Mathematics Department Key Stage 3

Philosophy

The aims and objectives of the Mathematics scheme of work 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.

This is done by addressing each of the topics that form the curriculum in a manner that attempts to interlink areas studied. The curriculum is designed in a spiral manner, so that discrete areas of maths are revisited and built on in each year (e.g. Algebra topics are met in Autumn Year 7, Autumn Year 8 and Autumn Year 9).

Subject content by term (the order that topics are taught in may vary)

Year 7 Autumn Term

- Apply the four operations, including formal written methods, to integers and decimals - all both positive and negative. Multiplying and dividing by 10/100/1000 etc
- Order positive and negative integers, decimals (and simple fractions). Use the symbols =, ≠, ≤, ≥, >, <
- Understand and use place value (e.g. when working with very large or very small numbers and when calculating with decimals)
- Recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions)
- Use conventional notation for priority of operations, including brackets, powers, roots and reciprocals (BIDMAS)
- Use positive integer powers and associated real roots (square, cube and higher). Recognise powers of 2,3,4 and 5
- Use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate
- **P1 Assessments**
- Understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors
- Know the difference between an equation and an identity
- Use and interpret algebraic notation, including: ab in place of $a \times b$; $3y$ in place of $y+y+y$ and $3xy$; 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 $a \div b$; brackets
- Simplify and manipulate algebraic expressions by collecting like terms
- Substitute numerical values into formulae and expressions, including scientific formulae
- Solve linear equations in one unknown algebraically

Year 7 Spring Term

- Use ratio notation, including reduction to its simplest form, 1:n/n:1 and ratios in real life contexts i.e. scales

- Express one quantity as a fraction of another, where the fraction is less than or greater than 1
- Define percentage as "number of parts per hundred"
- Express one quantity as a percentage of another
- Compare two quantities using percentages or using percentages and fractions
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
- Appropriate measures of central tendency (median, mean, mode and modal class) and spread (range)
- Apply statistics to describe a population (using measures of spread and central tendency)
- Interpret and construct tables, charts and diagrams, including frequency tables, bar charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data and know their appropriate use
- Use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description
- Derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language
- Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres
- Use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and / or rotation symmetries
- Know that the perpendicular distance from a point to a line is the shortest distance to the line
- Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; plus angles in a triangle
- Revision: algebra, including solving equations

Year 7 Summer Term

- Revision: algebra, including collecting like terms
- Simplify and manipulate algebraic expressions by multiplying a single term over a bracket (including a coefficient in front of the unknown and an unknown outside the bracket)
- Calculate: perimeters of 2D shapes. (Link to algebra)
- Know and apply formulae to calculate: area of rectangles, triangles, parallelograms, trapezia
- Use standard units of measure and related concepts (length, area, volume / capacity, mass, time, money etc)
- Change freely between related standard units (eg time, length, area, volume / capacity, mass) and compound units (eg speed, rates of pay, prices) in numerical (and algebraic) contexts
- **P2 Assessments**
- Recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions
- Generate terms of a sequence from either a term-to term or position-to-term rule; calculate the nth term of linear sequences
- Work with co-ordinates in all 4 quadrants
- Plot graphs of equations that correspond to straight line graphs in the co-ordinate plane

- Apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments
- Relate relative expected frequencies to theoretical probability, using appropriate language and the 0 to 1 probability scale
- Record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees

Year 8 Autumn Term

- Use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor lowest common multiple, prime fatorisation, including using product notation and the unique factorisation theorem
- Calculate with roots and with integer indices
- Estimate the powers and roots of any given positive number
- Recap on Y7 number work from Autumn 1, addressing any obvious areas of weakness
- 4 operations with decimals
- Estimating answers and check calculations using approximation and estimation.
- Be able to order fractions (N1.1 - taking it on from ordering simple fractions that was covered in Year 7)
- Apply the four operations to fractions (proper and improper) and mixed numbers (all both positive and negative)
- Calculate exactly with fractions
- Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 35/10 and 7/2)
- Interpret fractions and percentages as operators
- Interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase / decrease and original value problems, and using the context of simple interest including in financial mathematics
- Recap on Y7 algebra work from either Autumn 2 or Summer 1, addressing any obvious areas of weakness.
- Simplify and manipulate algebraic expressions by: taking out common factors; simplifying expressions involving sums, products and powers; expand the products of two binomials
- Understand and use standard mathematical formulae
- Solving linear equations in one unknown including those with the unknown on both sides of the equation
- In algebraic expressions, use and interpret coefficients written as fractions rather than decimals

Year 8 Spring Term

- 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 and use proportion as equality of ratios
- Apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)
- Express a multiplicative relationship between two quantities as a ratio or as a fraction
- Relate ratios to fractions

- Identify and work with fractions in ratio problems
- Use scale factors, scale diagrams and maps
- Compare lengths, areas and volumes using ratio notation
- **T1 Assessments**
- Deduce expressions to calculate the nth term of linear sequences
- Work with co-ordinates in all 4 quadrants
- Plot graphs of equations that correspond to straight line graphs in the co-ordinate plane
- Where appropriate, interpret simple expressions as functions with inputs and outputs
- Relate ratios to linear functions
- Find approximate solutions to linear equations using a graph

Year 8 Summer Term

- Recap Y7 probability
- Apply the property that the probabilities of an exhaustive set of outcomes sum to 1; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to 1
- Understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size
- Construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities
- 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. Use appropriate measures of spread (range, including consideration of outliers)
- Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference
- Know and use the formulae: circumference of a circle = 2 Pi r = Pi d, area of a circle = Pi r^2; areas of circles and composite shapes
- Identify and apply circle definitions and properties, including tangent, arc, sector and segment
- Calculate exactly with multiples of Pi
- Volume and surface area of cuboids and other right prisms (including cylinders)

Year 9 Autumn Term

- Recap on Y8 estimation and decimals work
- Recap on Y8 fraction work
- Round numbers and measures to an appropriate degree of accuracy (eg to a specified number of decimal places or significant figures)
- Use inequality notation to specify simple error intervals due to truncation or rounding
- Solve problems using direct and inverse proportion, including graphical and algebraic representations
- Use compound units including density and pressure, speed, rates of pay and unit pricing
- **P3 Assessments**
- Translate simple situations or procedures into algebraic expressions or formulae
- Rearrange formulae to change the subject
- Argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments

- Expand the product of two binomials and factorise quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares. Simplify expressions using the laws of indices
- Solve quadratic equations algebraically by factorising, (including those that require rearrangement) find approximate solutions using a graph
- solve linear inequalities in one variable
- represent the solution set on a number line
- solve linear inequalities in one variable using set notation and on a graph

Year 9 Spring Term

- Understand and use alternate, corresponding and co-interior angles on parallel lines
- Derive and use the sum of angles in a triangle (eg to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)
- Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings
- Identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement
- Describe translations as 2D vectors
- Solve geometrical problems on coordinate axes
- Apply systematic listing strategies including use of the product rule for counting
- Recap Y8 probability work if required
- Enumerate sets and combinations of sets systematically, using tables, grids, frequency tables, Venn diagrams and tree diagrams
- Set up, solve and interpret the answers in growth and decay problems, including simple and compound interest

Year 9 Summer Term

- Interpret and construct pie charts for categorical data and know their appropriate use
- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- Tables and line graphs for time series data and know their appropriate use
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: appropriate graphical representation involving discrete, continuous and grouped data
- **T2 Assessments**
- Apply angle facts, triangle similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs
- Apply the concepts of congruence and similarity, including the relationships between lengths in similar figures
- Apply Pythagoras' theorem and the trigonometric ratios to find angles and lengths in right-angled triangles in two dimensional figures
- Know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$, and the trigonometric ratios, SOHCAHTOA