



Mathematics Curriculum Map – Years 7-11

KS3 National Curriculum

Purpose of Study: The purposes of this qualification are to:

- provide evidence of students' achievements against demanding and fulfilling content, to give students the confidence that the mathematical skills, knowledge and understanding that they will have acquired during the course of their study are as good as that of the highest performing jurisdictions in the world
- provide a strong foundation for further academic and vocational study and for employment, to give students the appropriate mathematical skills, knowledge and understanding to help them progress to a full range of courses in further and higher education. This includes Level 3 mathematics courses as well as Level 3 and undergraduate courses in other disciplines such as biology, geography and psychology, where the understanding and application of mathematics is crucial

Aims: We aim to build fluency and nurture confidence in Maths by focusing on problem-solving and reasoning throughout. The aims are to enable students to:

- develop fluent knowledge, skills and understanding of mathematical methods and concepts
- acquire, select and apply mathematical techniques to solve problems
- reason mathematically, make deductions and inferences, and draw conclusions
- comprehend, interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

Y7	Y8	Y9	Y10	Y11	GCSE Exam Specification (Edexcel)
<u>ALL</u>	<u>ALL</u>	<u>FOUNDATION</u>	<u>FOUNDATION</u>	<u>FOUNDATION</u>	Examined on the following areas:
Consolidate the rapid recall of number facts, including positive integer complements to 100 and multiplication facts to 10 ´ 10, and quickly derive associated division facts. Use standard column procedures to add and subtract whole numbers and decimals with up to two places. Understand and use decimal notation and place value; multiply and divide integers and	"Add, subtract, multiply and divide integers. Understand the infinite nature of the sets of integers, real and rational numbers." Recognise and use multiples, factors (divisors), common factor, highest common factor, lowest common multiple and primes; find the prime factor decomposition of a number (e.g. 8000 = 26 x 53).	1a Basic Use of Numbers Understand and order integers Write numbers in words and writing numbers from words Add and subtract integers Recall all multiplication facts to 10 x 10, and use them to derive quickly the corresponding division facts Multiply or divide any number by powers of 10 Multiply and divide integers	Patterns & Sequences Generate simple sequences of odd or even numbers Find the missing numbers in a number pattern or sequence Find the n^{th} term of a number sequence Use the n^{th} number of an arithmetic sequence	Ratio By the end of the module the student should be able to: Understand what is meant by ratio Write a ratio in its simplest form; and find an equivalent ratio Solve a ratio problem in context, eg recipes	1 Number 2 Algebra 3 Ratio, proportion and rates of change 4 Geometry and measures 5 Probability 6 Statistics Two tiers are available: Foundation and Higher (content is defined for each tier). • Each student is permitted to take assessments in either the Foundation tier or Higher tier.

<p>decimals by 10, 100, 1000, and explain the effect.</p> <p>Compare and order decimals in different contexts; know that when comparing measurements they must be in the same units.</p> <p>Understand negative numbers as positions on a number line; order, add and subtract positive and negative integers in context.</p> <p>Make and justify estimates and approximations of calculations.</p> <p>Enter numbers and interpret the display in different contexts (decimals, money).</p> <p>Solve word problems and investigate in a range of contexts: number; compare and evaluate solutions.</p> <p>Generate and describe simple integer sequences.</p> <p>Generate terms of a simple sequence, given a rule (e.g. finding a term from the previous term, finding a term given its position in the sequence).</p> <p>Generate sequences from practical contexts</p>	<p>Use squares, positive and negative square roots, cubes and cube roots, and index notation for small positive integer powers.</p> <p>Generate and describe integer sequences.</p> <p>Generate terms of a linear sequence using term-to-term and position-to-term definitions of the sequence, on paper and using a spreadsheet or graphical calculator.</p> <p>Begin to use linear expressions to describe the nth term of an arithmetic sequence, justifying its form by referring to the activity or practical context from which it was generated.</p> <p>Identify alternate angles and corresponding angles; understand a proof that: - the sum of the angles of a triangle is 180° and of a quadrilateral is 360°; the exterior angle of a triangle is equal to the sum of the two interior opposite angles.</p> <p>Solve geometrical problems using side and angle properties of equilateral, isosceles and right-angled triangles and special quadrilaterals, explaining</p>	<p>Add, subtract, multiply and divide negative numbers</p> <p>Round whole numbers to the nearest: 10, 100, 1000, ...</p> <p>1b Types of Number</p> <p>Recognise even and odd numbers</p> <p>Identify factors, multiples and prime numbers</p> <p>Find the prime factor decomposition of positive integers</p> <p>Find the common factors and common multiples of two or three numbers</p> <p>Find the Lowest common multiple (LCM) and Highest common factor (HCF) of two numbers</p> <p>Recall integer squares up to 15×15 and the corresponding square roots</p> <p>Recall the cubes of 2, 3, 4, 5 and 10</p> <p>Find squares and cubes</p> <p>Find square roots and cube roots</p>	<p>Find whether a number is part of a given sequence</p> <p>Continue a sequence derived from diagrams</p> <p>Use a calculator to produce a sequence of numbers</p> <p>Extend simple sequences involving cube numbers</p> <p>Use and extend Fibonacci type sequences</p> <p>Use and extend Quadratic sequences</p> <p>Use and extend Geometric sequences</p> <p>Perimeters & Areas</p> <p>Measure shapes to find perimeters and areas</p> <p>Find the perimeter of rectangles and triangles</p> <p>Find the perimeter of compound shapes</p> <p>Find the area of a rectangle and triangle</p> <p>Recall and use the formulae for the area of a</p>	<p>Share a quantity in a given ratio</p> <p>Understand and use examples in direct proportion</p> <p>Use direct and inverse proportion graphically and algebraically</p> <p>Scattergraphs & Correlation</p> <p>By the end of the module the student should be able to:</p> <p>Draw and produce a scatter graph</p> <p>Look at data to find patterns and exceptions</p> <p>Distinguish between positive, negative and zero correlation using lines of best fit</p> <p>Interpret correlation in terms of the problem</p> <p>Understand that correlation does not imply causality</p> <p>Draw lines of best fit by eye and understand what it represents</p>	<ul style="list-style-type: none"> • The qualification consists of three equally-weighted written examination papers at either Foundation tier or Higher tier. • All three papers must be at the same tier of entry and must be completed in the same assessment series. • Paper 1 is a non-calculator assessment and a calculator is allowed for Paper 2 and Paper 3. • Each paper is 1 hour and 30 minutes long. • Each paper has 80 marks. • The content outlined for each tier will be assessed across all three papers. • Each paper will cover all Assessment Objectives, in the percentages outlined for each tier. (See the section <i>Breakdown of Assessment Objectives</i> for more information.) • Each paper has a range of question types; some questions will be set in both mathematical and non-mathematical contexts. • See <i>Appendix 3</i> for a list of formulae that can be provided in the examination (as part of the relevant question). • Two assessment series available per year: May/June and November*. • First assessment series: May/June 2017. • The qualification will be graded and certificated on a nine-grade scale from 9 to 1 using the total mark across all three papers where 9 is the highest grade. Individual papers are not graded. • Foundation tier: grades 1 to 5.
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<p>and describe the general term in simple cases. Suggest extensions to problems by asking 'What if...?'; begin to generalise and to understand the significance of a counter-example. Express simple functions in words, then using symbols; represent them in mappings. Use letter symbols to represent unknown numbers or variables. Use 2-D representations to visualise 3-D shapes and deduce some of their properties. Use names and abbreviations of units of measurement to measure, estimate, calculate and solve problems in everyday contexts involving length, area. Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles. Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles. Solve word problems and investigate in a</p>	<p>reasoning with diagrams and text; classify quadrilaterals by their geometric properties. Apply angle facts, triangle congruence, similarity and properties of named quadrilaterals to derive results about angles and sides, using transformational, axiomatic and property-based reasoning. Use straight edge and compasses to construct: - the mid-point and perpendicular bisector of a line segment; - the bisector of an angle; - the perpendicular from a point to a line. Use the vocabulary of probability when interpreting the results of an experiment; appreciate that random processes are unpredictable. Know that if the probability of an event occurring is p, then the probability of it not occurring is $1 - p$; find and record all possible mutually exclusive outcomes for single events and two successive events in a systematic way, using diagrams and tables.</p>	<p>Angles, Lines and Triangles</p> <p>Measure and draw lines, to the nearest mm</p> <p>Measure and draw angles, to the nearest degree</p> <p>Estimate sizes of angles</p> <p>Recall and use properties of angles: at a point angles at a point on a straight line, including right angles vertically opposite angles</p> <p>Find the size of missing angles at a point or at a point on a straight line</p> <p>Distinguish between acute, obtuse, reflex and right angles</p> <p>Name angles</p> <p>Give reasons for calculations</p> <p>Use geometric language appropriately</p>	<p>triangle, rectangle and a parallelogram Calculate areas of compound shapes made from triangles and rectangles</p> <p>Find the area of a trapezium by using the formula</p> <p>Solve a range of problems involving areas including cost of carpet type questions</p> <p>Straight Line Graphs</p> <p>By the end of the module the student should be able to:</p> <p>Use axes and coordinates to specify points in all four quadrants in 2-D</p> <p>Identify points with given coordinates</p> <p>Identify coordinates of given points (NB: Points may be in the first quadrant or all four quadrants)</p> <p>Find the coordinates of points identified by geometrical information in 2-D</p>	<p>Use a line of best fit to predict values of one variable given values of the other variable</p> <p>Draw: Pictograms</p> <p>Composite bar charts</p> <p>Comparative and dual bar charts</p> <p>Frequency polygons,</p> <p>Histograms with equal class intervals</p> <p>Frequency diagrams for grouped discrete data</p> <p>Line graphs</p> <p>Interpret: composite bar charts comparative and dual bar charts stem and leaf diagrams scatter graphs frequency polygons</p>	<p>• Higher tier: grades 4 to 9 (grade 3 allowed).</p>
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<p>range of contexts: length, perimeter and area. Begin to identify and use angle, side and symmetry properties of triangles and quadrilaterals. Use correctly the vocabulary, notation and labelling conventions for lines, angles and shapes.</p> <p>Use fraction notation to describe parts of shapes and to express a smaller whole number as a fraction of a larger one; simplify fractions by cancelling all common factors and identify equivalent fractions; convert terminating decimals to fractions e.g. $0.23 = 23/100$; use a diagram to compare two or more simple fractions. Begin to add and subtract simple fractions and those with common denominators; calculate simple fractions of quantities and measurements (whole-number answers); multiply a fraction by an integer. Understand percentage as the 'number of parts per 100'; recognise the equivalence of</p>	<p>Estimate probabilities from experimental data; understand that: - if an experiment is repeated there may be, and usually will be, different outcomes; increasing the number of times an experiment is repeated generally leads to better estimates of probability.</p> <p>Use units of measurement to estimate, calculate and solve problems in everyday contexts involving length, area, volume, capacity, mass, time and angle; know rough metric equivalents of imperial measures in daily use (feet, miles, pounds, pints, gallons). Deduce and use formulae for the area of a triangle, parallelogram and trapezium; calculate areas of compound shapes made from rectangles and triangles. "Use compound units such as speed, unit pricing and density to solve problems. Solve kinematic problems involving constant speed." Know that a recurring decimal is a fraction; use division to convert a fraction to a decimal;</p>	<p>Identify points, lines and angles</p> <p>Use two letter notation for a line and three letter notation for an angle</p> <p>Distinguish between scalene, equilateral, isosceles and right-angled triangles</p> <p>Understand and use the angle properties of triangles</p> <p>Find a missing angle in a triangle, using the angle sum of a triangle is 180°</p> <p>Use the side/angle properties of isosceles and equilateral triangles Understand and use the angle sum of triangles</p> <p>Collecting Data</p> <p>By the end of the module the student should be able to:</p> <p>Specify the problem and plan</p> <p>Decide what data to collect and what</p>	<p>Find the coordinates of the midpoint of a line segment, AB, given the coordinates of A and B Draw, label and put suitable scales on axes</p> <p>Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane</p> <p>Plot and draw graphs of functions</p> <p>Plot and draw graphs of straight lines of the form $y = mx + c$</p> <p>Find the gradient of a straight line from a graph</p> <p>Find the equation of a line through 2 points.</p> <p>Find the equation of a line through one point given the gradient.</p> <p>Averages & Range</p> <p>By the end of the module the student should be able to:</p>	<p>Recognise simple patterns and characteristic relationships in bar charts, line graphs and frequency polygons</p> <p>Know that correlation does not imply causation.</p> <p>Probability</p> <p>By the end of the module the student should be able to:</p> <p>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</p> <p>Write probabilities in words, fractions, decimals and percentages</p> <p>Find the probability of an event happening using theoretical probability</p> <p>Find the probability of an event happening using relative frequency</p> <p>Estimate the number of times an event will occur,</p>	
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<p>percentages, fractions and decimals; calculate simple percentages. Consolidate and extend mental methods of calculation to include decimals, fractions and percentages, accompanied where appropriate by suitable jottings; solve simple word problems mentally. Check a result by considering whether it is of the right order of magnitude and by working the problem backwards. Break a complex calculation into simpler steps, choosing and using appropriate and efficient operations, methods and resources, including ICT. Present and interpret solutions in the context of the original problem; explain and justify methods and conclusions, orally and in writing. Use letter symbols to represent unknown numbers or variables; know the meanings of the words term, expression and equation. Understand that algebraic operations follow the same</p>	<p>order fractions by writing them with a common denominator or by converting them to decimals. Add and subtract fractions by writing them with a common denominator; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction. Interpret percentage as the operator 'so many hundredths of' and express one given number as a percentage of another; use the equivalence of fractions, decimals and percentages to compare proportions; calculate percentages and find the outcome of a given percentage increase or decrease. Understand addition and subtraction of fractions; use the laws of arithmetic and inverse operations. Recall known facts, including fraction to decimal conversions; use known facts to derive unknown facts, including products such as 0.7 and 6, and 0.03 and 8. Consolidate and extend mental methods of calculation, working with</p>	<p>statistical analysis is needed</p> <p>Collect data from a variety of suitable primary and secondary sources</p> <p>Use suitable data collection techniques</p> <p>Process and represent the data</p> <p>Interpret and discuss the data</p> <p>Understand how sources of data may be biased</p> <p>Identify which primary data they need to collect and in what format, including grouped data</p> <p>Consider fairness</p> <p>Understand sample and populations</p> <p>Design a question for a questionnaire</p> <p>Criticise questions for a questionnaire</p> <p>Design and use data-collection sheets for</p>	<p>Calculate the mean, mode, median and range for discrete data</p> <p>Calculate the mean, mode, median and range from an ordered stem and leaf diagram</p> <p>Produce an ordered stem and leaf diagram</p> <p>Calculate the modal class and interval containing the median for continuous data</p> <p>Calculate the mean, median and mode from a frequency table</p> <p>Estimate the mean of grouped data using the mid-interval value</p> <p>Compare the mean and range of two distributions</p> <p>Recognise the advantages and disadvantages between measures of average</p> <p>Calculate the mean of a small data set, using the appropriate key on a scientific calculator</p> <p>Draw:</p>	<p>given the probability and the number of trials</p> <p>Use theoretical models to include outcomes using dice, spinners, coins</p> <p>List all outcomes for single events systematically</p> <p>List all outcomes for two successive events systematically</p> <p>Use and draw sample space diagrams</p> <p>Add simple probabilities</p> <p>Identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1</p> <p>Use $1 - p$ as the probability of an event not occurring where p is the probability of the event occurring</p> <p>Find a missing probability from a list or table</p> <p>Compare experimental data and theoretical probabilities</p>	
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<p>conventions and order as arithmetic operations. Simplify linear algebraic expressions by collecting like terms; begin to multiply a single term over a bracket (integer coefficients). Use simple formulae from mathematics and other subjects, substitute positive integers into simple linear expressions and formulae and, in simple cases, derive a formula. Identify the necessary information to solve a problem; represent problems mathematically, making correct use of symbols, words, diagrams and tables. Identify parallel and perpendicular lines; know the sum of angles at a point, on a straight line and in a triangle and recognise vertically opposite angles. Use conventions and notation for 2-D coordinates in all four quadrants; find coordinates of points determined by geometric information.</p> <p>Calculate statistics for small sets of discrete</p>	<p>decimals, fractions and percentages; solve word problems mentally. Begin to distinguish the different roles played by letter symbols in equations, formulae and functions; know the meanings of the words formula and function. Know that algebraic operations follow the same conventions and order as arithmetic operations; use index notation for small positive integer powers. Simplify or transform linear expressions by collecting like terms; multiply a single term over a bracket. Use formulae from mathematics and other subjects; substitute integers into simple formulae, and positive integers into expressions involving small powers (e.g. $3 \times 2 + 4$ or 2×3); derive simple formulae. Know and use the formula for the volume of a cuboid; calculate volumes and surface areas of cuboids and shapes made from cuboids. Investigate in a range of contexts: measures. Estimate probabilities from experimental data;</p>	<p>grouped, discrete and continuous data</p> <p>Collect data using various methods</p> <p>Sort, classify and tabulate data and discrete or continuous quantitative data</p> <p>Group discrete and continuous data into class intervals of equal width</p> <p>Extract data from lists and tables</p> <p>Design and use two-way tables for discrete and grouped data</p> <p>Use information provided to complete a two way table</p> <p>Infer properties of a population from a sample whilst knowing the limitation of the sample. Limitation of a sample.</p> <p>Introduction to Algebra</p> <p>By the end of the module the student should be able to:</p> <p>Use notation and symbols correctly</p>	<p>Pictograms</p> <p>Composite bar charts</p> <p>Comparative and dual bar charts</p> <p>Frequency polygons, Histograms with equal class intervals</p> <p>Frequency diagrams for grouped discrete data</p> <p>Line graphs</p> <p>Interpret:</p> <p>composite bar charts</p> <p>comparative and dual bar charts</p> <p>stem and leaf diagrams</p> <p>scatter graphs</p> <p>frequency polygons</p> <p>Consider outliers when calculating range.</p> <p>Circles</p> <p>By the end of the module the student should be able to:</p> <p>Find circumferences of circles and areas enclosed by circles</p> <p>Recall and use the formulae for the circumference of a circle and the area enclosed by a circle</p> <p>Use $\pi \approx 3.142$ or use the π button on a calculator</p>	<p>Compare relative frequencies from samples of different sizes</p> <p>Use tree diagrams to solve probability problems.</p> <p>Use Venn diagrams</p> <p>Pythagoras' Theorem</p> <p>Understand and recall Pythagoras' Theorem</p> <p>Use Pythagoras' theorem to find the hypotenuse</p> <p>Use Pythagoras' theorem to find a side</p> <p>Use Pythagoras' theorem to find the length of a line segment from a coordinate grid</p> <p>Apply Pythagoras' theorem to practical situations</p> <p>Formulae</p> <p>Derive a simple formula, including those with squares, cubes and roots</p> <p>Use formulae from mathematics and other subjects expressed initially in words and then using letters and symbols</p>	
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<p>data: - find the mode, median and range, and the modal class for grouped data; calculate the mean, including from a simple frequency table, using a calculator for a larger number of items.</p> <p>Interpret diagrams and graphs (including pie charts), and draw conclusions based on the shape of graphs and simple statistics for a single distribution.</p> <p>Use vocabulary and ideas of probability, drawing on experience. Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts; identify all the possible mutually exclusive outcomes of a single event.</p> <p>Collect data from a simple experiment and record in a frequency table; estimate probabilities based on this data.</p> <p>Round positive whole numbers to the nearest 10, 100 or 1000 and decimals to the nearest</p>	<p>understand that: - if an experiment is repeated the estimate becomes more reliable and closer to the theoretical probability.</p> <p>Read and write positive integer powers of 10; multiply and divide integers and decimals by 0.1, 0.01.</p> <p>Order decimals. Round positive numbers to any given power of 10; round decimals to the nearest whole number or to one or two decimal places.</p> <p>Consolidate and extend mental methods of calculation, working with decimals, squares and square roots, cubes and cube roots; solve word problems mentally.</p> <p>Make and justify estimates and approximations of calculations.</p> <p>Consolidate standard column procedures for addition and subtraction of integers and decimals with up to two places.</p> <p>Discuss a problem that can be addressed by statistical methods and identify related questions to explore.</p>	<p>Write an expression</p> <p>Simplify algebraic expressions in one or more like terms, by adding and subtracting</p> <p>Understand the difference between the word 'equation', 'formula', and 'expression'</p> <p>Multiply and divide with variables and numbers</p> <p>Multiply a single algebraic term over a bracket</p> <p>Write expressions using squares and cubes</p> <p>Factorise algebraic expressions by taking out common factors</p> <p>Decimals</p> <p>Understand place value, identifying the values of the digits</p> <p>Write decimals in ascending order of size</p>	<p>Find the perimeters and areas of semicircles and quarter circles</p> <p>Calculate with multiples of π. Find areas and perimeters of compound shapes involving circles and calculate arc lengths and areas of sectors.</p> <p>Circles</p> <p>By the end of the module the student should be able to:</p> <p>Find circumferences of circles and areas enclosed by circles</p> <p>Recall and use the formulae for the circumference of a circle and the area enclosed by a circle</p> <p>Use $\pi \approx 3.142$ or use the π button on a calculator</p> <p>Find the perimeters and areas of semicircles and quarter circles</p> <p>Calculate with multiples of π. Find areas and perimeters of compound shapes involving circles and calculate arc lengths and areas of sectors.</p>	<p>Substitute numbers into a formula</p> <p>Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$</p> <p>Change the subject of a formula</p> <p>Find the solution to a problem by writing an equation and solving it</p> <p>Simultaneous Equations & Quadratics</p> <p>By the end of the module the student should be able to:</p> <p>Multiply 2 brackets and factorise.</p> <p>Expand double brackets.</p> <p>Solve Quadratics by factorising.</p> <p>Generate points and plot graphs of simple quadratic functions, then more general quadratic functions</p> <p>Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function</p>	
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<p>whole number or one decimal place. Understand addition, subtraction, multiplication and division as they apply to whole numbers and decimals; know how to use the laws of arithmetic and inverse operations. Know and use the order of operations, including brackets. Consolidate and extend mental methods of calculation to include decimals, fractions and percentages, accompanied where appropriate by suitable jottings; solve simple word problems mentally. Make and justify estimates and approximations of calculations. Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers. Check a result by considering whether it is of the right order of magnitude and by working the problem backwards.</p>	<p>Decide which data to collect to answer a question, and the degree of accuracy needed; identify possible sources. Plan how to collect the data, including sample size; design and use two-way tables for discrete data. Collect data using a suitable method, such as observation, controlled experiment using ICT, or questionnaire. Calculate statistics, including with a calculator; recognise when it is appropriate to use the range, mean, median and mode; construct and use stem-and-leaf diagrams. Construct, on paper and using ICT: pie charts for categorical data; bar charts and frequency diagrams for discrete data; simple scatter graphs; identify which are most useful in the context of the problem. Interpret tables, graphs and diagrams for discrete data and draw inferences that relate to the problem being discussed; relate summarised data to the questions being explored.</p>	<p>Approximate decimals to a given number of decimal places or to one significant figure</p> <p>Add and subtract decimals</p> <p>Multiply and divide decimal numbers by integers and decimal numbers</p> <p>Recall integer squares up to 15×15 and the corresponding square roots</p> <p>Recall the cubes of 2, 3, 4, 5 and 10</p> <p>Find squares and cubes</p> <p>Find square roots and cube roots</p> <p>Know that, eg $13.5 \div 0.5 = 135 \div 5$</p> <p>Check their answers by rounding, and know that eg $29 \times 31 \approx 30 \times 30$</p> <p>Use inverse operations (use one calculation to find the answer to another)</p> <p>Check</p>	<p>Constructions, Loci & Congruence</p> <p>By the end of the module the student should be able to:</p> <p>Use straight edge and a pair of compasses to do standard constructions such as</p> <p>Construct a triangle</p> <p>Construct an equilateral triangle</p> <p>Understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not</p> <p>Construct the perpendicular bisector of a given line</p> <p>Construct the perpendicular from a point to a line</p> <p>Construct the bisector of a given angle</p> <p>Construct angles of 60°, 90°, 30°, 45°</p> <p>Draw parallel lines</p> <p>Construct diagrams of everyday 2-D situations</p>	<p>Sketch and recognise cubic and reciprocal graphs.</p> <p>New Additional Content for Exams – Standard Form & Simultaneous Equations</p> <p>Calculate using standard form without a calculator.</p> <p>Solve simultaneous equations (algebraically and graphically). Derive simultaneous from real life situations</p> <p>HIGHER</p> <p>Simultaneous & Quadratic Equations</p> <p>Find the exact solutions of two simultaneous equations in two unknowns</p> <p>Use elimination or substitution to solve simultaneous equations</p> <p>Interpret a pair of simultaneous equations as a pair of straight lines and their solution as the point of intersection. Consider the real life applications, eg mobile phone bills</p> <p>Set up and solve a pair of simultaneous equations in two variables</p>	
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<p>Carry out calculations with more than one step using brackets and the memory; use the square root and sign change keys.</p> <p>Use names and abbreviations of units of measurement to measure, estimate, calculate and solve problems in everyday contexts involving length, area, mass, capacity and time; convert one metric unit to another (e.g. grams to kilograms); read and interpret scales on a range of measuring instruments.</p> <p>Begin to identify and use angle, side and symmetry properties of triangles and quadrilaterals; solve geometrical problems involving these properties, using step-by-step deduction and explaining reasoning with diagrams and text.</p> <p>Use 2-D representations to visualise 3-D shapes and deduce some of their properties.</p>	<p>Communicate orally and on paper the results of a statistical enquiry and the methods used, using ICT as appropriate; justify the choice of what is presented.</p> <p>Express simple functions in symbols; represent mappings expressed algebraically.</p> <p>"Generate points in all four quadrants and plot the graphs of linear functions, where y is given explicitly in terms of x, on paper and using ICT; recognise that equations of the form $y = mx + c$ correspond to straight-line graphs. Refer to the Cartesian Plane or Cartesian Axes as the mathematical way to name these graphs."</p> <p>Construct linear functions arising from real-life problems and plot their corresponding graphs; discuss and interpret graphs arising from real situations.</p> <p>Use standard column procedures for multiplication and division of integers and decimals, including by decimals such as 0.6 or 0.06; understand where to position the decimal</p>	<p>calculations by rounding, eg $29 \times 31 \approx 30 \times 30$</p> <p>Check answers by reverse calculation, eg if $9 \times 23 = 207$ then $207 \div 9 = 23$</p> <p>Use inverse operations (use one calculation to find the answer to another)</p> <p>Check calculations by rounding, eg $29 \times 31 \approx 30 \times 30$</p> <p>Check answers by reverse calculation, eg if $9 \times 23 = 207$ then $207 \div 9 = 23$</p> <p>Round to both decimal places and significant figures. Specify error due to rounding.</p> <p>Similarity, Symmetry and Congruence</p> <p>By the end of the module the student should be able to:</p> <p>Recognise reflection symmetry of 2-D shapes</p> <p>Identify and draw lines of symmetry on a</p>	<p>involving rectangles, triangles, perpendicular and parallel lines</p> <p>Draw and construct diagrams from given instructions</p> <p>A region bounded by a circle and an intersecting line</p> <p>A given distance from a point and a given distance from a line</p> <p>Equal distances from 2 points or 2 line segments Regions which may be defined by 'nearer to' or 'greater than'</p> <p>Find and describe regions satisfying a combination of loci</p> <p>Construct for example a regular hexagon inside a circle</p> <p>Use congruence criteria for triangles</p> <p>Fractions, Decimals & Percentages</p> <p>Understand that a percentage is a fraction in hundredths</p>	<p>Solve simple quadratic equations by factorisation and completing the square</p> <p>Solve quadratic inequalities</p> <p>Solve simple quadratic equations by using the quadratic formula</p> <p>Learn the quadratic equation formula</p> <p>Select and apply algebraic and graphical techniques to solve simultaneous equations where one is linear and one quadratic</p> <p>Solve equations involving algebraic fractions which lead to quadratic equations</p> <p>Solve quadratic equations by completing the square</p> <p>Plot and recognise cubic, reciprocal, exponential and circular functions $y = \sin x$ and $y = \cos x$, within the range -360° to $+360^\circ$ (see above)</p> <p>Use the graphs of these functions to find approximate solutions to equations, eg given x find y (and vice versa)</p> <p>Match equations with their graphs</p>	
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<p>Recognise and use multiples, factors (divisors), common factor and primes (less than 100); use simple tests of divisibility. Recognise the first few triangular numbers, squares of numbers to at least 12×12, and the corresponding roots. Use the square root key. Generate terms of a simple sequence, given a rule (e.g. finding a term from the previous term, finding a term given its position in the sequence). Generate sequences from practical contexts and describe the general term in simple cases. Express simple functions in words, then using symbols; represent them in mappings. Generate coordinate pairs that satisfy a simple linear rule; plot the graphs of simple linear functions, where y is given explicitly in terms of x, on paper and using ICT; recognise straight-line graphs parallel to the x-axis or y-axis.</p> <p>Break a complex calculation into simpler steps, choosing and</p>	<p>point by considering equivalent calculations. Check a result by considering whether it is of the right order of magnitude and by working the problem backwards. Carry out more difficult calculations effectively and efficiently using the function keys of a calculator for sign change, powers, roots and fractions; use brackets and the memory. Enter numbers and interpret the display of a calculator in different contexts (negative numbers, fractions, decimals, percentages, money, metric measures, time). Know that if two 2-D shapes are congruent, corresponding sides and angles are equal. Transform 2-D shapes by simple combinations of rotations, reflections and translations, on paper and using ICT; identify all the symmetries of 2-D shapes. Transform 2-D shapes by simple combinations of rotations, reflections and translations, on paper and using ICT; identify all</p>	<p>shape</p> <p>Recognise rotation symmetry of 2-D shapes</p> <p>Identify the order of rotational symmetry of a 2-D shape</p> <p>Draw or complete diagrams with a given number of lines of symmetry</p> <p>Draw or complete diagrams with a given order of rotational symmetry</p> <p>Understand congruence</p> <p>Identify shapes which are congruent</p> <p>Understand similarity</p> <p>Identify shapes which are similar, including</p>	<p>Convert between fractions, decimals and percentages</p> <p>Write one number as a percentage of another number</p> <p>Calculate the percentage of a given amount</p> <p>Use percentages to solve problems</p> <p>Convert between fractions, decimals and percentages to find percentage change</p> <p>Find a percentage of a quantity in order to increase or decrease</p> <p>Use percentages in real-life situations</p> <p>Value of profit or loss</p> <p>Simple interest</p> <p>Income tax calculations</p> <p>Solve problems involving percentage change and reverse percentages.</p> <p>Calculate compound interest.</p> <p>Use growth and decay to solve problems.</p>	<p>Recognise the characteristic shapes of all these functions</p> <p>Construct the graphs of simple loci including the circle $x^2 + y^2 = r^2$ for a circle of radius r centred at the origin of the coordinate plane. Find the intersection points of a given straight line with this circle graphically</p> <p>Select and apply construction techniques and understanding of loci to draw graphs based on circles and perpendiculars of lines. Derive the quadratic equation by completing the square</p> <p>Locate turning points by completing the square. (It does not specify turning points in the text books.)</p> <p>Apply concepts of rates changes by looking at the gradients of tangents and chords to a curve.</p> <p>Recognise and use the equation of a circle centred at the origin. Find the equation of a tangent to a circle at a given point, using the fact it is perpendicular to the radius.</p>
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<p>using appropriate and efficient operations, methods and resources, including ICT. Recognise the equivalence of percentages, fractions and decimals; calculate simple percentages and use percentages to compare simple proportions. Understand the relationship between ratio and proportion; use direct proportion in simple contexts; use ratio notation, reduce a ratio to its simplest form and divide a quantity into two parts in a given ratio; solve simple problems about ratio and proportion using informal strategies. Check a result by considering whether it is of the right order of magnitude and by working the problem backwards.</p> <p>Given a problem that can be addressed by statistical methods, suggest possible answers. Decide which data would be relevant to an enquiry and possible sources.</p>	<p>the symmetries of 2-D shapes. Understand and use the language and notation associated with enlargement; enlarge 2-D shapes, given a centre of enlargement and a positive whole-number scale factor; explore enlargement using ICT. Begin to distinguish the different roles played by letter symbols in equations, formulae and functions; know the meanings of the words formula and function. Construct and solve linear equations with integer coefficients (unknown on either or both sides, without and with brackets) using appropriate methods (e.g. inverse operations, transforming both sides in the same way). Use formulae from mathematics and other subjects; substitute integers into simple formulae, including examples that lead to an equation to solve; derive simple formulae.</p> <p>Understand addition and subtraction of fractions and integers, and multiplication and</p>	<p>all circles or all regular polygons with equal number of sides</p> <p>Recall the properties and definitions of special types of quadrilaterals, including symmetry properties</p> <p>List the properties of each, or identify (name) a given shape</p> <p>Draw sketches of shapes</p> <p>Name all quadrilaterals that have a specific property</p> <p>Identify quadrilaterals from everyday usage</p> <p>Classify quadrilaterals by their geometric properties</p> <p>Distinguish between scalene, equilateral, isosceles and right-</p>	<p>Linear Equations & Inequalities</p> <p>By the end of the module the student should be able to:</p> <p>Set up simple equations</p> <p>Rearrange simple equations</p> <p>Solve simple equations</p> <p>Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation</p> <p>Solve linear equations which include brackets, those that have negative signs occurring anywhere in the equation, and those with a negative solution</p> <p>Solve linear equations in one unknown, with integer or fractional coefficients</p> <p>Use linear equations to solve word problems</p> <p>Solve simple linear inequalities in one</p>	<p>Surface Area & Volume</p> <p>Find the surface area of simple shapes (prisms) using the formulae for triangles and rectangles, and other shapes</p> <p>Recall and use the formulae for the circumference of a circle and the area enclosed by a circle</p> <p>Give an exact answer to a question involving the area of a circle</p> <p>Calculate the lengths of arcs and the areas of sectors of circles</p> <p>Answers in terms of π may be required</p> <p>Find the surface area of a cylinder</p> <p>Find the area of a segment of a circle given the radius and length of the chord</p> <p>Convert between units of area</p> <p>Use axes and coordinates to specify points in all four quadrants in 2-D and 3-D</p>	
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<p>Plan how to collect and organise small sets of data; design a data collection sheet or questionnaire to use in a simple survey; construct frequency tables for discrete data, grouped where appropriate in equal class intervals. Collect small sets of data from surveys and experiments, as planned. "Construct, on paper and using ICT, graphs and diagrams to represent data, including: bar-line graphs; frequency diagrams for grouped discrete data; use ICT to generate pie charts. "</p> <p>Interpret diagrams and graphs (including pie charts), and draw simple conclusions based on the shape of graphs. Solve word problems and investigate in a range of contexts: handling data. Solve word problems and investigate in a range of contexts: number and algebra. Identify the necessary information to solve a problem; represent problems mathematically, making correct use of symbols,</p>	<p>division of integers; use the laws of arithmetic and inverse operations. "Use the order of operations, including brackets, with more complex calculations. Make and justify estimates and approximations of calculations." Consolidate and extend mental methods of calculation, working with decimals, fractions and percentages, squares and square roots, cubes and cube roots; solve word problems mentally. Consolidate standard column procedures for addition and subtraction of integers and decimals with up to two places. Use standard column procedures for multiplication and division of integers and decimals, including by decimals such as 0.6 or 0.06; understand where to position the decimal point by considering equivalent calculations. Simplify or transform linear expressions by collecting like terms; multiply a single term over a bracket. Construct and solve linear equations with integer coefficients</p>	<p>angled triangles</p> <p>Understand and use the angle properties of triangles</p> <p>Make accurate drawing of triangles and other 2-D shapes using a ruler and a protractor</p> <p>Recall the definition of a circle and identify and draw parts of a circle</p> <p>Draw a circle given its radius or diameter</p> <p>Angles and Shapes</p> <p>Calculate and use the sums of the interior angles of polygons</p> <p>Use geometrical language appropriately and recognise and name pentagons, hexagons, heptagons, octagons and decagons</p> <p>Know, or work out, the relationship between</p>	<p>variable, and represent the solution set on a number line</p> <p>Use the correct notation to show inclusive and exclusive inequalities</p> <p>Solve algebraic equations involving squares and cubes eg $x^3 + 3x = 40$</p> <p>Solve 'real life' problems on areas and volumes, eg the length of a rectangular room is 2 m longer than the width. If the area is 30 m², find the width.</p> <p>3D Shapes and Volume</p> <p>By the end of the module the student should be able to:</p> <p>Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone</p> <p>Know the terms face, edge and vertex</p> <p>Use 2-D representations of 3-D shapes</p> <p>Use isometric grids</p>	<p>Find the coordinates of points identified by geometrical information in 2-D and 3-D</p> <p>Know and use formulae to calculate the surface areas and volumes of cuboids and right-prisms</p> <p>Solve a range of problems involving surface area and volume, eg given the volume and length of a cylinder find the radius</p> <p>Find the volume of a cylinder and surface area of a cylinder</p> <p>Convert between volume measures, including cubic centimetres and cubic metres</p> <p>Solve problems involving more complex shapes and solids, including segments of circles and frustums of cones</p> <p>Find the surface area and volumes of compound solids constructed from; cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinder, eg solids in everyday use</p> <p>Index Notation & Surds</p>	
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<p>words, diagrams, tables and graphs. Use letter symbols to represent unknown numbers or variables; know the meanings of the words term, expression and equation. Understand that algebraic operations follow the same conventions and order as arithmetic operations. Simplify linear algebraic expressions by collecting like terms; begin to multiply a single term over a bracket (integer coefficients). Construct and solve simple linear equations with integer coefficients (unknown on one side only) using an appropriate method (e.g. inverse operations). "Use a ruler and protractor to: measure and draw lines to nearest millimetre and angles, including reflex angles, to the nearest degree; construct a triangle given two sides and the included angle (SAS) or two angles and the included side (ASA); explore these constructions using ICT."</p>	<p>(unknown on either or both sides, without and with brackets) using appropriate methods (e.g. inverse operations, transforming both sides in the same way). Begin to use graphs and set up equations to solve simple problems involving direct proportion. Discuss a problem that can be addressed by statistical methods and identify related questions to explore. Decide which data to collect to answer a question, and the degree of accuracy needed; identify possible sources. Plan how to collect the data, including sample size; construct frequency tables with given equal class intervals for sets of continuous data. Given the coordinates of points A and B, find the mid-point of the line segment AB. Use straight edge and compasses to construct: a triangle, given three sides (SSS); use ICT to explore this construction. (Find simple loci, both by reasoning and by using ICT, to produce shapes and paths, e.g. an</p>	<p>the number of sides of a polygon and the sum of its interior angles Know that the sum of the exterior angles of any polygon is 360° Calculate the size of each exterior/interior angle of a regular polygon Understand tessellations of regular and irregular polygons Tessellate combinations of polygons Explain why some shapes tessellate and why other shapes do not Understand and use the angle properties of parallel lines</p>	<p>Draw nets and show how they fold to make a 3-D solid Understand and draw front and side elevations and plans of shapes made from simple solids Given the front and side elevations and the plan of a solid, draw a sketch of the 3-D solid Find volumes of shapes by counting cubes Recall and use formulae for the volume of cubes and cuboids Calculate the volumes of right prisms and shapes made from cubes and cuboids Convert between units of volume Convert between units of area Find the surface area and volume of a cylinder Real Life & Quadratic Graphs</p>	<p>Find the value of calculations using indices Use index laws to simplify and calculate numerical expressions involving powers, eg $(2^3 \times 2^5) \div 2^4$, 4^0, $8^{-2/3}$ Use index notation for integer powers of 10 Use standard form, expressed in conventional notation Be able to write very large and very small 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 Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, and powers of a power</p>
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<p>Recognise and use multiples, factors (divisors), common factor, highest common factor and lowest common multiple in simple cases, and primes (less than 100); use simple tests of divisibility. Consolidate the rapid recall of number facts, including positive integer complements to 100 and multiplication facts to 10², and quickly derive associated division facts. Consolidate and extend mental methods to include decimals, fractions and percentages, accompanied where appropriate by suitable jottings; solve simple word problems mentally. Make and justify estimates and approximations of calculations. Construct and solve simple linear equations with integer coefficients (unknown on one side only) using an appropriate method (e.g. inverse operations). Generate sequences from practical contexts and describe the general term in simple cases.</p>	<p>equilateral triangle.) - Loci and bearings are no longer in KS3 - so this section doesn't need covering. SAT Level 4 - 6 Use standard column procedures for multiplication and division of integers and decimals, including by decimals such as 0.6 or 0.06; understand where to position the decimal point by considering equivalent calculations. Check a result by considering whether it is of the right order of magnitude and by working the problem backwards. Consolidate understanding of the relationship between ratio and proportion; reduce a ratio to its simplest form, including a ratio expressed in different units, recognising links with fraction notation. Calculate missing quantities and totals using given ratios, including reduction to simplest form. Use units of measurement to estimate, calculate and solve problems in everyday contexts.</p>	<p>Mark parallel & perpendicular lines on a diagram</p> <p>Find missing angles using properties of corresponding and alternate angles</p> <p>Understand and use the angle properties of quadrilaterals</p> <p>Use the fact that angle sum of a quadrilateral is 360°</p> <p>Give reasons for angle calculations</p> <p>Use three figure-bearings to specify direction</p> <p>Mark on a diagram the position of point <i>B</i> given its bearing from the point <i>A</i></p> <p>Give a bearing between the points on a map or scaled plan</p> <p>Given the bearing of point <i>A</i> from point <i>B</i>, work out the bearing</p>	<p>By the end of the module the student should be able to:</p> <p>Draw graphs representing 'real' examples like filling a bath/containers</p> <p>Interpret and draw linear graphs, including conversion graphs, fuel bills etc</p> <p>Solve problems relating to mobile phone bills with fixed charge and price per unit</p> <p>Interpret non-linear graphs like the number of cans in a vending machine at times throughout the day</p> <p>Substitute values of <i>x</i> into a quadratic function to find the corresponding values of <i>y</i></p> <p>Draw graphs of quadratic functions</p>	<p>Know that, eg $x^3 = 64$ $\Rightarrow x = 8^{2/3}$</p> <p>Rationalise the denominator, eg $\frac{1}{\sqrt{3}-1} = \left(\frac{\sqrt{3}+1}{2}\right)$, and, eg write $(\sqrt{18} + 10) \div \sqrt{2}$ in the form $p + q\sqrt{2}$</p> <p>Similarity & Congruence</p> <p>Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and a pair of compasses constructions</p> <p>Understand similarity of triangles and of other plane figures, and use this to make geometric inferences</p> <p>Formal geometric proof of similarity of two given triangles</p> <p>Recognise that all corresponding angles in similar figures are equal in size when the lengths of sides are not</p>	
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<p>Express simple functions (in words, then) using symbols; represent them in mappings. Calculate statistics for small sets of discrete data: - find the mode, median and range, and the modal class for grouped data; - calculate the mean, including from a simple frequency table, using a calculator for a larger number of items.</p> <p>Understand and use the language and notation associated with reflections, translations and rotations. Recognise and visualise the transformation and symmetry of a 2-D shape: reflection in given mirror lines, and line symmetry; rotation about a given point, and rotation symmetry; translation; explore these transformations and symmetries using ICT. Revise & Prepare for end of year exam. Set 3 - SAT - level 3 -5</p> <p>Set 2 - SAT - level 4 - 6</p>	<p>Plot the graphs of linear functions, where y is given explicitly in terms of x, on paper and using ICT. Construct linear functions arising from real-life problems and plot their corresponding graphs; discuss and interpret graphs arising from real situations. Solve more demanding problems and investigate in a range of contexts: algebra. Solve more complex problems by breaking them into smaller steps or tasks, choosing and using efficient techniques for algebraic manipulation. Know and use geometric properties of cuboids and shapes made from cuboids; begin to use plans and elevations. Make simple scale drawings. Find simple loci, both by reasoning and by using ICT, to produce shapes and paths, e.g. an equilateral triangle. "Use bearings to specify direction. (This has been removed from KS3)" Know and use the formula for the volume of a cuboid; calculate</p>	<p>of B from A</p> <p>Recall and use properties of perpendicular lines</p> <p>Understand the proof that the angle sum of a triangle is 180°</p> <p>Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices</p> <p>Make an accurate scale drawing from a diagram</p> <p>Identify shapes which are similar, including all circles or all regular polygons with equal number of sides Interpret map/model scales as a ratio</p> <p>Fractions</p> <p>By the end of the module the student should be able to:</p>	<p>Use quadratic graphs to solve approximate solution of a quadratic equation from the graph of the corresponding quadratic function</p> <p>Interpret gradients from real life graphs eg for height of bath water vs time, the gradient is the rate of filling</p> <p>Solve problems involving money conversions, eg £'s to Euros etc</p> <p>Transformations</p> <p>Describe and transform 2-D shapes using single rotations</p> <p>Understand that rotations are specified by a centre and an (anticlockwise) angle</p> <p>Find the centre of rotation</p> <p>Rotate a shape about the origin, or any other point</p>	<p>Understand the effect of enlargement for perimeter, area and volume of shapes and solids</p> <p>Understand that enlargement does not have the same effect on area and volume</p> <p>Use simple examples of the relationship between enlargement and areas and volumes of simple shapes and solids</p> <p>Use the effect of enlargement on areas and volumes of shapes and solids Know the relationships between linear, area and volume scale factors of mathematically similar shapes and solids</p> <p>Proportion</p> <p>Calculate an unknown quantity from quantities that vary in direct or inverse proportion Set up and use equations to solve word and other problems involving direct proportion or inverse proportion and relate algebraic solutions to graphical representation of the equations</p>	
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<p>Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers.</p> <p>Interpret the display of a calculator in different contexts (decimals, percentages).</p> <p>Calculate simple fractions of quantities and measurements (whole-number answers); multiply a fraction by an integer.</p> <p>Recognise the equivalence of percentages, fractions and decimals; calculate simple percentages and use percentages to compare simple proportions.</p> <p>Break a complex calculation into simpler steps, choosing and using appropriate and efficient operations, methods and resources, including ICT.</p> <p>Generate coordinate pairs that satisfy a simple linear rule; plot the graphs of simple linear functions, where y is given explicitly in terms of x, on paper and using ICT; recognise straight-line graphs</p>	<p>volumes and surface areas of cuboids and shapes made from cuboids.</p> <p>Collect data using a suitable method, such as observation, controlled experiment, including data logging using ICT, or questionnaire.</p> <p>Calculate statistics, including with a calculator; calculate a mean using an assumed mean; know when it is appropriate to use the modal class for grouped data.</p> <p>Construct, on paper and using ICT: bar charts and frequency diagrams for continuous data; simple line graphs for time series; identify which are most useful in the context of the problem.</p> <p>Interpret tables, graphs and diagrams for continuous data and draw inferences that relate to the problem being discussed; relate summarised data to the questions being explored.</p> <p>Compare two distributions using the range and one or more of the mode, median and mean.</p> <p>Communicate orally and on paper the results of a</p>	<p>Visualise a fraction diagrammatically</p> <p>Understand a fraction as part of a whole</p> <p>Recognise and write fractions in everyday situations</p> <p>Find fractions of amounts</p> <p>Write a fraction in its simplest form and recognise equivalent fractions</p> <p>Compare the sizes of fractions using a common denominator</p> <p>Add and subtract fractions by using a common denominator</p> <p>Write an improper fraction as a mixed fraction</p>	<p>Describe and transform 2-D shapes using single reflections</p> <p>Understand that reflections are specified by a mirror line</p> <p>Identify the equation of a mirror line of symmetry</p> <p>Describe and transform 2-D shapes using single translations</p> <p>Understand that translations are specified by a distance and direction (using a vector)</p> <p>Translate a given shape by a vector</p> <p>Describe and transform 2-D shapes using enlargements by a positive scale factor</p> <p>Understand that an enlargement is specified by a centre and a scale factor</p> <p>Scale a shape on a grid (without a centre specified)</p> <p>Draw an enlargement</p>	<p>Pythagoras' & Trigonometry</p> <p>Understand, recall and use Pythagoras' theorem in 2-D, then in 3-D problems</p> <p>Recall and use the trigonometric ratios to solve 2-D and 3-D problems</p> <p>Understand the language of planes, and recognise the diagonals of a cuboid</p> <p>Calculate the length of a diagonal of a cuboid</p> <p>Find the angle between a line and a plane (but not the angle between two planes or between two skew lines)</p> <p>Plot and recognise cubic, reciprocal, exponential and circular functions $y = \sin x$, $y = \cos x$ and $y = \tan x$ within the range -360° to $+360^\circ$ (see above)</p> <p>Use the graphs of these functions to find approximate solutions to equations, eg given x find y (and vice versa)</p> <p>Match equations with their graphs</p>	
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<p>parallel to the x-axis or y-axis. Begin to plot and interpret the graphs of simple linear functions arising from real-life situations. Suggest extensions to problems by asking 'What if...?'; begin to generalise and to understand the significance of a counter-example. Solve word problems and investigate in a range of contexts: shape and space. Suggest extensions to problems by asking 'What if...?'; begin to generalise and to understand the significance of a counter-example. Begin to identify and use angle, side and symmetry properties of triangles and quadrilaterals; solve geometrical problems involving these properties, using step-by-step deduction and explaining reasoning with diagrams and text. Explore transformations and symmetries using ICT. Use a ruler and protractor to: construct a triangle given two</p>	<p>statistical enquiry and the methods used, using ICT as appropriate; justify the choice of what is presented. Compare experimental and theoretical probabilities in different contexts. Max Box - Pupils can produce a line graph of results, and practise representing data techniques.</p>	<p>Convert between fractions and decimals</p> <p>Algebra 2</p> <p>By the end of the module the student should be able to:</p> <p>Use index notation for squares and cubes</p> <p>Use index notation for powers of 10</p> <p>Find the value of calculations using indices</p> <p>Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, and of powers of a power</p> <p>Multiply a single algebraic term over a bracket</p>	<p>Enlarge a given shape using (0, 0) as the centre of enlargement</p> <p>Enlarge shapes with a centre other than (0, 0)</p> <p>Find the centre of enlargement</p> <p>Recognise that enlargements preserve angle but not length</p> <p>Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides</p> <p>Describe and transform 2-D shapes using combined rotations, reflections, translations, or enlargements</p> <p>Understand that distances and angles are preserved under rotations, reflections and translations, so that any shape is congruent under any of these transformations</p>	<p>Recognise the characteristic shapes of all these functions</p> <p>Construct the graphs of simple loci including the circle $x^2 + y^2 = r^2$ for</p> <p>Find the unknown lengths, or angles, in non right-angle triangles using the sine and cosine rules</p> <p>Find the area of triangles given two lengths and an included angle</p> <p>Learn sine, cosine and area of triangle (using sine) formulae.</p> <p>Know exact values for sin, cos and tan at key angles (0,30,45,60,90 degrees).</p> <p>Transformations of Functions</p> <p>Apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$, $y = af(x)$ for linear, quadratic, sine and cosine functions Select and apply the transformations of reflection, rotation, enlargement and translation of functions expressed algebraically</p>	
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<p>sides and the included angle (SAS) or two angles and the included side (ASA); explore these constructions using ICT. Use a ruler and protractor to construct simple nets of 3-D shapes, e.g. cuboid, regular tetrahedron, square-based pyramid, triangular prism. Interpret diagrams and graphs (including pie charts), and draw conclusions based on the shape of graphs and simple statistics for a single distribution. Compare two simple distributions using the range and one of the mode, median or mean. Write a short report of a statistical enquiry and illustrate with appropriate diagrams, graphs and charts, using ICT as appropriate; justify the choice of what is presented. Understand and use the probability scale from 0 to 1; find and justify probabilities based on equally likely outcomes in simple contexts; identify all the possible mutually exclusive outcomes of a single event.</p>		<p>Use simple instances of index laws</p> <p>Factorise algebraic expressions by taking out common factors</p> <p>Use brackets and the hierarchy of operations (BIDMAS)</p> <p>Using A Calculator</p> <p>By the end of the module the student should be able to:</p> <p>Use inverse operations (use one calculation to find the answer to another)</p> <p>Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is undefined)</p>	<p>Describe a transformation</p> <p>Recognise that all corresponding angles in similar shapes are equal in size when the corresponding lengths of sides are not equal in size</p> <p>Find corresponding lengths in similar shapes.</p> <p style="text-align: center;"><u>HIGHER</u></p> <p>Fractions, Decimals & Percentages</p> <p>By the end of the module the student should be able to:</p> <p>Understand that a percentage is a fraction in hundredths</p> <p>Convert between fractions, decimals and percentages Convert between recurring decimals and exact fractions as well as understanding the proof</p> <p>Write one number as a percentage of another number</p>	<p>Interpret and analyse transformations of functions and write the functions algebraically</p> <p>Circle Geometry/Theorems</p> <p>Recall the definition of a circle and identify (name) and draw the parts of a circle</p> <p>Understand related terms of a circle</p> <p>Draw a circle given the radius or diameter</p> <p>Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point</p> <p>Understand and use the fact that tangents from an external point are equal in length</p> <p>Find missing angles on diagrams</p> <p>Give reasons for angle calculations involving the use of tangent theorems</p> <p>Prove and use the facts that: the angle subtended by an arc at the centre of a circle is twice the angle subtended</p>	
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<p>Collect data from a simple experiment and record in a frequency table; estimate probabilities based on this data. Compare experimental and theoretical probabilities in simple contexts.</p> <p>Fun mathematical lesson: e.g. make a hexaflexagon, or do a lesson on your favourite aspect of maths! Have fun.</p>		<p>Convert between fractions and decimals</p> <p>Recognise terminating & recurring decimals</p> <p>Interpreting a calculator display</p> <p>Working out powers and roots</p> <p>Using a calculator to work out complex calculations</p> <p>Adding, Subtracting, Multiplying & Dividing using standard form</p> <p>Measure</p> <p>Interpret scales on a range of measuring instruments inc mm, cm, m, km, ml, cl, l, mg, g, kg, tonnes, °C</p> <p>Indicate given values on a scale</p>	<p>Calculate the percentage of a given amount</p> <p>Find a percentage increase/decrease of an amount</p> <p>Find a reverse percentage, eg find the original cost of an item given the cost after a 10% deduction</p> <p>Use a multiplier to increase by a given percent over a given time , eg $1.1^8 \times 64$ increases 64 by 10% over 8 years</p> <p>Calculate simple and compound interest</p> <p>Use recurring decimals as fractions.</p> <p>Co-ordinates & Linear Graphs</p> <p>By the end of the module the student should be able to:</p> <p>Understand that a percentage is a fraction in hundredths</p> <p>Convert between fractions, decimals and percentages</p> <p>Convert between recurring decimals and</p>	<p>at any point on the circumference</p> <p>the angle in a semicircle is a right angle</p> <p>angles in the same segment are equal</p> <p>opposite angles of a cyclic quadrilateral sum to 180°</p> <p>alternate segment theorem the perpendicular from the centre of a circle to a chord bisect the chord</p> <p>Algebra</p> <p>Simplify rational expressions by cancelling, adding, subtracting, and multiplying</p> <p>Vectors</p> <p>Understand that $2a$ is parallel to a and twice its length</p> <p>Understand that a is parallel to $-a$ and in the opposite direction</p> <p>Use and interpret vectors as displacements in the plane (with an associated direction)</p> <p>$\vec{a} + \vec{b} = \vec{c}$ Use standard vector notation to combine vectors by addition,</p>	
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		<p>Know that measurements using real numbers depend upon the choice of unit</p> <p>Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction</p> <p>Convert units within one system</p> <p>Convert metric units to metric units (Metric equivalents should be known)</p> <p>Convert imperial units to imperial units (NB: Conversion between imperial units will be given)</p> <p>Convert between metric and imperial measures</p> <p>Know rough metric equivalents of pounds,</p>	<p>exact fractions as well as understanding the proof</p> <p>Write one number as a percentage of another number</p> <p>Calculate the percentage of a given amount</p> <p>Find a percentage increase/decrease of an amount</p> <p>Find a reverse percentage, eg find the original cost of an item given the cost after a 10% deduction</p> <p>Use a multiplier to increase by a given percent over a given time , eg $1.1^8 \times 64$ increases 64 by 10% over 8 years</p> <p>Calculate simple and compound interest</p> <p>Use recurring decimals as fractions.</p> <p>Ratio & Scale</p> <p>Use ratios</p> <p>Write ratios in their simplest form</p>	<p>eg $\mathbf{AB + BC = AC}$ and $\underline{\mathbf{a}} + \underline{\mathbf{b}} = \underline{\mathbf{c}}$</p> <p>Represent vectors, and combinations of vectors, in the plane</p> <p>Solve geometrical problems in 2-D, eg show that joining the midpoints of the sides of any quadrilateral forms a parallelogram</p>	
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feet, miles, pints and gallons, ie

Metric Imperial

1 kg = 2.2 pounds

4.5 ints = 1 litre

4.5 / = 1 gallon

8km = 5 miles

30m = 1 foot

Estimate conversions

Convert between 12–hour and 24–hour hour clock times

Read bus and train timetables and plan journeys

Use the relationship between distance, speed and time to solve problems

Convert between metric units of speed, eg km/h to m/s

Perform calculations with density, mass and volume.

Divide a quantity in a given ratio

Solve a ratio problem in a context

Use and interpret maps and scale drawings

Read and construct scale drawings drawing lines and shapes to scale
Estimate lengths using a scale diagram

Solve word problems about ratio and proportion

Calculate an unknown quantity from quantities that vary in direct or inverse proportion

Transformations

Understand translation as a combination of a horizontal and vertical shift including signs for directions

Translate a given shape by the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Understand rotation as a (anti clockwise) turn about a given origin

		<p>Charts & Graphs</p> <p>By the end of the module the student should be able to</p> <p>Draw:</p> <p>Pictograms</p> <p>Composite bar charts</p> <p>Comparative and dual bar charts</p> <p>Frequency polygons,</p> <p>Histograms with equal class intervals</p> <p>Frequency diagrams for grouped discrete data</p> <p>Line graphs</p> <p>Interpret:</p> <p>composite bar charts</p> <p>comparative and dual bar charts</p> <p>stem and leaf diagrams</p> <p>scatter graphs</p> <p>frequency polygons</p> <p>From pictograms, bar charts, line graphs and histograms with equal class intervals:</p>	<p>Reflect shapes in a given mirror line; parallel to the coordinate axes and then $y = x$ or $y = -x$</p> <p>Enlarge shapes by a given scale factor from a given point; using positive and negative scale factors greater and less than one</p> <p>Find the centre of enlargement</p> <p>Understand that shapes produced by translation, rotation and reflection are congruent to the image</p> <p>Describe and transform 2-D shapes using single rotations</p> <p>Understand that rotations are specified by a centre and an (anticlockwise) angle</p> <p>Find the centre of rotation</p> <p>Rotate a shape about the origin, or any other point</p> <p>Describe and transform 2-D shapes using combined rotations, reflections, translations, or enlargements</p>		
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		<p>read off frequency values</p> <p>calculate total population</p> <p>find greatest and least values</p> <p>Recognise simple patterns and characteristic relationships in bar charts, line graphs and frequency polygons</p> <p>Use dual or comparative bar charts to compare distributions</p> <p>Represent data in a pie chart</p> <p>Interpret data in a pie chart</p> <p>Understand that the frequency represented by corresponding sectors in two pie charts is dependent upon the total populations represented by each of the pie charts</p> <p>From pie charts</p>	<p>Use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations</p> <p>Distinguish properties that are preserved under particular transformations</p> <p>Recognise that enlargements preserve angle but not length, linking to similarity</p> <p>Describe a transformation</p> <p>Formulae & Solution of Linear Equations</p> <p>Show the solution set of several inequalities in two variables on a graph</p> <p>Derive a formula</p> <p>Use formulae from mathematics and other subjects</p> <p>Substitute numbers into a formula</p> <p>Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$</p>		
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		<p>find the total frequency find the size of each category</p> <p><u>HIGHER</u></p> <p>Number</p> <p>Identify factors, multiples and prime numbers</p> <p>Find the prime factor decomposition of positive integers</p> <p>Find the common factors and common multiples of two numbers</p> <p>Find the Highest Common Factor (HCF) and the Least Common Multiple (LCM) of two numbers</p> <p>Recall integer squares from 2×2 to 15×15 and the corresponding square roots</p> <p>Recall the cubes of 2, 3, 4, 5 and 10</p> <p>Use index notation for squares and cubes</p>	<p>Set up linear equations from word problems</p> <p>Solve simple linear equations</p> <p>Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation</p> <p>Solve linear equations that include brackets, those that have negative signs occurring anywhere in the equation, and those with a negative solution</p> <p>Solve linear equations in one unknown, with integer or fractional coefficients</p> <p>Solve simple linear inequalities in one variable, and represent the solution set on a number line</p> <p>Use the correct notation to show inclusive and exclusive inequalities</p> <p>Change the subject of a formula including cases where the subject is on both sides of the original formula, or where a power of the subject appears</p>		
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		<p>Use brackets and the hierarchy of operations (BIDMAS)</p> <p>Understand that the inverse operation of raising a positive number to a power n is raising the result of this operation to the power $\frac{1}{n}$</p> <p>Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, and powers of a power</p> <p>Use index laws to simplify and calculate numerical expressions involving powers, eg $(2^3 \times 2^5) \div 2^4$, 4^0, $8^{-\frac{2}{3}}$</p> <p>Patterns & Sequences</p> <p>Use notation and symbols correctly</p> <p>Write an expression</p>	<p>Pythagoras' & Trigonometry</p> <p>Understand, recall and use Pythagoras' theorem in 2-D</p> <p>Calculate the length of a line segment in a 2-D plane</p> <p>Give an answer in the use of Pythagoras' Theorem as $\sqrt{13}$</p> <p>Recall and use the trigonometric ratios to solve 2-D problems</p> <p>Find angles of elevation and angles of depression</p> <p>Quadratic Functions, Equations & Graphs</p> <p>Generate points and plot graphs of simple quadratic functions, then more general quadratic functions</p> <p>Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function</p> <p>Find the intersection points of the graphs of a linear and quadratic function, knowing</p>		
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		<p>Manipulate algebraic expressions by collecting like terms</p> <p>Substitute numbers into a formula</p> <p>Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$</p> <p>Recognise sequences of odd and even numbers</p> <p>Generate simple sequences of numbers, squared integers and sequences derived from diagrams</p> <p>Describe the term-to-term definition of a sequence in words</p> <p>Identify which terms cannot be in a sequence</p> <p>Generate specific terms in a sequence using the position-to-term and term-to-term rules</p> <p>Find the n^{th} term of an arithmetic sequence</p>	<p>that these are the approximate solutions of the corresponding simultaneous equations representing the linear and quadratic functions</p> <p>Plot and recognise cubic, reciprocal, exponential and circular functions $y = \sin x$ and $y = \cos x$, within the range -360° to $+360^\circ$ (see above)</p> <p>Use the graphs of these functions to find approximate solutions to equations, eg given x find y (and vice versa)</p> <p>Use calculators to explore exponential growth and decay</p> <p>Solve cubic functions by successive substitution of values of x</p> <p>Use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them</p> <p>Understand the connections between changes of sign and location of roots</p>		
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Use the n^{th} term of an arithmetic sequence

Recognise geometric sequences (when the common ratio may be a surd.)

Fractions

Find equivalent fractions

Compare the sizes of fractions

Write a fraction in its simplest form

Find fractions of an amount

Convert between mixed numbers and improper fractions

Add and subtract fractions

Multiply and divide fractions including mixed numbers

Use recurring decimals as fractions.

Integers & Decimals
Understand and order
integers and decimals

Find equivalent
fractions

Write decimals in
ascending order of size

Understand and use
positive numbers and
negative integers, both
as positions and
translations on a
number line

Multiply and divide by
any number between 0
and 1

Multiply and divide
decimal numbers by
whole numbers and
decimal numbers (up
to 2 d.p.)
eg $266.22 \div 0.34$

Add, subtract, multiply
and divide integers,
negative numbers and
decimals

Round whole numbers
to the nearest, 10, 100,
1000, ...

Round decimals to appropriate numbers of decimal places or significant figures

Check their calculations by rounding, eg $29 \times 31 \approx 30 \times 30$

Check answers to a division sum using multiplication eg use inverse operations

Multiply and divide whole numbers by a given multiple of 10

Put digits in the correct place in a decimal number

Approximate decimals to a given number of decimal places or significant figures

Know that eg $13.5 \div 0.5 = 135 \div 5$

Convert between recurring decimals and exact fractions as well as understanding the proof

Calculate the upper and lower bounds of calculations,

particularly when working with measurements

Find the upper and lower bounds of calculations involving perimeter, areas and volumes of 2-D and 3-D shapes

Find upper & lower bounds in real life situations using measurements given to appropriate degrees of accuracy

Give the final answer to an appropriate degree of accuracy following an analysis of the upper and lower bounds of a calculation

Use recurring decimals as fractions.

Change recurring decimals into fractions

Shape & Angle

Recall and use properties of angles

–
angles at a point

–
angles at a point on a straight line

perpendicular lines

vertically opposite angles

Understand and use the angle properties of parallel lines

Understand, draw and measure bearings

Calculate bearings and solve bearings problems

Distinguish between scalene, isosceles, equilateral, and right-angled triangles

Understand and use the angle properties of triangles

Use the angle sum of a triangle is 180°

Understand and use the angle properties of intersecting lines

Mark parallel lines on a diagram

Use the properties of corresponding and alternate angles

Understand and use the angle properties of quadrilaterals

Give reasons for angle calculations

Explain why the angle sum of a quadrilateral is 360°

Understand the proof that the angle sum of a triangle is 180°

Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices

Use the size/angle properties of isosceles and equilateral triangles

Recall and use these properties of angles in more complex problems

Calculate and use the sums of the interior angles of polygons

Use geometric language appropriately and recognise and name pentagons, hexagons, heptagons, octagons and decagons

Use the angle sums of irregular polygons

Calculate and use the angles of regular polygons

Use the sum of the interior angles of an n sided polygon

Use the sum of the exterior angles of any polygon is 360°

Use the sum of the interior angle and the exterior angle is 180°

Find the size of each interior angle or the size of each exterior angle or the number of sides of a regular polygon

Understand tessellations of regular and irregular polygons and combinations of polygons

Explain why some shapes tessellate when other shapes do not

Compound Measures

Convert between units of measure in the same system. (NB: Conversion between imperial units will be given. metric equivalents should be known)

Know rough metric equivalents of pounds, feet, miles, pints and gallons: Metric /Imperial 1 kg= 2.2 pounds,
1 litre=1.75 pints,
4.5 litres = 1 gallon,
30 km = 5 miles,
30 m = 1 foot

Convert between imperial and metric measures

Use the relationship between distance, speed and time to solve problems

Convert between metric units of speed eg km/h to m/s

Know that density is found by $\text{mass} \div \text{volume}$

Use the relationship between density, mass and volume to solve problems, eg find the mass of an object with a given volume and density

Convert between metric units of density eg kg/m to g/cm

Calculate speed when, eg fractions of an hour must be entered as fractions or as decimals

Similarity & Congruence

Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and a pair of compasses constructions

Understand similarity of triangles and of other plane figures, and use this to make geometric inferences

Formal geometric proof of similarity of two given triangles

Recognise that all corresponding angles in similar figures are equal in size when the lengths of sides are not

Algebra

Use notation and symbols correctly

Write an expression

Manipulate algebraic expressions by collecting like terms

Multiply a single term over a bracket

Factorise algebraic expressions by taking out common factors

Expand the product of two linear expressions

Factorise quadratic expressions using the difference of two squares

Perimeter & Area

Measure sides of a rectangle to work out perimeter or area

Calculate perimeters of shapes made from triangles and rectangles

Find the perimeter of rectangles and triangles

Calculate areas of shapes made from triangles and rectangles

Recall and use the formulae for the area of a triangle, rectangle and a parallelogram

Find the area of a trapezium and a parallelogram

Calculate perimeter and area of compound shapes made from triangles, rectangles and other shapes

Find circumferences of circles and areas enclosed by circles

Recall and use the formulae for the circumference of a circle and the area enclosed by a circle

Use $\pi \approx 3.142$ or use the π button on a calculator

Find the perimeters and areas of semicircles and quarter circles

2D & 3D Shapes

Use 2-D representations of 3-D shapes
Use isometric grids

Draw nets and show how they fold to make a 3-D solid

Understand and draw front and side elevations and plans of shapes made from simple solids

Given the front and side elevations and the plan of a solid, draw a sketch of the 3-D solid

Constructions & Loci

Use straight edge and a pair of compasses to do standard constructions

Construct triangles inc an equilateral triangle

Understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not

Construct the perpendicular bisector of a given line

Construct the perpendicular from a point to a line

Construct the perpendicular from a point on a line

Construct the bisector
of a given angle

Construct angles of
 60° , 90° , 30° , 45°

Draw parallel lines

Draw circles and arcs
to a given radius

Construct a regular
hexagon inside a circle

Construct diagrams of
everyday 2-D situations
involving rectangles,
triangles,
perpendicular and
parallel lines

Draw and construct
diagrams from given
information

Construct: -a region
bounded by a circle
and an intersecting line
- a given distance from
a point and a given
distance from a line

- equal distances from
2 points or 2 line
segments

- regions which may be defined by 'nearer to' or 'greater than'

Find and describe regions satisfying a combination of loci

Use and interpret maps and scale drawings

Read and construct scale drawings drawing lines and shapes to scale

(12.6)

Estimate lengths using a scale diagram

Formulae & Solution of Linear Equations

Solve simple linear equations

Select an expression/identity/equation/formula from a list

Solve linear equations, with integer coefficients, in which the unknown appears on either side or on both sides of the equation

Solve linear equations that include brackets, those that have negative signs occurring anywhere in the equation, and those with a negative solution

Solve linear equations in one unknown, with integer or fractional coefficients

Set up linear equations from word problems