MATHEMATICS: Programme of Study

Key Stage 4 – Number

Entry Level- learners working below GCSE level	Functional Skills- interlink with Foundation FS 1 / FS 2	Foundation Review of KS3 and linked with Functional skills	Higher- developing skills from Foundation for most able
Component 1 -To be able to read, write, order and compare numbers up to 1000 and recognise place value. -To be able to round numbers to the nearest 10,100,1000. -To be able to recognise and use multiples of 2,3,4,5,8,10,50& 100. Component 2 -To be able to add and subtract up to 3 digit numbers. -To be able to multiply and divide 2 digit by 1 digit numbers and use and recall multiplication facts. -To use inverse operations to find missing numbers -To be able to use and interpret +,-,x,÷& = in real life situations for solving problems Component 4 To be able to calculate amounts and give change	NS1 Read, write, order and compare large numbers (up to one million) NS2 Recognise and use positive and negative numbers NS3 Multiply and divide whole numbers and decimals by 10, 100, 1000 NS4 Use multiplication facts and make connections with division facts NS6 Calculate the squares of one-digit and two-digit numbers NS7 Follow the order of precedence of operators NS18 Read, write, order and compare positive and negative numbers of any size NS19 Carry out calculations with numbers up to one million including strategies to check answers including estimation and approximation	**Number** N1 order positive and negative integers, decimals and fractions. N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions N3 use inverse operations N4 use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, N5 apply systematic listing strategies N6 use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 N7 calculate with roots N8 calculate exactly with fractions and multiples of π N9 calculate with and interpret standard form	**Number** N1use the symbols =, ≠, <, >, ≤, ≥ N2 apply using mixed numbers – all both positive and negative; understand and use place value N3 use conventional notation for order of operations, including brackets, powers, roots and reciprocals N4Express a number as a product of its prime factors N5Multiply the number of outcomes for each event to find the total number of combinations N6estimate powers and roots of any given positive number N7 calculate with fractional indices N8calculate exactly with surds and simplify surd expressions involving squares (e.g. √12 = √(4 × 3) = √4 × √3 = 2√3) and rationalise denominators N9 calculate with and interpret standard form A × 10n, where 1 ≤ A < 10 and n is an integer

Key Stage 4- Number continued

Entry Level- learners working below GCSE level	Functional Skills- interlink with Foundation FS 1 / FS 2	Foundation Review of KS3 and linked with Functional skills	Higher- developing skills from Foundation for most able
Component 3 -To be able to understand	NS8 Read, write, order and compare common fractions and mixed numbers	**Fractions, Decimals and Percentages** N10 work interchangeably with terminating	**Fractions, Decimals and Percentages** N10 change recurring decimals into their

equality -To be able to identify and show halves, thirds, quarters, fifths and tenths. -To be able to recognise and identify equivalent fractions -To be able to add or subtract fractions with a common denominator	NS9 Find fractions of whole number quantities or measurements NS10 Read, write, order and compare decimals up to three decimal places NS11 Add, subtract, multiply and divide decimals up to two decimal places NS16 Recognise and calculate equivalences between common fractions, percentages and decimals NS13 Read, write, order and compare percentages in whole numbers NS21 Identify and know the equivalence between fractions, decimals and percentages NS22 Work out percentages of amounts and express one amount as a percentage of another NS23 Calculate percentage change (any size increase and decrease), and original value after percentage change NS24 Order, add, subtract and compare amounts or quantities using proper and improper fractions and mixed numbers NS25 Express one number as a fraction of another NS26 Order, approximate and compare decimals NS27 Add, subtract, multiply and divide decimals up to three decimal places NS12 Approximate by rounding to a whole number or to one or two decimal places NS15 Estimate answers to calculations using fractions and decimals	decimals and their corresponding fractions N11 identify and work with fractions in ratio problems N12 interpret fractions and percentages as operators **Measures and accuracy** N13 use standard units of mass, length, time, money and other measures N14 estimate answers; check calculations using approximation and estimation N15 round numbers and measures to an appropriate degree of accuracy	corresponding fractions and vice versa **Measures and accuracy** N15 use inequality notation(>, ≥, <, ≤, ≠) to specify simple error intervals due to rounding N16 apply and interpret limits of accuracy, including upper and lower bounds

Key Stage 4- Algebra

Entry Level- learners working below GCSE level	**Functional Skills-** interlink with Foundation FS 1 / FS 2	**Foundation** Review of KS3 and linked with Functional skills	**Higher-** developing skills from Foundation for most

			able
	NS20 Evaluate expressions and make substitutions in given formulae in words and symbols NS29 Follow the order of precedence of operators, including indices	**Notation, vocabulary and manipulation** A1 use and interpret algebraic manipulation A2 substitute numerical values into formulae and expressions A3 understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors A4 simplify and manipulate algebraic expressions by: collecting like terms, multiplying a single term over a bracket, taking out common factors, expanding products of two binomials ,factorising quadratic expressions, including the difference of two squares; simplifying expressions involving sums, products and powers, including the laws of indices A5 understand and use standard mathematical formulae; rearrange formulae to change the subject A6 know the difference between an equation and an identity **Graphs** A8 work with coordinates in all four quadrants A9 plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form y = mx + c to identify parallel lines. A10 identify and interpret gradients and intercepts of linear functions graphically and algebraically A12 recognise, sketch and interpret graphs of linear functions, quadratic functions A14 plot and interpret graphs of non-standard functions in real contexts to find approximate solutions to distance, speed and acceleration	**Notation, vocabulary and manipulation** A1 use and interpret algebraic conventions, including: • ab in place of a × b • 3y in place of y + y + y and 3 × y • a^2 in place of a × a,etc. A2 substitute into scientific formulae A4 simplify and manipulate algebraic expressions including surds and algebraic fractions. A6 use algebra to support and construct arguments and proofs A7 interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' **Graphs** A9 use the form y = mx + c to identify parallel and perpendicular lines A11 identify turning pointsof a quadratic graph by completing the square A12 recognise, sketch and interpret graphs of, exponential functions (y = kx) for positive values of k, and the trigonometric functions(y = sin x, y = cos x and y = tan x) for angles of any size A13 sketch translations and reflections of a given function

Key Stage 4- Algebra continued

Entry Level- learners working below GCSE level	Functional Skills- interlink with Foundation FS 1 / FS 2	Foundation Review of KS3 and linked with Functional skills	Higher- developing skills from Foundation for most able
	NS5 Use simple formulae expressed in words for one or two-step operations	**Solving equations and inequalities** A17 solve linear equations in one unknown algebraically ;find approximate solutions using a graph A18 solve quadratic equations algebraically by factorising; find approximate solutions using a graph A19 solve two simultaneous equations in two variables and find solutions using a graph A21 create algebraic expressions or formulae; **Sequences** A23 generate terms of a sequence from either a term-to-term or a position-to term rule A25 calculate the nth term of linear sequences	**Solving equations and inequalities** A17 solve linear equations with the unknown on both sides of the equation; find approximate solutions using a graph A18 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 A19 solve two simultaneous equations with two unknown values (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph A20 find approximate solutions to equations numerically using iteration A22 solve linear inequalities with one or two unknown value(s) **Sequences** A24 recognise and use sequences of simple geometric progressions (rn where n is an integer, and r is a rational number > 0 or a surd) and other sequences A25 write expressions to calculate the nth term of linear and quadratic sequences

Key Stage 4- Ratio, proportion and rates of change

Entry Level- learners working below GCSE level	**Functional Skills-** interlink with Foundation FS 1 / FS 2	**Foundation** Review of KS3 and linked with Functional skills	**Higher-** developing skills from Foundation for most able
Component 4 To recognise and identify coins and notes and appreciate the purchasing power of the different amounts. To be able to convert from pence to pounds and vice versa and use correct decimal notation including calculator interpretation.	M11 Convert between metric and imperial units of length, weight and capacity using a) a conversion factor and b) a conversion graph tax and simple budgeting NS28 Understand and calculate using ratios, direct proportion and inverse proportion M1 Calculate simple interest in multiples of 5% on amounts of money M2 Calculate discounts in multiples of 5% on amounts of money NS14 Calculate percentages of quantities, including simple percentage increases and decreases by 5% and multiples thereof M10 Calculate amounts of money, compound interest, percentage increases, decreases and discounts including M12 Calculate using compound measures including speed, density and rates of pay	R1 Change freely between related standard units and compound units in numerical and algebraic contexts R2 Use scale factors, scale diagrams and maps R3 Express one quantity as a fraction of another, R4 Use ratio notation, including reduction to simplest form R5 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; apply ratio to real contexts and problems R6 Express a multiplicative relationship between two quantities as a ratio or a fraction R7 Understand and use proportion as equality of ratios R8 Relate ratios to fractions and to linear functions R9 Define percentage as 'number of parts per 100'; interpret percentages and percentage changes as a fraction or a decimal; express one quantity as a percentage of another; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease, and simple interest R10 Solve problems involving direct and inverse proportion, including graphical and algebraic R11 Use compound units such as speed, rates of pay, unit pricing, density and pressure R12 Compare lengths, areas and volumes using ratio notation; make links to similarity and scale factors R13 Understand that X is inversely proportional to Y is equivalent to X is proportional to 1/Y ; R14 Interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion	R15 Understand that the gradient at a point on a curve gives the instantaneous rate of change; apply the concepts of average and instantaneous rate of change in numerical, algebraic and graphical contexts R16 including iterative processes

Key Stage 4- Geometry and measures

Entry Level- learners working below GCSE level	**Functional Skills-** interlink with Foundation FS 1 / FS 2	**Foundation** Review of KS3 and linked with Functional skills	**Higher-** developing skills from Foundation for most able
Component 7 -To be able to recognise and name 2D and 3D shapes, including nets of cubes and cuboids. -To be able to describe properties of shapes and understand the key words. -To be able to show symmetry on shapes. -To be able to understand what an angle is, identify a right angle, and identify if an angle is bigger or smaller than a right angle. -To be able to identify horizontal vertical and parallel lines. -To be able to identify and denote co-ordinates on a grid. -To be able to use compass points to give directions from a map.		**Properties & constructions** G1 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; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description G2 Use the standard ruler and compass constructions; use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line G3 Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle G4 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 ~~G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)~~ G6 Apply angle facts, triangle congruence, 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 G7identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors)	**Properties & constructions** G8 Describe the changes and invariance achieved by combinations of rotations, reflections and translations G10 Apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results

Key Stage 4- Geometry and measures continued

Entry Level- learners working below GCSE level	**Functional Skills-** interlink with Foundation FS 1 / FS 2	**Foundation** Review of KS3 and linked with Functional skills	**Higher-** developing skills from Foundation for most able
		G9 Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment G11 Solve geometrical problems on coordinate axes G12 Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, ~~pyramids, cones and spheres~~ G13 Construct and interpret plans and elevations of 3D shapes	
Component 6 -To be able to choose appropriate units, compare, order and add length, height, weight and capacity. -To be able to accurately draw and measure lengths including perimeter and estimate weight and capacity. To be able to read values from a scale including negative temperatures. Component 5 Calendar and time - To be able to know and order days, months and seasons and to know how many days, weeks in a month and a year. - To be able to tell the time from an analogue or digital clock and convert between 12	M3 Convert between units of length, weight, capacity, money and time, in the same system M4 Recognise and make use of simple scales on maps and drawings M5 Calculate the area and perimeter of simple shapes including those that are made up of a combination of rectangles M6 Calculate the volumes of cubes and cuboids M7 Draw 2-D shapes and demonstrate an understanding of line symmetry and knowledge of the relative size of angles M8 Interpret plans, elevations and nets of simple 3-D shapes M9 Use angles when describing position and direction, and measure angles in degrees M13 Calculate perimeters and areas of 2-D shapes including triangles and circles and composite shapes including non-rectangular shapes M14 Use formulae to find volumes and surface areas of 3-D shapes including cylinders (formulae to be given for 3-D shapes other than	**Mensuration & calculation** G14 Use standard units of measure and related concepts G15 Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings G16 Know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids prisms G17 Know the formulae: circumference of a circle , area of a circle; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; G18 Calculate arc lengths, angles and areas of sectors of circles G19 Apply the concepts of congruence/similarity, inc lengths, areas and volumes in similar figures G20 Know the formulae for: Pythagoras' theorem and the trigonometric ratios,; apply them to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three dimensional figures	**Mensuration & calculation** G22 know and apply the sine rule: $a/\sin A = b/\sin B = c/\sin C$, and cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$, to find unknown lengths and angles in non right-angled triangles G23 Know and apply the formula Area = ½ ab sinC to calculate the area, sides or angles of any triangle

and 24hr. - To have an understanding of how many seconds, minutes and hours are equal to and convert between them. - To be able to find the difference between two times and add up to three lengths of time given in minutes and hours.	cylinders) M15 Calculate actual dimensions from scale drawings and create a scale diagram given actual measurements M16 Use coordinates in 2-D, positive and negative, to specify the positions of points M17 Understand and use common 2-D representations of 3-D objects M18 Draw 3-D shapes including plans and elevations M19 Calculate values of angles and/or coordinates with 2-D and 3-D shapes	**Vectors** G24 describe translations as 2D vectors	

Key Stage 4- Probability

Entry Level- learners working below GCSE level	**Functional Skills- interlink with Foundation** FS 1 / FS 2	**Foundation** Review of KS3 and linked with Functional skills	**Higher-** developing skills from Foundation for most able
	H4 Understand probability on a scale from 0 (impossible) to 1 (certain) and use probabilities to compare the likelihood of events H5 Use equally likely outcomes to find the probabilities of simple events and express them as fractions H9 Work out the probability of combined events including the use of diagrams and tables, including two-way tables H10 Express probabilities as fractions, decimals and percentages H11 Draw and interpret scatter diagrams and recognise positive and negative correlation	P1 Record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees P2 Apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments P3 Relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale P4 Apply the property that the probabilities of an exhaustive set of outcomes sum to one; P5 Understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size P6 Enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams P7 Construct theoretical possibility spaces for single	P9 Use expected frequencies with two-way tables, tree diagrams and Venn diagrams to calculate and interpret conditional probabilities

		and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities P8Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations	

Key Stage 4- Statistics

Entry Level- learners working below GCSE level	**Functional Skills-** interlink with Foundation FS 1 / FS 2	**Foundation** Review of KS3 and linked with Functional skills	**Higher-** developing skills from Foundation for most able
Component 8 - To be able to sort and classify objects using one or more criterion. -To be able to collect information and record results using lists and tally charts. -To be able to construct, interpret and compare pictograms and bar charts and use them to extract numerical information. -To solve one-step and two-step problems based on statistical information.	H1 Represent discrete data in tables, diagrams and charts including pie charts, bar charts and line graphs H2 Group discrete data and represent grouped data graphically H3 Find the mean and range of a set of quantities H6 Calculate the median and mode of a set of quantities H7 Estimate the mean of a grouped frequency distribution from discrete data H8 Use the mean, median, mode and range to compare two sets of data	S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use S4 interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: ● appropriate graphical representation involving discrete, continuous and grouped data ● appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers) S5 apply statistics to describe a population S6 use and interpret scatter graphs; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent	S3 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

		trends	