Key Stage 3

By the end of key stage 3, pupils are expected to know, apply and understand the matters, skills and processes specified in the programme of study.

Pupils should be taught to	At Culcheth High School, this is taught
Working Mathematically	
▪ consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals, fractions, powers and roots	Year 7 (all sets): Term 1 – Number and Number Systems Year 8 (sets 1-3): Term 1 – Calculating Year 8 (set 4): Term 1 – Number and Number Systems
▪ select and use appropriate calculation strategies to solve increasingly complex problems	Year 7 (all sets): Term 1 – Calculating Year 8 (set 4): Term 1 – Calculating
▪ use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships	Year 7 (sets 1-3): Term 2 – Algebraic Proficiency: Tinkering Year 7 (set 4): Term 2 – Formulae Year 8 (sets 1-3): Term 1 – Algebraic Proficiency: Tinkering Year 8 (set 4): Term 2 – Algebraic Proficiency: Tinkering
▪ substitute values in expressions, rearrange and simplify expressions, and solve equations	Year 7 (sets 1-3): Term 2 – Algebraic Proficiency: Tinkering Year 7 (set 4): Term 2 – Algebraic Proficiency: Using Formulae Year 8 (sets 1-3): Term 1 – Algebraic Proficiency: Tinkering

	Year 8 (set 4): Term 2 – Algebraic Proficiency: Tinkering
▪ move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs]	Year 7 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (set 4): Term 2 – Proportional Reasoning
▪ develop algebraic and graphical fluency, including understanding linear and simple quadratic functions	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics.	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
Reason Mathematically	
▪ extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically	Year 7 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (set 4): Term 2 – Proportional Reasoning
▪ identify variables and express relations between variables algebraically and graphically	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ make and test conjectures about patterns and relationships; look for proofs or counter examples	Year 7 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (set 4): Term 2 – Pattern Sniffing

▪ begin to reason deductively in geometry, number and algebra, including using geometrical constructions	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
▪ interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning	Year 7 (sets 1-4): Term 3 Year 8 (sets 1-4): Term 3
▪ explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally.	Year 8 (sets 1-3): Terms 3 – Understanding Risk II
Solve problems	
▪ develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
▪ develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
▪ begin to model situations mathematically and express the results using a range of formal mathematical representations	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
▪ select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems.	Year 7 (sets 1-4): Term 3 Year 8 (sets 1-4): Term 3
Number	

▪ understand and use place value for decimals, measures and integers of any size	Year 7 (sets 1-3): Term 1 – Calculating Year 7 (set 4): Term 1 – Checking, approximating and estimating Year 8 (sets 1-3): Term 1 – Numbers and Number Systems Year 8 (set 4): Term 1 – Calculating
▪ order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥	Year 7 (sets 1-3): Term 1: Counting and Comparing Year 7 (set 4): Term 2 – Exploring Fractions, Decimals and Percentages
▪ use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property	Year 7 (sets 1-3): Term 1 – Number and Number Systems Year 7 (set 4): Term 2 – Exploring Fractions, Decimals and Percentages Year 8 (sets 1-3): Term 1 – Number and Number Systems Year 8 (set 4): Term 1 – Number and Number Systems
▪ use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
▪ recognise and use relationships between operations including inverse operations	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3

• use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations	Year 7 (sets 1-3): Term 1 – Number and Number Systems Year 8 (sets 1-3): Term 1 – Calculating Year 8 (set 4): Term 1 – Number and Number Systems
• interpret and compare numbers in standard form A x 10^n 1≤A<10, where n is a positive or negative integer or zero	Year 8 (sets 1-3): Term 1 – Number and Number Systems
• work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)	Year 7 (sets 1-3): Term 1 – Counting and comparing Year 8 (set 4): Term 1 – Counting and comparing
• define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%	Year 7 (sets 1-3): Term 1 – Counting and comparing Year 7 (set 4): Term 2 – Exploring Fractions, Decimals and Percentages Year 8 (set 4): Term 1 – Counting and comparing
• interpret fractions and percentages as operators	Year 7 (sets 1-3): Term 1 – Counting and comparing Year 7 (set 4): Term 2 – Exploring Fractions, Decimals and Percentages Year 8 (set 4): Term 1 – Counting and comparing
• use standard units of mass, length, time, money and other measures, including with decimal quantities	Year 7 (sets 1-4): Terms 1-3 Year 8 (sets 1-4): Terms 1-3
• round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures]	Year 7 (sets 1-3): Term 1 – Calculating Year 7 (set 4): Term 1 – Checking, approximating and estimating

	Year 8 (sets 1-3): Term 1 – Numbers and Number Systems Year 8 (set 4): Term 1 – Calculating
▪ use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a<x\leq b$	Year 7 (sets 1-3): Term 1 – Checking, approximating and estimating Year 7 (set 4): Term 1 – Checking, approximating and estimating Year 8 (sets 1-3): Term 1 – Numbers and Number Systems Year 8 (set 4): Term 1 – Checking, approximating and estimating
▪ use a calculator and other technologies to calculate results accurately and then interpret them appropriately	Year 7 (sets 1-3): Term 1 – Number and Number Systems Year 8 (sets 1-3): Term 1 – Calculating Year 8 (set 4): Term 1 – Number and Number Systems
▪ appreciate the infinite nature of the sets of integers, real and rational numbers.	Year 7 (sets 1-3): Term 1 – Number and Number Systems Year 8 (sets 1-3): Term 1 – Calculating Year 8 (set 4): Term 1 – Number and Number Systems
Algebra	
▪ use and interpret algebraic notation, including: ab in place of $a \times b$, $3y$ in place of $y + y + y$ and $3 \times y$, a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$; a^2b in place of $a \times a \times b$, $^a/_b$ in place of $a \div b$	Year 7 (sets 1-3): Term 2 – Algebraic Proficiency: Tinkering Year 7 (set 4): Term 2 – Algebraic Proficiency: Using Formulae Year 8 (sets 1-3): Term 1 – Algebraic Proficiency: Tinkering Year 8 (set 4): Term 2 – Algebraic Proficiency: Tinkering

▪ coefficients written as fractions rather than as decimals	Year 7 (sets 1-3): Term 2 – Algebraic Proficiency: Tinkering Year 8 (sets 1-3): Term 1 – Algebraic Proficiency: Tinkering Year 8 (set 4): Term 2 – Algebraic Proficiency: Tinkering
▪ substitute numerical values into formulae and expressions, including scientific formulae understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors simplify and manipulate algebraic expressions to maintain equivalence by: collecting like terms, multiplying a single term over a bracket, taking out common factors, expanding products of two or more binomials, understand and use standard mathematical formulae; rearrange formulae to change the subject, model situations or procedures by translating them into algebraic expressions or formulae and by using graphs	Year 7 (sets 1-3): Term 2 – Algebraic Proficiency: Tinkering Year 7 (set 4): Term 2 – Solving Equations and Inequalities Year 8 (sets 1-3): Term 1 – Algebraic Proficiency: Tinkering Year 8 (set 4): Term 2 – Algebraic Proficiency: Tinkering
▪ use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)	Year 7 (sets 1-3): Term 2 – Algebraic Proficiency: Tinkering Year 7 (set 4): Term 2 – Solving Equations and Inequalities Year 8 (sets 1-3): Term 1 – Algebraic Proficiency: Tinkering Year 8 (set 4): Term 2 – Algebraic Proficiency: Tinkering
▪ work with coordinates in all four quadrants	Year 7 (sets 1-3): Term 3 – Mathematical Movement Year 7 (set 4): Term 3 – Mathematical Movement
▪ recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising

▪ interpret mathematical relationships both algebraically and graphically	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ reduce a given linear equation in two variables to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
▪ generate terms of a sequence from either a term-to-term or a position-to-term rule	Year 7 (sets 1-3): Term 2 – Pattern Sniffing Year 7 (set 4): Term 2 – Pattern Sniffing Year 8 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (set 4): Term 2 – Pattern Sniffing
▪ recognise arithmetic sequences and find the nth term	Year 7 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (set 4): Term 2 – Pattern Sniffing
▪ recognise geometric sequences and appreciate other sequences that arise.	Year 7 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (sets 1-3): Term 2 – Pattern Sniffing Year 8 (set 4): Term 2 – Pattern Sniffing

Ratio, proportion and rates of change	
• change freely between related standard units [for example time, length, area, volume/capacity, mass]	Year 7 (sets 1-3): Term 2 – Measuring Space Year 8 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (set 4): Term 2 – Measuring Space
• use scale factors, scale diagrams and maps	Year 7 (set 4): Term 2 – Proportional Reasoning Year 8 (sets 1-3): Term 1 – Visualising and Constructing
• express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1	Year 7 (sets 1-3): Term 1 – Counting and comparing Year 7 (set 4): Term 2 – Exploring Fractions, Decimals and Percentages Year 8 (sets 1-3): Term 2 – Calculating Fractions, Decimals and Percentages Year 8 (set 4): Term 1 – Counting and comparing
• use ratio notation, including reduction to simplest form	Year 7 (sets 1-3): Term 2 – Proportional Reasoning Year 7 (set 4): Term 2 – Proportional Reasoning Year 8 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (set 4): Term 2 – Proportional Reasoning
• 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 understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction	Year 7 (sets 1-3): Term 2 – Proportional Reasoning Year 7 (set 4): Term 2 – Proportional Reasoning Year 8 (sets 1-3): Term 2 – Proportional Reasoning

	Year 8 (set 4): Term 2 – Proportional Reasoning
▪ relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions	Year 7 (sets 1-3): Term 2 – Proportional Reasoning Year 7 (set 4): Term 2 – Proportional Reasoning Year 8 (sets 1-3): Term 2 – Proportional Reasoning Year 8 (set 4): Term 2 – Proportional Reasoning
▪ solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics	Year 7 (sets 1-3): Term 1 – Counting and comparing Year 7 (set 4): Term 2 – Exploring Fractions, Decimals and Percentages Year 8 (sets 1-3): Term 2 – Calculating Fractions, Decimals and Percentages Year 8 (set 4): Term 1 – Counting and comparing
▪ solve problems involving direct and inverse proportion, including graphical and algebraic representations	Year 8 (sets 1-3): Term 3 – Solving Equations and Inequalities
▪ use compound units such as speed, unit pricing and density to solve problems	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
Geometry and measures	
▪ derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)	Year 7 (sets 1-3): Term 3 – Calculating Space Year 7 (set 4): Term 3 – Calculating Space Year 8 (sets 1-3): Term 3 – Calculating Space

	Year 8 (set 4): Term 3 – Calculating Space
• calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes	Year 7 (sets 1-3): Term 3 – Calculating Space Year 7 (set 4): Term 3 – Calculating Space Year 8 (sets 1-3): Term 3 – Calculating Space Year 8 (set 4): Term 3 – Calculating Space
• draw and measure line segments and angles in geometric figures, including interpreting scale drawings	Year 7 (sets 1-3): Term 3 – Measuring Space Year 8 (sets 1-3): Term 1 – Visualising and Constructing Year 8 (set 4): Term 2 – Measuring Space
• derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line	Year 8 (sets 1-3): Term 1 – Visualising and Constructing
• describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric	Year 7 (sets 1-3): Term 3 – Mathematical Movement Year 7 (set 4): Term 3 – Mathematical Movement Year 8 (set 4): Term 3 – Mathematical Movement
• use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles	Year 7 (sets 1-3): Term 3 – Mathematical Movement Year 7 (set 4): Term 3 – Mathematical Movement Year 8 (set 4): Term 3 – Mathematical Movement

• derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies	Year 7 (sets 1-3): Term 3 – Mathematical Movement Year 7 (set 4): Term 3 – Mathematical Movement Year 8 (set 4): Term 3 – Mathematical Movement
• identify properties of, and describe the results of, translations, rotations and reflections applied to given figures	Year 7 (sets 1-3): Term 3 – Mathematical Movement Year 7 (set 4): Term 3 – Mathematical Movement Year 8 (set 4): Term 3 – Mathematical Movement
• identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids	Year 7 (sets 1-3): Term 3 – Mathematical Movement Year 8 (set 4): Term 3 – Mathematical Movement
• apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles	Year 7 (sets 1-3): Term 2 – Investigating Angles Year 8 (set 4): Term 2 – Investigating Angles
• understand and use the relationship between parallel lines and alternate and corresponding angles	Year 8 (sets 1-3): Term 2 – Investigating Angles
• derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons	Year 8 (sets 1-3): Term 2 – Investigating Angles
• apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs	Year 8 (sets 1-3): Term 2 – Investigating Angles
• use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles	Year 8 (sets 1-3): Term 3

• use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D	Year 7 (sets 1-3): Term 2 – Investigating the Properties of Shapes Year 8 (set 4): Term 2 – Investigating the Properties of Shapes
• interpret mathematical relationships both algebraically and geometrically.	Year 8 (sets 1-3): Term 3 – Algebraic Proficiency: Visualising
Probability	
• record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale	Year 8 (sets 1-3): Term 1 – Understanding Risk I
• understand that the probabilities of all possible outcomes sum to 1	Year 8 (sets 1-3): Term 1 – Understanding Risk I
• enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams	Year 8 (sets 1-3): Term 1 – Understanding Risk I
• generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities.	Year 8 (sets 1-3): Term 3 – Understanding Risk II
Statistics	
• describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)	Year 7 (sets 1-3): Term 3 – Measuring Data Year 7 (set 4): Term 3 – Measuring Data Year 8 (sets 1-3): Term 3 – Measuring Data Year 8 (set 4): Term 3 – Measuring Data

▪ construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data	Year 7 (sets 1-3): Term 3 – Presentation of Data Year 7 (set 4): Term 3 – Presentation of Data Year 8 (sets 1-3): Term 3 – Presentation of Data Year 8 (set 4): Term 3 – Presentation of Data
▪ describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs.	Year 8 (sets 1-3): Term 3 – Presentation of Data

Key Stage 4

By the end of key stage 3, pupils are expected to know, apply and understand the matters, skills and processes specified in the programme of study. This programme of study specifies: the mathematical content that should be taught to all pupils, in standard type; and additional mathematical content to be taught to more highly attaining pupils, in **bold** type and braces { }.

Pupils should be taught to	At Culcheth High School, this is taught
Develop Fluency	
▪ consolidate their numerical and mathematical capability from key stage 3 and extend their understanding of the number system to include powers, roots {**and fractional indices**}	Year 9 (Sets 2-3): Term 2 Year 9 (Set 1): Term 2 Year 10 (Sets 2-3): Term 2
▪ select and use appropriate calculation strategies to solve increasingly complex problems, including exact calculations involving multiples of π {**and surds**}, use of standard form and application and interpretation of limits of accuracy	Year 9 (Sets 4-5): Term 1 Year 10 (Sets 2-3): Term 3 Year 10 (Set 1): Term 2

▪ consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions, {**and expressions involving surds and algebraic fractions**}	Year 10 (Sets 4-5): Term 1 Year 10 (Sets 2-3): Term 3 Year 11 (Set 1): Term 2
▪ extend fluency with expressions and equations from key stage 3, to include quadratic equations, simultaneous equations and inequalities	Year 10 (Sets 2-3): Term 2 Year 10 (Set 1): Term 1, 3 Year 11 (Sets 1-3): Term 1
▪ move freely between different numerical, algebraic, graphical and diagrammatic representations, including of linear, quadratic, reciprocal, {**exponential and trigonometric**} functions	Year 11 (Sets 1-5): Term 1
▪ use mathematical language and properties precisely.	Years 9-11 (Sets 1-5): Terms 1-3
Reason Mathematically	
▪ extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically	Year 9 (Sets 1-3): Term 1 Year 10 (Sets 4-5): Term 1
▪ extend their ability to identify variables and express relations between variables algebraically and graphically	Year 9 (Set 1): Term 2 Year 9 (Sets 1-3): Term 3 Year 11 (Sets 4-5): Term 1
▪ make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples;	Year 11 (Set 1): Term 2

begin to use algebra to support and construct arguments {**and proofs**}	
▪ reason deductively in geometry, number and algebra, including using geometrical constructions	Year 11 (Sets 3-1): Term 2
▪ interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning	Year 9 (Sets 1-3): Term 1 Year 10 (Sets 4-5): Term 1
▪ explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally	Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ assess the validity of an argument and the accuracy of a given way of presenting information.	Years 9-11 (Sets 1-5): Terms 1-3
Solve problems	
▪ develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems	Years 9-11 (Sets 1-5): Terms 1-3
▪ develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts	Years 9-11 (Sets 1-5): Terms 1-3
▪ make and use connections between different parts of mathematics to solve problems	Years 9-11 (Sets 1-5): Terms 1-3
▪ model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how	Years 9-11 (Sets 1-5): Terms 1-3

their solutions may have been affected by any modelling assumptions	
▪ select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem.	Years 9-11 (Sets 1-5): Terms 1-3
Number	
▪ apply systematic listing strategies, {**including use of the product rule for counting**}	Year 9 (Sets 1-5): Term 1
▪ {**estimate powers and roots of any given positive number**}	Year 9 (Sets 1-5): Term 1
▪ calculate with roots, and with integer {**and fractional**} indices	Year 9 (Sets 1-5): Term 1
▪ calculate exactly with fractions, {**surds**} and multiples of π; {**simplify surd** **expressions involving squares and rationalise denominators**}	Year 9 (Sets 4-5): Term 1 Year 10 (Sets 2-3): Term 3 Year 10 (Set 1): Term 2
▪ calculate with numbers in standard form $A \times 10^n$, where $1 \le A < 10$ and n is an integer	Year 9 (Sets 4-5): Term 1 Year 10 (Sets 2-3): Term 3 Year 10 (Set 1): Term 2
▪ {**change recurring decimals into their corresponding fractions and vice versa**}	Year 10 (Set 1): Term 2
▪ identify and work with fractions in ratio problems	Year 9 (Sets 1-3): Term 1 Year 10 (Sets 4-5): Term 1

▪ apply and interpret limits of accuracy when rounding or truncating, {**including upper and lower bounds**}.	Year 9 (Sets 1-5): Term 1
Algebra	
▪ simplify and manipulate algebraic expressions (including those involving surds {**and algebraic fractions**})	Year 10 (Set 1): Term 2 Year 10 (Sets 2-3): Term 3
▪ factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares; {**factorising quadratic expressions of the form $ax^2 + bx + c$**}	Year 9 (Sets 1-3): Term 2 Year 11 (Sets 1-3): Term 1
▪ know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments {**and proofs**}	Year 11 (Set 1): Term 2
▪ where appropriate, interpret simple expressions as functions with inputs and outputs; {**interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function'**}	Year 11 (Sets 1-3): Term 2
▪ 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	Year 9 (Set 1): Term 2 Year 9 (Sets 2-3): Term 3 Year 11 (Sets 4-5): Term 1
▪ identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically {**and turning points by completing the square**}	Year 11 (Sets 1-3): Term 1

▪ recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function, {**the exponential function, and the trigonometric functions (with arguments in degrees)** $y= \sin x$, $y=\cos x$ **and** $y= \tan x$ **for angles of any size**}	Year 10 (Sets 1-3): Term 3
▪ {**sketch translations and reflections of the graph of a given function**}	Year 10 (Sets 1-3): Term 3
▪ plot and interpret graphs (including reciprocal graphs {**and exponential graphs**}) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration	Year 11 (Sets 1-3): Term 2
▪ {**calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts**}	Year 11 (Sets 1-3): Term 2
▪ {**recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point**} solve quadratic equations {**including those that require rearrangement**} algebraically by factorising, {**by completing the square and by using the quadratic formula**}; find approximate solutions using a graph solve two simultaneous equations in two variables (linear/linear {**or linear/quadratic**}) algebraically; find approximate solutions using a graph	Year 11 (Sets 1-3): Term 2
▪ {**find approximate solutions to equations numerically using iteration**}	Year 11 (Sets 1-3): Term 1
▪ translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution	Year 10 (Sets 1-3): Term 2 Year 11 (Sets 1-3): Term 1

▪ solve linear inequalities in one {**or two**} variable{**s**}**, {and quadratic inequalities in one variable**}; represent the solution set on a number line, {**using set notation and on a graph**}	Year 9 (Sets 1-5): Term 2
▪ recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a positive rational number {**or a surd**}) {**and other sequences**}	Year 9 (Sets 1-5): Term 2
▪ deduce expressions to calculate the nth term of linear {**and quadratic**} sequences.	Year 9 (Sets 1-5): Term 2
▪ **Ratio, proportion and rates of change**	
▪ compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)	Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts	Year 9 (Sets 1-3): Term 3
▪ 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	Year 10 (Sets 1-3): Term 2 Year 11 (Sets 1-3): Term 1
▪ interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion	Year 10 (Sets 1): Term 2 Year 11 (Sets 1-3): Term 2
▪ {**interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of instantaneous and average**	Year 11 (Sets 1-3): Term 2

rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts}	
▪ set up, solve and interpret the answers in growth and decay problems, including compound interest {**and work with general iterative processes**}.	Year 9 (Sets 1-3): Term 1
▪ **Geometry and Measures**	
interpret and use fractional {**and negative**} scale factors for enlargements	Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ {**describe the changes and invariance achieved by combinations of rotations, reflections and translations**}	Year 10 (Set 1): Term 1 Year 10 (Sets 2-3): Term 2
▪ identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment	Years 10-11 (Sets 1-5): Term 2
▪ {**apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results**}	Year 11 (Sets 1-3): Term 2
▪ construct and interpret plans and elevations of 3D shapes	Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ interpret and use bearings	Year 9 (Sets 1-3): Term 3 Year 11 (Sets 4-5): Term 1
▪ calculate arc lengths, angles and areas of sectors of circles	Year 10 (Sets 1-3): Term 1

- calculate surface areas and volumes of spheres, pyramids, cones and composite solids	Year 10 (Set 1): Term 3
- apply the concepts of congruence and similarity, including the relationships between lengths, {**areas and volumes**} in similar figures	Year 10 (Set 1): Terms 1, 3 Year 10 (Sets 2-3): Term 1 Year 11 (Sets 4-5): Term 1
- apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in rightangled triangles {**and, where possible, general triangles**} in two {**and three**} dimensional figures	Year 11 (Sets 1-5): Term 1
- know the exact values of sinθ and cosθ for θ= 0^0, 30 , 45 , ^{0} ^{0} 60^0 and 90^0 ; know the exact value of tanθ for θ= 0^0, 30 , ^{0} 45^0 and 60^0	Year 11 (Sets 1-3): Term 1
- {**know and apply the sine rule and cosine rule to find unknown lengths and angles**}	Year 11 (Sets 1-3): Term 1
- {**know and apply Area = $\frac{1}{2}ab$sinC to calculate the area, sides or angles of any triangle**}	Year 11 (Sets 1-3): Term 1
- describe translations as 2D vectors	Year 10 (Set 1): Term 1 Year 10 (Sets 2-3): Term 2 Year 11 (Sets 4-5): Term 2
- apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; {**use vectors to construct geometric arguments and proofs**}.	Year 10 (Set 1): Term 1 Year 10 (Sets 2-3): Term 2 Year 11 (Sets 4-5): Term 2

▪ **Probability**	
▪ apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one	Year 9 (Sets 4-5): Term 2 Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size	Year 9 (Sets 4-5): Term 2 Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions	Year 9 (Sets 4-5): Term 2 Year 10 (Sets 1-3): Term 1 Year 11 (Sets 4-5): Term 2
▪ {**calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams**}.	Year 11 (Set 1): Term 3
▪ **Statistics**	
infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling	Year 11 (Set 1): Term 1 Year 11 (Sets 2-5): Term 2
▪ interpret and construct tables and line graphs for time series data	Year 9 (Sets 1-3): Term 2

▪ {**construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use**}	Year 11 (Set 1): Term 1 Year 11 (Sets 2-3): Term 2
▪ interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: appropriate graphical representation involving discrete, continuous and grouped data, {**including box plots**}, appropriate measures of central tendency (including modal class) and spread {**including quartiles and inter-quartile range**}	Year 9 (Sets 1-3): Term 2 Year 10 (Sets 4-5): Terms 2, 3
▪ apply statistics to describe a population	Year 9 (Sets 1-3): Term 2 Year 10 (Sets 4-5): Terms 2, 3
▪ use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.	Year 9 (Sets 1-3): Term 2 Year 10 (Sets 4-5): Term 3