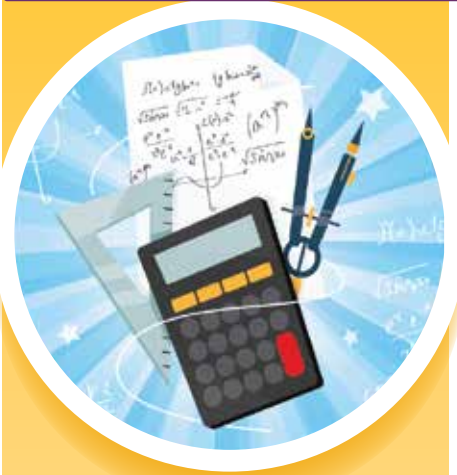


Mathematics - Vision



MATHEMATICS

»» The department's curriculum intent:

- Mathematics includes everyone; there is a pathway for all
- The awe of Mathematics is celebrated and is accessible to all including our most able, gifted mathematicians
- Our pupils appreciate the beauty and value of Mathematics in its many guises
- Our pupils understand that Mathematics pervades the real world and learn about the application of Mathematics in the 'real world' context and as appropriate learn Mathematics 'by stealth'
- Our pupils feel confident in persevering and taking risks; they have no fear of Mathematics and enjoy the feeling of success that Mathematics brings
- Our curriculum sees transferrable skills and Learning Talents as the foundation tools that pupils develop and use to become successful mathematicians
- Our pupils enjoy the opportunity that FRaP gives them to practise their skills and to 'plug gaps' both in their approaches to learning & revision and in their subject knowledge

»» The department within the context of St Paul's:

- The gifts we grow
- Service to others
- Respect and forgiveness
- Spiritual and moral development
- Positive relationships
- Each pupil is equally important
- Local needs and diversity of community
- Consistency of expectations
- Celebration of success
- Key group needs and individual pupil needs

»» The department's curriculum implementation:

The curriculum is implemented and mapped in the following areas:

- Tiers and level of challenge
- Learning Talents
- Subject/real life context
- Mathematical knowledge and skills
- Independent Learning
- Progression is demonstrated across all of the above through the mapping documents.
- Information on progression and skills is shared with all stakeholders: parents receive half-termly topic lists to inform and support; pupils receive half-termly topic stickers in their books; and teachers have mapping documents to inform planning.

»» The department's monitoring of impact:

- Teaching review
- Live lesson experiences
- Book scrutiny
- Learning walks
- Scheme of Learning evaluations
- Attainment and progress data
- Curriculum mapping
- Learning Talent mapping
- Independent Learning mapping
- Pupil interviews
- Staff mentoring

'It is not enough to have a good mind, the main thing is to use it well' - Descartes

'Do not worry about your difficulties in Mathematics, I assure you mine are greater' - Einstein



Mathematics - Course Pathways



Mathematics - Y7-11 Rationale

- » • The Mathematics curriculum for Years 7 to 11 is structured for stage rather than age.
- » • Pupils are put in to sets at the beginning of Year 7 based on a triangulation of data from SATs, CATs and baseline assessments at St Paul's.
- » • Sets are reviewed regularly and pupils move between sets as is appropriate for the individual. Set change decisions are made based on trends in the pupil's assessment data rather than one assessment.
- » • If a pupil moves up a set they are provided with additional coaching and intervention work to help them be ready for the new group.
- » • The set determines the tier of work within the Schemes of Learning that will be followed. These tiers are indicative of the GCSE grade that the pupil may currently be working at however, we recognise that national standards change every year so this is always seen as an approximation.
- » • Different classes within a year group will follow different tiers, as they work on the tier that the Department Leadership Team and the Class Teacher see as most fitting for the class's needs.
- » • Classes across different year groups will follow the same tier, as they work on the tier that the Department Leadership Team and the Class Teacher see as most fitting for the class's needs. As an example classes on tier 4 may include top set Year 7, middle set Year 9 and lower set Year 11 groups.
- » • Pupils are provided with a Revision and Progression Booklet which includes a topic list for each half term, a diagrammatic view of how new learning builds on prior learning and space for pupils to record the key points and examples for each objective.
- » • Mathematics is taught in context for much of the curriculum, this follows educational research including the work of Professor Jo Boaler. The curriculum is structured in to modules linked to the areas of life that are relevant and engaging for pupils, this is based on their feedback. The contexts are regularly reviewed to ensure that pupils can relate to the context and are motivated by learning Mathematics that can be used outside of the Mathematics classroom.
- » • For the latter stage of Year 11 many classes move to the 5Rs revision programme that has been developed in school based on educational research funded by EEF. The lessons are structured to follow the same pattern: Recall, Routine, Revise, Repeat and Ready?





	Tier 0	Tier 1
Maths & Communications and Maths & Planet Earth	<ul style="list-style-type: none"> Identify, represent and estimate numbers Read and write numbers up to 1000 in numerals and in words Add and subtract numbers mentally Tell and write the time from an analogue clock, including using Roman numerals Read Roman numerals to 100 Measure, compare, lengths (m/cm/mm) Draw 2-D shapes Know the number of seconds in a minute and the number of days in each month, year and leap year Identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn Identify whether angles are greater than or less than a right angle Write and calculate mathematical statements for multiplication and division Count up and down in tenths Interpret and present data using bar charts, pictograms and tables 	<ul style="list-style-type: none"> Add and subtract whole numbers Recall multiplication facts to 10×10 Write numbers in words, and vice versa Order positive and negative decimals Understand place value Round numbers to a given power of 10 Estimate answers to calculations, including use of rounding Recognise even and odd numbers Understand the word multiple and identify multiples Use geometrical language appropriately and recognise/name polygons Listed the properties of a shape Use and interpret maps Use axes and identify coordinates in the positive quadrant Interpret and discuss data including from tables Produce pictograms, composite bar charts or dual bar charts Calculate Mode and Range
Maths and Emerging Technologies & Maths and Media & Business	<ul style="list-style-type: none"> Solve problems including missing number problems, using number facts Identify horizontal and vertical lines and pairs of perpendicular and parallel lines Identify right angles, recognise how combining right angles can make turns Estimate and read time with accuracy to the nearest minute Recognise, find and write fractions of a set of objects Measure the perimeter of 2-D shapes Record and compare time in terms of seconds, minutes and hours Use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight Read Roman Numerals to 100 Round any number to the nearest 10, 100 or 1000 Add and subtract amounts of money to give change, using £ and p Interpret, present data and solve questions using bar charts, pictograms and tables Recognise and use fractions as numbers 	<ul style="list-style-type: none"> Add, subtract, multiply and divide whole numbers Recall all multiplication facts to 10×10 Recognise even and odd numbers Multiply or divide any number by powers of 10 Generate arithmetic sequences of numbers, and sequences derived from diagrams Write the term-to-term definition of a sequence in words Find a specific term in a sequence using term-to-term rules Identify which terms cannot be in a sequence Divide whole numbers and decimals Order integers and decimals Understand and use positive numbers and negative integers Understand place value Identify the value of digits in a decimal or whole number Estimate answers to calculations, including use of rounding Enter a range of calculations including those involving time and money Use correct notation for time, 12- & 24- hour clock Work out time intervals Produce: pictograms, composite bar charts, comparative and dual bar charts Calculate Mode and Median Use ratios Find equivalent fractions Write a fraction in its simplest form Compare fractions
Maths & the Universe	<ul style="list-style-type: none"> Recognise the place value of each digit in a three-digit number (hundreds, tens, ones) Count backwards through zero to include negative numbers Add and subtract numbers mentally Estimate the answer to a calculation and use inverse operations to check answers Identify horizontal and vertical lines and pairs of perpendicular and parallel lines Recognise 3-D shapes in different orientations and describe them Measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml) Interpret and present data using bar charts, pictograms and tables Know the number of seconds in a minute and the number of days in each month, year and leap year Solve problems, including missing number problems, involving multiplication and division Recognise and show, using diagrams, equivalent fractions with small denominators 	<ul style="list-style-type: none"> Add, subtract, multiply and divide whole numbers Recall all multiplication facts to 10×10 Use positive integer powers and associated real roots Recognise powers of 2 Identify points with given coordinates Draw and label axes Work with coordinates Use geometric language appropriately Use letters to identify points, lines and angles Mark perpendicular lines on a diagram Mark parallel lines on a diagram Use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres Describe and transform 2-D shapes using single reflections Understand that reflections are specified by a mirror line Recognise reflection symmetry of 2-D shapes Identify and draw lines of symmetry on a shape Recognise rotation symmetry of 2-D shapes Identify the order of rotational symmetry of a 2-D shape
Maths & Current Affairs	<ul style="list-style-type: none"> Add and subtract amounts of money to give change, using both £ and p Solve problems, including missing number problems, involving multiplication and division Count backwards through zero to include negative numbers Round any number to the nearest 10, 100 or 1000 Read and write numbers up to 1000 in numerals and in words Record and compare time in terms of seconds, minutes and hours Use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight Measure the perimeter of simple 2-D shapes Recognise 3-D shapes in different orientations and describe them Recognise angles as a property of shape or a description of a turn Interpret and present data using bar charts, pictograms and tables Solve questions using information presented in scaled bar charts and pictograms and tables Recognise and show, using diagrams, equivalent fractions with small denominators 	<ul style="list-style-type: none"> Add, subtract, multiply and divide whole numbers and decimals Recall all multiplication facts to 10×10 Enter a range of calculations including those involving time and money Use correct notation for time, 12- and 24- hour clock Enter a range of calculations including those involving time and money Find equivalent fractions Write a fraction in its simplest form Compare fractions Process and represent the data Interpret and discuss the data Design and use two-way tables for discrete data Use information provided to complete a two-way table Interpret and analyse through appropriate measures of central tendency median, mode, and range
Maths & Culture	<ul style="list-style-type: none"> Compare and order numbers up to 1000 Add and subtract numbers with up to three digits, using formal written methods Solve problems, including missing number problems, using number facts, place value using the multiplication tables Compare durations of events Draw 2-D shapes and make 3-D shapes using modelling materials Identify right angles and the fact combining right angles makes turns Measure, compare, add and subtract: lengths (cm/mm); mass (kg/g); volume/capacity (l/ml) Interpret and present data using bar charts, pictograms and tables Solve questions using information presented in scaled bar charts and pictograms and tables Compare and order unit fractions, and fractions with the same denominators 	<ul style="list-style-type: none"> Identify quadrilaterals from everyday usage Measure and draw lines to the nearest mm List the properties of each, or identified a given shape Use geometrical language appropriately Recognise and name pentagons, hexagons, heptagons, octagons and decagons Use letters to identify points, lines and angles Mark perpendicular and parallel lines on a diagram Recognise and name pentagons, hexagons, heptagons, octagons and decagons Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone Know the terms face, edge and vertex Draw nets and show how they fold to make a 3-D solid Describe and transform 2-D shapes using single reflections Understand that reflections are specified by a mirror line Understand that translations are specified by a distance and direction
Maths and Healthy Living	<ul style="list-style-type: none"> Recognise the place value of each digit in a three-digit number (hundreds, tens, ones) Compare and order numbers up to 1000 Add and subtract numbers with up to three digits, using formal written methods Estimate the answer to a calculation and use inverse operations to check answers Solve problems, including missing number problems, involving multiplication and division Tell and write the time from an analogue clock, including using Roman numerals, 12-hour and 24-hour Add and subtract fractions with the same denominator within one whole Interpret and present data using bar charts, pictograms and tables Solve questions using information presented in scaled bar charts and pictograms and tables Measure the perimeter of 2-D shapes Draw 2-D shapes and make 3-D shapes using modelling materials Recognise angles as a property of shape 	<ul style="list-style-type: none"> Added, subtracted, multiplied and divided whole numbers Recalled all multiplication facts to 10×10 Used standard units of length, time and other measures Estimated answers Measure shapes to find perimeters and areas Find the perimeter of rectangles and triangles Find the perimeter of compound shapes Find the area of a rectangle and triangle Distinguish between impossible, unlikely, even chance, likely, and certain events Mark events and/or probabilities on a probability scale of 0 to 1 Write probabilities in words, fractions, decimals and percentages

	Tier 2	Tier 3
Maths & Communications and Maths & Planet Earth	<ul style="list-style-type: none"> Write numbers in words Understand and use place value, identify the value of digits in numbers Apply addition and subtraction operations to integers Use Venn diagrams to classify shapes Recall the properties and definitions of quadrilaterals Classify quadrilaterals by their geometric properties Ordered positive, negative and decimals Distinguished between the different types of triangles Understand and use the angle properties of triangles 	<ul style="list-style-type: none"> Calculate angles around a point Use axes and coordinates to specify points in all four quadrants Use compass points Add, subtract, multiply and divide integers and decimals Convert between fractions and decimals Add, subtract, multiply and divide negative numbers Understand and use positive and negative integers Find a percentage of a quantity Extract data from lists and tables. Interpret composite bar charts Find the Mode, Median and Range
Maths and Emerging Technologies & Maths and Media & Business	<ul style="list-style-type: none"> Recognise sequences of odd and even numbers Generate simple sequences of numbers, and squared integers Describe the term-to-term definition of a sequence in words Use positive integer powers including squares and cubes Recognise powers of 2 Identify factors and multiples Solve word problems Use algebraic notation and symbols correctly Write an expression Add, subtract, multiply and divide whole numbers, integers 	<ul style="list-style-type: none"> Recall all multiplication facts 10×10 Sort, classify and tabulate data and discrete or continuous quantitative data Produce: composite bar charts Calculate: mean, mode, median and range Use ratios and write ratios in their simplest form Add, subtract, multiply and divide whole numbers, integers, negative numbers, decimals Estimate answers and check calculations using approximation Use percentages to solve problems Use formulae from mathematics and other subjects Substitute numbers into a formula
Maths & the Universe	<ul style="list-style-type: none"> Add, subtract, multiply and divide whole numbers, integers, negative numbers, and decimals Order decimals, use the symbols =, \neq, $<$, $>$, \leq, \geq Work interchangeably with terminating decimals and their corresponding fractions Use positive integer powers and associated real roots (square and cube) Substitute values into formulae Work with coordinates in all four quadrants Plot graphs of equations that correspond to straight-line graphs in the coordinate plane Use and interpret algebraic notation Identify, describe and construct congruent shapes including on coordinate axes by considering rotation, reflection and translation 	<ul style="list-style-type: none"> Know how to enter complex calculations on the calculator display Use a range of calculator functions including +, -, \times, \div, x^2, \sqrt{x}, memory, xy, $x1/y$ and brackets Write ratios in their simplest form & Divide a quantity in a given ratio Solve a ratio problem in context Use algebraic notation and symbols correctly Manipulate algebraic expressions by collecting like terms Multiply a single term over a bracket Write expressions to solve problems Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane Plot and draw graphs of straight lines with equations of the form $y = mx + c$
Maths & Current Affairs	<ul style="list-style-type: none"> Use percentages to solve problems Find a percentage of a quantity in order to increase or decrease Add, subtract, multiply and divide whole numbers, integers, negative numbers, and decimals Produce and use: pictograms Calculate and interpret mean, mode, range and median 	<ul style="list-style-type: none"> Change freely between related standard units (e.g. length, area, volume/capacity, mass) Add, subtract, multiply and divide integers, negative numbers and fractions Calculate: mean, mode, median, range, modal class Interpret and construct tables, charts and diagrams Know and apply formulae to calculate: area of triangles, parallelograms, trapezia Know and apply formulae to calculate volume of cuboids and other right prisms Use ratio notation Apply ratio to real life problems and contexts Substitute numerical values into formulae and expressions Understand and use mathematical formulae Round numbers and measures to an appropriate degree of accuracy to a specified number of decimal places
Maths & Culture	<ul style="list-style-type: none"> Understand tessellations of regular and irregular polygons Tessellate combinations of polygons Make an accurate drawing Measure angles accurately List the properties of each, or identify (name) of a given shape or solid Classify quadrilaterals by their geometric properties Use straight edge and a pair of compasses to do standard constructions Construct a triangle Construct a regular hexagon inside a circle Use positive integer powers and real roots Recall the powers of 2, 3, 4, 5 and 10 	<ul style="list-style-type: none"> Derive and apply the properties: parallelogram, trapezium, kite and rhombus; and triangles Use conventional terms and notations: polygons with reflection and/or rotation symmetries Identify, describe and construct congruent shapes, including on coordinate axes by rotation, reflection and translation Measure line segments and angles in geometric figures, including interpreting scale drawings Use ratio notation, including reduction to simplest form Multiply and divide whole numbers Recognise and use sequences of Fibonacci type sequences Divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio
Maths and Healthy Living	<ul style="list-style-type: none"> Add, subtract, multiply and divide whole numbers, and integers Calculate: mean, mode, median and range Distinguish between events which are: impossible, unlikely, even chance, likely, and certain to occur Mark events and/or probabilities on a probability scale of 0 to 1 Write probabilities in words or fractions, percentages or decimals Find a missing probability from a list or table Apply systematic listing strategies Estimate answers Add, subtract, multiply and divide integers Substitute numbers into a formula 	<ul style="list-style-type: none"> Draw straight line graphs for real-life situations Interpret distance-time graphs Use appropriate equipment to construct given figures and use them to solve problems Apply the properties of angles on parallel lines Derive and use the sum of angles in a triangle



	Tier 4	Tier 5
Maths & Communications and Maths & Planet Earth	<ul style="list-style-type: none"> Identify and apply circle definitions and properties Know the formulae: circumference of a circle and area of a circle Use and interpret algebraic notation Manipulate algebraic expressions by collecting like terms Multiply a single term over a bracket Use and interpret algebraic notation Substitute numbers into a formula Use the standard ruler and compass constructions Construct given figures and solve loci problems Apply the properties of angles Interpret and construct tables, charts and diagrams Use and interpret scatter graphs Recognise correlation 	<ul style="list-style-type: none"> Develop a good quality of written communication Research Model Mathematicians Factorise quadratic expressions Expand the product of two binomials Simplify expressions Substituted numerical values Find approximate solutions to equations using iteration Interpret, analyse and compare distributions Interpret, analyse and compare averages of grouped data Use and interpret scatter graphs; recognise correlation Draw estimated lines of best fit, make predictions Use the standard ruler and compass constructions Know the formula for Pythagoras' Theorem Calculate with and interpret standard form Round numbers and measures to an appropriate degree of accuracy
Maths and Emerging Technologies & Maths and Media & Business	<ul style="list-style-type: none"> Apply the four operations, including formal written methods to integers and decimals Understand and use place value including when calculating with decimals Solve word problems Know how to enter complex calculations into a calculator Understand and interpret the calculator display Estimate answers; check calculations using approximation & estimation, including answers obtained using technology Use a range of calculator functions including $+$, $-$, \times, \div, x^2, \sqrt{x}, memory, fractions, time, xy, $x1/y$, and brackets Work interchangeably with terminating decimals and their corresponding fractions Substitute numerical values into formulae and expressions, including scientific formula Generate points and plot graphs of simple quadratic functions, then more general quadratic functions Construct and interpret plans and elevations of 3D shapes. Know & apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids Know the formulae: calculate surface area & volume of composite solids (cylinders, prisms, cuboids) Plot graphs of equations that correspond to straight-line graphs in the coordinate plane; Identify and interpret gradients and intercepts of linear functions graphically and algebraically Interpret the gradient of a straight line graph as a rate of change Draw straight line graphs for real-life situations - fixed charge (standing charge) and cost per unit Use ratio notation, including reduction to simplest form Identify and work with fractions in ratio problems 	<ul style="list-style-type: none"> Apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$, $y = a f(x)$ for sine and cosine functions Know the exact values of $\sin \theta$, $\cos \theta$ and $\tan \theta$ for given degrees Simplifying expressions involving sums, products and powers, including the laws of indices Estimate powers and roots of any given positive number Calculate with roots, and with integer and negative indices Plot and interpret graphs including reciprocal and exponential graphs Translate simple situations or procedures into algebraic expressions or formulae Solve linear inequalities in one variable Represent the solution set on a number line Know the difference between an equation, identity, formula and expression Factorise quadratic expressions of the form Define a percentage as the number of parts per hundred Interpret percentages and percentage change as a fraction or a decimal Solve problems using simple interest including in financial mathematics Solve problems involving percentage change, including percentage increase/decrease and original value problems Interpret the gradient of a straight line graph as a rate of change Identify and interpret gradients and intercepts of linear functions graphically and algebraically Recognise and interpret graphs that illustrate direct proportion Solve problems involving direct proportion graphically
Maths & the Universe	<ul style="list-style-type: none"> Use positive integer powers and associated real roots Estimate powers and roots of any given positive number Calculate with roots, and with integer indices (laws of indices) Simplifying expressions sums, products and powers, including laws of indices Use the concepts and vocabulary of prime numbers, factors, multiples, HCF, LCM Prime factorisation, including using product notation and the unique factor theorem Factorise single brackets Understand and use compound measures, including speed and density Solve word problems Generate terms of a sequence from either a term-to-term or a position-to-term rule Recognise and use sequences of triangular, square and cube numbers Deduce expressions to calculate the nth term of linear Rearrange formulae to change the subject Solve linear equations with one unknown 	<ul style="list-style-type: none"> Plot and interpret graphs including reciprocal and exponential Set up, solve and interpret the answers in growth and decay problems Change freely between related standard units and compound units Substitute numerical values into formulae and expressions, including scientific formulae Use compound measures, including speed Interpret the gradient of a straight line graph as a rate of change Recognise and interpret graphs that illustrate direct and inverse proportion Understand and use standard mathematical formulae Rearrange formulae to change the subject Understand and use compound measures, including density Calculate with and interpret standard form Know the formulae for Pythagoras's theorem Know the trigonometric ratios, Use surds and π in exact calculations, without a calculator
Maths & Current Affairs	<ul style="list-style-type: none"> Solve problems involving percentage change, including repeated percentage increase/decrease Find a percentage of a quantity in order to increase or decrease Estimate the mean for large data sets with grouped data Distinguish between positive, negative and zero correlation using lines of best fit Understand that correlation does not imply causality Use a line of best fit, or otherwise, to predict values of one variable given values of the other variable Plot and interpret graphs in real contexts Solve linear equations in one unknown algebraically (including unknown on both sides of the equation); Identify and interpret gradients and intercepts of linear functions graphically and algebraically Plot a linear graph, use the form $y = mx + c$ to identify parallel lines Use dual or comparative bar charts to compare distributions Interpret and construct tables, pie & vertical line charts for ungrouped discrete numerical data. Interpret, analyse and compare the distributions of data sets 	<ul style="list-style-type: none"> Know the formulae for Pythagoras's theorem Know the trigonometric ratios Solve problems involving percentage change including original value problems Set up, solve and interpret the answers in compound interest Solve problems involving direct proportion Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling Use and interpret scatter graphs Recognise correlation Draw estimated lines of best fit; make predictions Interpret, analyse and compare distributions through: appropriate graphical representations including box plots Interpret, analyse and compare distributions through: quartiles and inter-quartile range
Maths & Culture	<ul style="list-style-type: none"> Use and interpret algebraic notation Simplified algebraic expressions by collecting like terms Manipulated algebraic expressions by multiplying a single term over a bracket Apply and interpret limits of accuracy, including upper and lower bounds Change freely between related standard units Use standard units of measure and related concepts Identify, describe and construct congruent and similar shapes, by considering rotation, reflection, translation and enlargements Use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; Describe translations as 2D vectors 	<ul style="list-style-type: none"> Construct and interpret plans and elevations of 3D shapes Measure line segments including interpreting scale drawings Use scale factors and scale diagrams Use the concepts and vocabulary of highest common factor, lowest common multiple Prime factorisation, including using product notation and the unique factorisation theorem only using Venn diagrams Use Venn diagrams Identify, describe and construct enlargements using fractional scale factors Solve a ratio problem in a context Given the front and side elevations and the plan of a solid, draw a sketch of the 3-D solid Express a multiplicative relationship between two quantities as a ratio or fraction Understand and draw front and side elevations and plans of shapes made from simple solids Use and interpret maps and scale drawings Read and construct drawings Draw lines and shapes to scale Understand, recall and use Pythagoras' theorem in 2-D
Maths and Healthy Living	<ul style="list-style-type: none"> Relate relative expected frequencies to theoretical probability Numerate sets and combinations of sets systematically, using tables, grids Record describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees Construct given figures and solve loci problems Measure line segments in geometric figures including scale drawings Know and apply the formulae: circumference of a circle, area of a circle Estimate answers; check calculations using approximation and estimation Round numbers and measures to an appropriate degree of accuracy Change freely between related standard units and compound units e.g. speed Use compound units such as speed 	<ul style="list-style-type: none"> Construct theoretical probability spaces for single and combined experiments Calculate the probability of independent and dependent combined events including using tree diagrams Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables and tree diagrams Enumerate sets and combinations of sets systematically using tables, grids and tree diagrams Venn diagrams for probabilities Substitute numerical values into formulae and expressions, including scientific formulae Estimate answers; check calculations using approximation and estimation Apply and interpret limits of accuracy, including upper and lower bounds Use inequality notation to specify simple error intervals due to truncation or rounding

	Tier 6	Tier 7
Maths & Communications and Maths & Planet Earth	<ul style="list-style-type: none"> Identify properties of the faces, surfaces, edges and vertices Calculate the lengths of arcs and the areas of sectors of circles. Calculate perimeter and area of compound shapes Calculate exactly with fractions, surds and multiples of π Simplify surd expressions Know the formulae for Pythagoras' Theorem Know the exact values of $\sin \theta$, $\cos \theta$ and $\tan \theta$ Been able to apply the sine rule to find unknown lengths and angles Use the form $y=mx+c$ to identify parallel and perpendicular lines Find the equation of the line through two points Find the equation of a line through a give point and the gradient Identify and interpret gradients and intercepts of linear functions 	<ul style="list-style-type: none"> Calculate the area of a segment of a circle Apply $\text{Area}=\frac{1}{2} \text{absin}C$ to calculate the area/sides/angles of triangles Been able to apply formulae for area of circles and composite shapes Find approximate solutions to equations numerically using iteration Worked with general iterative processes Apply the standard circle theorems Identify and apply circle definitions and properties Apply the sine rule to find unknown lengths/angles Apply the cosine rule to find unknown lengths/angles Interpret and use bearings Calculate and interpret conditional probabilities Calculate conditional probabilities using Venn diagrams Solve quadratic equations using the quadratic formula Solve quadratic equations by completing the square Identify and interpret roots, intercepts and turning points
Maths and Emerging Technologies & Maths and Media & Business	<ul style="list-style-type: none"> Recognise, sketch and interpret graphs of linear functions, cubic functions, the reciprocal function, exponential functions and the trigonometric functions Plot and interpret graphs of non-standard functions in real contexts Change recurring decimals into their corresponding fractions and vice versa Review, identify and interpret gradients and intercepts of linear functions graphically and algebraically Identify and interpret intercepts Solve two simultaneous equations in two variables graphically Recognise and use the equation of a circle with centre at the origin Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling Construct and interpret diagrams for grouped discrete data and continuous data Interpret, analyse and compare the distributions of data sets through appropriate measures of central tendency and spread Construct and interpret diagrams for continuous data Interpret and construct tables, charts and diagrams, including frequency tables, fo ungrouped discrete numerical data 	<ul style="list-style-type: none"> Review the equation of a circle with radius r and centre $(0,0)$ Review finding the point of intersection of a line and a curve. Review solving two simultaneous equations graphically Find the point(s) of intersection of two curves. Find approximate solutions for two simultaneous equations in two variables using a graph (linear/quadratic) Find the equation of a tangent to a circle at a given point. Interpret the gradient at a point on a curve as the instantaneous rate of change (gradients of chords and tangents) Sketch translations and reflections of a given function including trigonometric functions Translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation(s) and interpret the solution. Represent the solution on a graph Use inequalities to identify regions on a graph that satisfy conditions Solve quadratic inequalities in one variable Represent the solution using set notation and on a graph Calculate or estimate gradients of graphs and areas under graphs including quadratic and other non-linear graphs, and interpret results in cases such as financial contexts
Maths & the Universe	<ul style="list-style-type: none"> Apply and prove the standard circle theorems concerning angles, radii, tangents and chords Find missing angles on diagrams Prove and use the facts that: the angle in a semicircle is a right angle and opposite angles of a cyclic quadrilateral sum to 180° Explore the gradients of parallel lines and lines perpendicular to each other Write down the equation of a line parallel or perpendicular to a given line Select and use the fact that when $y = mx + c$ is the equation of a straight line Interpret and analyse a straight line graph and generate equations of lines parallel and perpendicular to the given line Calculate or estimate gradients of graphs and areas under graphs and interpret results in cases such as distance-time graphs and velocity-time graphs Interpret a pair of simultaneous equations as a pair of straight lines and their solution as the point of intersection Find the exact solutions of two simultaneous equations in two unknowns Use elimination to solve simultaneous equations 	<ul style="list-style-type: none"> Calculate exactly with surds Simplify surd expressions Rationalise denominators Understand and use vector notation Calculate, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector Solve geometrical problems in 2-D using vector methods Apply vector methods for simple geometrical proofs Argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments and proofs Plot graphs of simple cubic functions, the reciprocal function, the circular functions $y = \sin x$ and $y = \cos x$. Recognise the characteristic shapes of all these functions Construct the graphs of simple loci including the circle equation Plot graphs of equations that correspond to straight-line graphs in the coordinate plane Use the form $y = mx + c$ to identify parallel and perpendicular lines Find the equation of the line through two given points, or through one point with a given gradient Understand that X is inversely proportional to Y is equivalent to X is proportional to $1/Y$ Construct and interpret equations that describe direct and inverse proportion
Maths & Current Affairs	<ul style="list-style-type: none"> Calculate with dependent and independent events. Find the probability of successive events, such as several throws of a dice. Estimate the number of times an event will occur, given the probability and the number of trials. Understand conditional probabilities; understand selection with or without replacement. Draw and use a tree diagram to calculate conditional probability. Understand the terms 'Locus' & 'Loci'. Construct a locus which is equidistant from a fixed point. Construct a locus which is equidistant from a line segment. Construct a locus which is equidistant from 2 fixed points. Apply a combination of loci to various functional problems Interpret simple expressions as functions with inputs and outputs; interpret the reverse process as the 'inverse function' Solve problems involving direct proportion, including graphical and algebraic representations Identify and use proportionality formulae Represent these solutions on a graph represent the solution set on a number line Solve linear inequalities in one or two variable(s) 	<ul style="list-style-type: none"> Construct and interpret diagrams for grouped discrete data and continuous data Construct and interpret cumulative frequency graphs Interpret, analyse and compare the distributions of data sets through: box plots, median, and spread, including consideration of outliers, quartiles and inter-quartile range Calculate or estimate gradients of graphs and areas under graphs, including non-linear graphs, and interpret results Calculate with roots, and with fractional and negative indices Simplify and manipulate algebraic fractions Revision of probabilities, calculations, percentages, rearranging equations
Maths & Culture	<ul style="list-style-type: none"> Identify, describe and construct similar shapes Identify, describe and construct enlargement using fractional and negative scale factors Understand similarity of triangles, and use this to make geometric inferences Understand and use the effect of enlargement for perimeter, area and volume of shapes and solids Know the relationships between linear, area and volume scale factors of similar shapes and solids Solve problems involving more complex shapes and solids Find the surface area and volumes of compound solids Recognise and use sequences Deduce expressions to calculate the nth term 	<ul style="list-style-type: none"> Find the surface area and volumes of compound solids constructed from cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinders Pythagoras in 3D and Trigonometry to find measurements Know the relationships between linear, area and volume scale factors of mathematically similar shapes and solids Understand and use vector notation Calculate, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector Calculate the resultant of two vectors Solve geometrical problems in 2-D using vector methods Apply vector methods for simple geometrical proofs
Maths and Healthy Living	<ul style="list-style-type: none"> Understand and use vector notation Calculate, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector Calculate the resultant of two vectors Solve geometrical problems in 2-D using vector methods Apply vector methods for simple geometrical proofs Use the trigonometric ratios to solve 2-D and 3-D problems Understand, recall and use trigonometric relationships in right-angled triangles Use the sine and cosine rules to solve 2-D and 3-D problems Solve simple quadratic equations by using the quadratic formula Identify turning points of quadratic functions graphically; deduce roots algebraically Solve linear equations in one unknown algebraically; find approximate solutions using a graph 	<ul style="list-style-type: none"> Solve linear equations with integer or fractional coefficients, that include brackets Simplify rational expressions by cancelling, adding, subtracting, and multiplying Solve simple quadratic equations by using the quadratic formula Factorise quadratic expressions using the difference of two squares Solve simple quadratic equations by factorisation and completing the square Deduce roots of turning points by completing the square Calculate the lengths of arcs and the areas of sectors of circles Use inequality notation to specify simple error intervals due to truncation or rounding Apply and interpret limits of accuracy, including upper and lower bounds

Tier 8 & 9

**Maths & Communications
and Maths & Planet Earth**

- Recognise the characteristic shapes of all these functions
- Draw and plot a range of mathematical functions
- Interpret and analyse a range of mathematical functions
- Know the exact values of $\sin\theta$, $\cos\theta$ and $\tan\theta$
- Construct the graphs of simple loci including the circle
- Find the intersection points of a give straight line with a circle
- Find approximate solutions using a graph
- Apply construction techniques and understand loci
- Find the equation of a tangent to a circle at a give point
- Demonstrate the tangent on a circle is perpendicular to the radius
- Demonstrate that tangents from an external point are equal in length
- Find missing angles on diagrams
- Give reasons for angle calculations involving tangent theorems
- Use Circle Theorems
- Use standard form, expressed in conventional notation
- Write numbers presented in a context in standard form
- Convert between ordinary and standard form representations
- Interpret a calculator display using standard form
- Calculate with standard form
- Recognise common factors, expanding products, factorise quadratics
- Solve quadratic equations by factorising
- Simplify algebraic fractions

**Maths and Emerging
Technologies & Maths
and Media & Business**

- Plot graphs of cubic and reciprocal function
- Recognise the characteristic shapes of all these functions
- Draw and plot a range of mathematical functions
- Interpret and analyse a range of mathematical functions
- Know the exact values of $\sin\theta$, $\cos\theta$ and $\tan\theta$
- Construct the graphs of simple loci including the circle
- Find the intersection points of a give straight line with a circle
- Find approximate solutions using a graph
- Apply construction techniques and understand loci
- Find the equation of a tangent to a circle at a give point
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