Write a ratio in the form <math>1 : n</math> or <math>n : 1</math></li> <li>• Use equality of ratios to solve problems.</li> <li>• Share a quantity in a given ratio</li> </ul>	<p><u>Direct and Inverse Proportion</u></p> <ul style="list-style-type: none"> <li>• Use proportion to solve problems using informal strategies or the unitary method of solution</li> <li>• Use direct proportion to solve geometrical problems</li> <li>• Calculate an unknown quantity from quantities that vary in direct proportion or inverse proportion</li> <li>• Set up and use equations to solve word and other problems involving direct proportion or inverse proportion</li> <li>• Relate algebraic solutions to graphical representation of the equations</li> <li>• Sketch an appropriately shaped graph (partly or entirely non-linear) to represent a real-life situation</li> <li>• Choose the graph that is sketched correctly from a selection of alternatives</li> </ul>



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	<ul style="list-style-type: none"> <li>• Use ratio to solve word problems using informal strategies or using the unitary method of solution</li> <li>• <b>Use ratio to solve, for example geometrical, algebraic, statistical, and numerical problems</b></li> <li>• Solve best-buy problems using informal strategies or using the unitary method of solution.</li> <li>• Represent the ratio of two quantities in direct proportion as a linear relationship and represent the relationship graphically</li> </ul>	<ul style="list-style-type: none"> <li>• Recognise the graphs that represent direct and inverse proportion.</li> <li>• Understand that an equation of the form <math>y = kx</math> represents direct proportion and that <math>k</math> is the constant of proportionality</li> <li>• Understand that an equation of the form <math>y = \frac{k}{x}</math> represents inverse proportion and that <math>k</math> is the constant of proportionality.</li> <li>• Match direct and inverse proportion graphs to their equations and vice versa</li> <li>• Draw graphs to represent direct and inverse proportion.</li> </ul>
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Visualising and Constructing		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Construct 2D shapes from written descriptions</li> <li>• Construct perpendicular bisectors and angle bisectors</li> <li>• Know the vocabulary of enlargement</li> <li>• Find the centre of enlargement</li> <li>• Find the scale factor of an enlargement</li> <li>• Use the centre and scale factor to carry out an enlargement with positive integer scale factor</li> <li>• Know and understand the vocabulary of plans and elevations</li> <li>• Interpret plans and elevations</li> <li>• Use the concept of scaling in diagrams</li> <li>• Construct a scale diagram involving bearings</li> <li>• Use bearings to solve geometrical problems</li> </ul>	<p><u>Scale Drawings and Bearings</u></p> <ul style="list-style-type: none"> <li>• Use and interpret maps and scale drawings</li> <li>• Use a scale on a map to work out an actual length</li> <li>• Use a scale with an actual length to work out a length on a map</li> <li>• Construct scale drawings</li> <li>• Use scale to estimate a length, for example use the height of a man to estimate the height of a building where both are shown in a scale drawing</li> <li>• Work out a scale from a scale drawing given additional information.</li> <li>• Recall and use the eight points of the compass (N, NE, E, SE, S, SW, W, NW) and their equivalent three-figure bearings</li> <li>• Use compass point and three-figure bearings to specify direction</li> <li>• Mark points on a diagram given the bearing from another point</li> <li>• Draw a bearing between points on a map or scale drawing</li> </ul>	

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	<ul style="list-style-type: none"> <li>• Measure the bearing of a point from another given point</li> <li>• Work out the bearing of a point from another given point</li> <li>• Work out the bearing to return to a point, given the bearing to leave that point.</li> </ul> <p><u>2D representations of 3D shapes</u></p> <ul style="list-style-type: none"> <li>• Use 2D representations of 3D shapes</li> <li>• Draw nets and show how they fold to make a 3D solid</li> <li>• Analyse 3D shapes through 2D projections and cross sections, including plans and elevations</li> <li>• Understand and draw front and side elevations and plans of shapes made from simple solids, for example a solid made from small cubes</li> <li>• Understand and use isometric drawings.</li> </ul>	
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Investigating Properties of shape		
Year 8	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Know the vocabulary of 3D shapes</li> <li>• Know the connection between faces, edges and vertices in 3D shapes</li> <li>• Visualise a 3D shape from its net</li> <li>• Recap and recall the names and shapes of special triangles and quadrilaterals</li> <li>• Know the meaning of a diagonal of a polygon</li> <li>• Know the properties of the special quadrilaterals including diagonals</li> <li>• Apply the properties of triangles to solve problems</li> <li>• Apply the properties of quadrilaterals to solve problems. Reviewed in other topic areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognise and name regular polygons: pentagons, hexagons, octagons and decagons</li> <li>• Use the sum of the interior angles of a triangle to deduce the sum of the interior angles of any polygon. Use the fact that the sum of the interior angles of an n-sided polygon is <math>180(n - 2)</math></li> <li>• Use the fact that the sum of the exterior angles of any polygon is <math>360^\circ</math></li> <li>• Use the relationship 'interior angle + exterior angle = <math>180^\circ</math>'</li> <li>• Recall the properties and definitions of special types of quadrilaterals</li> <li>• Identify and use symmetries of special types of quadrilaterals</li> </ul>	

Foundation SOW Progression

Measuring Space		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Convert fluently between metric units of length</li> <li>• Convert fluently between metric units of mass</li> <li>• Convert fluently between metric units of volume / capacity</li> <li>• Convert fluently between units of time</li> <li>• Convert fluently between units of money</li> <li>• Solve practical problems that involve converting between units</li> <li>• State conclusions clearly using the units correctly</li> </ul> <p>Reviewed in other topic areas</p>	<ul style="list-style-type: none"> <li>• Interpret scales on a range of measuring instruments, including those for time, temperature and mass, reading from the scale or marking a point on a scale to show a stated value</li> <li>• Know, use and convert between standard metric</li> <li>• Use conversions between imperial units and metric units using common approximations, for example 5 miles <math>\approx</math> 8 kilometres, 1 gallon <math>\approx</math> 4.5 litres, 2.2 pounds <math>\approx</math> 1 kilogram, 1 inch <math>\approx</math> 2.5 centimetres</li> <li>• Choose appropriate units for estimating measurements, for example a television mast, the height of a man</li> <li>• Know that measurements using real numbers depend on the choice of unit</li> <li>• Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction.</li> <li>• Recall and use conversions for metric measures for length, area, volume and capacity</li> <li>• Know and use compound measures such as area, volume and speed</li> <li>• Understand and use compound measures and compound units including area, volume, speed, rates of pay, density and pressure</li> <li>• Understand speed and know the relationship between speed, distance and time</li> <li>• Understand units in common usage such as miles per hour or metres per second. The values used in the question will make the required unit clear.</li> </ul>	

Foundation SOW Progression

Investigating Angles		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• Identify alternate angles and know that they are equal</li> <li>• Identify corresponding angles and know that they are equal</li> <li>• Use knowledge of alternate and corresponding angles to calculate missing angles in geometrical diagrams</li> <li>• Establish the fact that angles in a triangle must total <math>180^\circ</math></li> <li>• Use the fact that angles in a triangle total <math>180^\circ</math> to work out the total of the angles in any polygon</li> <li>• Establish the size of an interior angle in a regular polygon</li> <li>• Know the total of the exterior angles in any polygon Establish the size of an exterior angle in a regular polygon</li> </ul>	<ul style="list-style-type: none"> <li>• Understand the standard conventions for equal sides and parallel lines</li> <li>• Distinguish between acute, obtuse, reflex and right angles</li> <li>• Name points, lines and angles using letter notations</li> <li>• Draw and identify parallel and perpendicular lines</li> <li>• Work out the size of missing angles at a point</li> <li>• Work out the size of missing angles at a point on a straight line</li> <li>• Know that vertically opposite angles are equal</li> <li>• Justify an answer with explanations such as 'angles on a straight line', etc.</li> <li>• Understand and use the angle properties of parallel lines</li> <li>• Understand the consequent properties of parallelograms</li> <li>• Derive and use the proof that the angle sum of a triangle is <math>180^\circ</math></li> <li>• Derive and use the proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices</li> <li>• Use angle properties of equilateral, isosceles and right-angled triangles</li> <li>• Use the fact that the angle sum of a quadrilateral is <math>360^\circ</math></li> </ul>	

Foundation SOW Progression

Calculating Space		
Year 7-9	Year 10	Year 11
<ul style="list-style-type: none"> <li>Recognise that the value of the perimeter can equal the value of area</li> <li>Use standard formulae for area and volume</li> <li>Find missing lengths in 2D shapes when the area is known</li> <li>Know that the area of a trapezium is given by the formula <math>\text{area} = \frac{1}{2} \times (a + b) \times h = \left(\frac{a+b}{2}\right)h = \frac{(a+b)h}{2}</math></li> <li>Calculate the area of a trapezium</li> <li>Understand the meaning of surface area</li> <li>Find the surface area of cuboids (including cubes) when lengths are known</li> <li>Find missing lengths in 3D shapes when the volume or surface area is known</li> </ul>	<p><u>Perimeter and Area</u></p> <ul style="list-style-type: none"> <li>Calculate the perimeter of shapes drawn on a grid</li> <li>Calculate the perimeter of simple shapes</li> <li>Work out the perimeter of a rectangle</li> <li>Work out the perimeter of a triangle</li> <li>Calculate the perimeter of shapes made from triangles and rectangles</li> <li>Calculate the area of shapes drawn on a grid</li> <li>Recall and use the formulae for the area of a rectangle, triangle, parallelogram and trapezium</li> <li>Calculate the area of compound shapes made from triangles and rectangles, for example an L shape or T shape</li> <li>Calculate the area of simple shapes</li> <li>Work out the surface area of nets made up of rectangles and triangles</li> <li>Know the terms face, edge and vertex (vertices)</li> <li>Understand that cubes, cuboids, prisms and cylinders have uniform areas of cross-section</li> </ul> <p><u>Circles</u></p> <ul style="list-style-type: none"> <li>Recall the definition of a circle</li> <li>Identify, name and draw the parts of a circle</li> <li>Draw a circle given the radius or diameter.</li> <li>Use <math>\pi = 3.14</math> or the <math>\pi</math> button on a calculator</li> <li>Recall and use the formula for the circumference of a circle</li> <li>Work out the circumference of a circle, given the radius or diameter</li> <li>Work out the radius or diameter of a circle, given the circumference</li> <li>Work out the perimeter of semicircles, quarter circles or other fractions of a circle</li> <li>Recall and use the formula for the area of a circle</li> <li>Work out the area of a circle, given the radius or diameter</li> <li>Work out the radius or diameter of a circle, given the area</li> </ul>	<ul style="list-style-type: none"> <li>Compare lengths, areas or volumes of similar shapes</li> <li>Recall and use the formula for the volume of a cube or cuboid</li> <li>Recall and use the formula for the volume of a cylinder</li> <li>Recall and use the formula for the volume of a prism</li> <li>Work out the volume of a cube or cuboid</li> <li>Work out the volume of a cylinder</li> <li>Work out the volume of a prism, for example a triangular prism.</li> <li>Work out the volume of spheres, pyramids and cones</li> <li>Work out the volume of compound solids constructed from cubes, cuboids, cones, pyramids, cylinders, spheres and hemispheres</li> <li>Give answers in terms of <math>\pi</math> and use values given in terms of <math>\pi</math> in calculations.</li> </ul>

Foundation SOW Progression

	<ul style="list-style-type: none"> <li>• Work out the area of semicircles, quarter circles or other fractions of a circle</li> <li>• Work out the surface area of spheres, pyramids and cones and compound shapes constructed from these</li> <li>• Calculate the length of arcs of circles</li> <li>• Calculate the area of sectors of circles</li> <li>• Given the lengths or areas of arcs, calculate the angle subtended at the centre.</li> </ul> <p>Give answers in terms of <math>\pi</math> and use values given in terms of <math>\pi</math> in calculations.</p>	
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Presenting Data		
Year 9	Year 10	Year 11
<p>Retention of the key facts below is checked and emphasis is placed on problem solving and reasoning within this topic</p> <ul style="list-style-type: none"> <li>• Know the meaning of continuous data</li> <li>• Interpret a grouped frequency table for continuous data</li> <li>• Construct a grouped frequency table for continuous data</li> <li>• Plot a scatter diagram of bivariate data</li> <li>• Understand the meaning of 'correlation'</li> <li>• Interpret a scatter diagram using understanding of correlation</li> </ul>	<ul style="list-style-type: none"> <li>• Draw all of the charts and diagrams listed below</li> <li>• Understand which of the diagrams are appropriate for different types of data</li> <li>• Interpret and obtain information from any of the types of diagram</li> <li>• Understand that a time series is a series of data points typically spaced over uniform time intervals</li> <li>• Plot and interpret time-series graphs</li> <li>• Use a time-series graph to predict a subsequent value</li> <li>• Understand that if data points are joined with a line then the line will not represent actual values but will show a trend</li> <li>• Decide whether data is discrete or continuous and use this decision to make sound judgements in choosing suitable diagrams for the data</li> <li>• Understand the difference between grouped and ungrouped data</li> <li>• Understand the advantages and disadvantages of grouping data</li> <li>• Distinguish between primary and secondary data</li> </ul>	<ul style="list-style-type: none"> <li>• recognise and name positive, negative or no correlation as types of correlation</li> <li>• recognise and name strong, moderate or weak correlation as strengths of correlation</li> <li>• understand that just because a correlation exists, it does not necessarily mean that causality is present</li> <li>• draw a line of best fit by eye for data with strong enough correlation, or know that a line of best fit is not justified due to the lack of correlation</li> <li>• understand outliers and make decisions whether or not to include them when drawing a line of best fit</li> <li>• use a line of best fit to estimate unknown values when appropriate.</li> <li>• look for unusual data values such as a value that does not fit an otherwise good</li> </ul>

## Foundation SOW Progression

Measuring data		
Year 9	Year 10	Year 11
<p>Retention of the key facts below is checked and emphasis is placed on problem solving and reasoning within this topic</p> <ul style="list-style-type: none"> <li>• Find the modal class of set of grouped data</li> <li>• Find the class containing the median of a set of data</li> <li>• Find the midpoint of a class</li> <li>• Calculate an estimate of the mean from a grouped frequency table</li> <li>• Estimate the range from a grouped frequency table</li> <li>• Analyse and compare sets of data</li> <li>• Appreciate the limitations of different statistics (mean, median, mode, range)</li> <li>• Choose appropriate statistics to describe a set of data</li> <li>• Justify choice of statistics to describe a set of data</li> </ul>	<p>See above as well</p> <p><u>Statistical Measures</u></p> <ul style="list-style-type: none"> <li>• Look for unusual data values (outliers) such as a value that does not fit an otherwise good correlation</li> <li>• Understand that samples may or may not be representative of a population</li> <li>• Understand that the size and construction of a sample will affect how representative it is.</li> <li>• Find the mean for a discrete frequency distribution</li> <li>• Find the median for a discrete frequency distribution</li> <li>• Find the mode or modal class for frequency distributions</li> <li>• Calculate an estimate of the mean for a grouped frequency distribution, knowing why it is an estimate</li> <li>• Find the interval containing the median for a grouped frequency distribution</li> <li>• Choose an appropriate measure to be the 'average', according to the nature of the data</li> <li>• Find patterns in data that may lead to a conclusion being drawn</li> <li>• Use measures of central tendency and measures of dispersion to describe a population</li> </ul>	

Probability		
Year 9	Year 10	Year 11
<ul style="list-style-type: none"> <li>• List all the outcomes for an experiment</li> <li>• Identify equally likely outcomes</li> <li>• Work out theoretical probabilities for events with equally likely outcomes</li> <li>• Know how to represent a probability</li> <li>• List all elements in a combination of sets using a Venn diagram</li> <li>• List outcomes of an event systematically</li> <li>• List outcomes of an event using a grid (two-way table)</li> </ul>	<ul style="list-style-type: none"> <li>• Design and use two-way tables</li> <li>• Complete a two-way table from given information</li> <li>• Calculate probabilities from two-way tables</li> <li>• Complete a frequency table for the outcomes of an experiment</li> <li>• Understand when outcomes can or cannot happen at the same time</li> <li>• Use this understanding to calculate probabilities</li> </ul>	<ul style="list-style-type: none"> <li>• List all the outcomes for a single event in a systematic way</li> <li>• List all the outcomes for two events in a systematic way</li> <li>• Complete a frequency table for the outcomes of an experiment</li> <li>• Use lists or tables to find probabilities</li> <li>• Appreciate the 'lack of memory' in a random situation, for example a fair coin is still equally likely to give heads or tails even after five heads in a row.</li> </ul>

## Foundation SOW Progression

<ul style="list-style-type: none"> <li>• Use frequency trees to record outcomes of probability experiments</li> <li>• Make conclusions about probabilities based on frequency trees</li> <li>• Construct theoretical possibility spaces for combined experiments with equally likely outcomes</li> <li>• Calculate probabilities using a possibility space</li> <li>• Use theoretical probability to calculate expected outcomes</li> </ul> <p>Use experimental probability to calculate expected outcomes</p>	<ul style="list-style-type: none"> <li>• Appreciate that the sum of the probabilities of all possible mutually exclusive outcomes has to be 1</li> <li>• Find the probability of a single outcome from knowing the probability of all other outcomes.</li> </ul> <p>Understand the terms mutually exclusive events, exhaustive events</p>	<ul style="list-style-type: none"> <li>• Recall that an ordinary fair dice is an unbiased dice numbered 1, 2, 3, 4, 5 and 6 with equally likely outcomes</li> <li>• Work out probabilities by counting or listing equally likely outcomes.</li> <li>• Understand and use the term relative frequency</li> <li>• Consider differences, where they exist, between the theoretical probability of an outcome and its relative frequency in a practical situation</li> <li>• Understand that experiments rarely give the same results when there is a random process involved</li> <li>• Estimate probabilities by considering relative frequency.</li> <li>• Understand that the greater the number of trials in an experiment, the more reliable the results are likely to be</li> <li>• Understand how a relative frequency diagram may show a settling down as sample size increases, enabling an estimate of a probability to be reliably made; and that if an estimate of a probability is required, the relative frequency of the largest number of trials available should be used.</li> <li>• Complete a frequency tree from given information</li> <li>• Use a frequency tree to compare frequencies of outcomes</li> <li>• Complete tables and /or grids to show outcomes and probabilities</li> <li>• Complete a tree diagram to show outcomes and probabilities</li> <li>• Understand that <math>P(A)</math> means the probability of event A</li> <li>• Understand that <math>P(A/)</math> means the probability of event not A</li> <li>• Understand that <math>P(A \cup B)</math> means the probability of event A or B or both</li> <li>• Understand that <math>P(A \cap B)</math> means the probability of event A and B</li> <li>• Understand a Venn diagram consisting of a universal set and at most two sets, which may or may not intersect</li> <li>• shade areas on a Venn diagram involving at most two sets, which may or may not intersect</li> <li>• solve problems given a Venn diagram</li> </ul>
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Foundation SOW Progression

		<ul style="list-style-type: none"> <li>• solve problems where a Venn diagram approach is a suitable strategy to use but a diagram is not given in the question.</li> <li>• know when it is appropriate to add probabilities</li> <li>• know when it is appropriate to multiply probabilities</li> <li>• understand the meaning of independence for events</li> <li>• calculate probabilities when events are dependent</li> <li>• understand the implications of with or without replacement problems for the probabilities obtained</li> <li>• complete a tree diagram to show outcomes and probabilities</li> <li>• use a tree diagram as a method for calculating probabilities for independent or dependent events.</li> </ul>
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KS4

Transformations		
Year 9	Year 10	Year 11
	<ul style="list-style-type: none"> <li>• Recognise reflection symmetry of 2D shapes</li> <li>• Identify and draw lines of symmetry on a shape or diagram (incl. on a Cartesian grid)</li> <li>• Draw or complete a diagram with a given number of lines of symmetry (incl. on a Cartesian grid)</li> <li>• Identify the order of rotational symmetry on a shape or diagram (incl. on a Cartesian grid)</li> <li>• Draw or complete a diagram with rotational symmetry (incl. on a Cartesian grid)</li> <li>• Describe and transform 2D shapes using single rotations specified by a centre and an angle (measures using simple fractions of a turn or degrees) on and off a grid</li> <li>• Find a centre of rotation</li> <li>• Describe and transform 2D shapes using single reflections specified by a mirror line</li> <li>• Find the equation of a line of reflection</li> <li>• Describe and transform 2D shapes using translation specified by a distance and direction (using a vector)</li> </ul>	

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	<ul style="list-style-type: none"> <li>• describe and transform 2D shapes on a grid using enlargements (with or without a specified centre) with a positive scale factor</li> <li>• Find the centre of enlargement</li> <li>• Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides</li> <li>• Understand that lengths and angles are preserved under rotations, reflections and translations, so that any figure is congruent under any of these transformations but recognise that enlargements preserve angle but not length</li> </ul>	
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Congruence and Similarity		
Year 9	Year 10	Year 11
	<ul style="list-style-type: none"> <li>• Understand congruence</li> <li>• Identify shapes that are congruent</li> <li>• Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and compass constructions.</li> <li>• Recognise congruent shapes when rotated, reflected or in different orientations</li> <li>• Understand similarity</li> <li>• Understand similarity of triangles and of other plane figures, and use this to make geometric inferences</li> <li>• Identify shapes that are similar, including all squares, all circles or all regular polygons with equal number of sides</li> <li>• Recognise similar shapes when rotated, reflected or in different orientations</li> <li>• Understand the effect of enlargement on perimeter</li> <li>• Work out the side of one shape that is similar to another shape given the ratio or scale factor of lengths</li> </ul>	

Foundation SOW Progression

Constructions and Loci		
Year 9	Year 10	Year 11
	<ul style="list-style-type: none"> <li>• Measure and draw lines to the nearest mm</li> <li>• Measure and draw angles to the nearest degree</li> <li>• Draw circles or part circles given the radius or diameter</li> <li>• Make accurate drawings of triangles and other 2D shapes using a ruler and a protractor</li> <li>• Make an accurate scale drawing from a sketch, diagram or description</li> <li>• Construct a triangle</li> <li>• Construct an equilateral triangle with a given side or given side length</li> <li>• Construct a perpendicular bisector of a given line, at a given point on a given line and from a given point to a given line</li> <li>• Construct an angle bisector</li> <li>• Construct an angle of <math>60^\circ</math></li> <li>• Draw parallel lines</li> <li>• Construct a region, for example, bounded by a circle and an intersecting line</li> <li>• Construct loci, for example, given a fixed distance from a point and a fixed distance from a given line</li> <li>• Construct loci, for example, given equal distances from two points</li> <li>• Construct loci, for example, given equal distances from two line segments</li> <li>• Construct a region that is defined as, for example, less than a given distance or greater than a given distance from a point or line segment</li> <li>• Describe regions satisfying several conditions.</li> </ul>	

Foundation SOW Progression

Pythagoras Theorem		
Year 9	Year 10	Year 11
		<ul style="list-style-type: none"> <li>• understand, recall and use Pythagoras' theorem in 2D problems</li> <li>• These problems can be two step problems requiring Pythagoras in both steps</li> </ul>

Trigonometry		
Year 9	Year 10	Year 11
		<ul style="list-style-type: none"> <li>• Understand, recall and use trigonometric ratios in right-angled triangles</li> <li>• Use the trigonometric ratios in right-angled triangles to solve problems, including those involving bearings</li> <li>• Recall exact values of sine, cosine and tangent for <math>0^\circ</math>, <math>30^\circ</math>, <math>45^\circ</math> and <math>60^\circ</math> and use these in calculations without the use of a calculator</li> <li>• Recall that <math>\sin 90^\circ = 1</math> and <math>\cos 90^\circ = 0</math></li> <li>• Solve right-angled triangles with angles of <math>30^\circ</math>, <math>45^\circ</math> or <math>60^\circ</math> without using a calculator</li> </ul>

Vectors		
Year 9	Year 10	Year 11
		<ul style="list-style-type: none"> <li>• Understand and use vector notation</li> <li>• Calculate and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector</li> <li>• Calculate the resultant of two vectors</li> <li>• Understand and use the commutative and associative properties of vector addition.</li> </ul>