Year 12 Further Maths

	Number	Algebra	Ratio and Proportion	Geometry and Measure	Statistics and Handling Data
EYFS	Count confidently and understand the numbers to 10.	Understand the relationships between numbers and make connections and patterns with numbers.		Develop reasoning skills with space, shape and measure. Build understanding of the 3-D world.	
KS1	Count, read and write numerals to 100. Count in multiples of 2, 3, 5 and 10. Identify and represent numbers using objects. Read, write and calculate, including problem solving, addition, subtraction, multiplication and division statements. Recognise halves, thirds and quarters and calculate simple fractions of an amount. Recognise equivalent fractions and decimals.	Order and arrange combinations of mathematical objects in patterns and sequences.		Compare, describe and solve practical problems involving measure. Measure and record units of measure and their symbols including length, mass, money and time. Begin to tell the time. Recognise the names and properties of common 2-D and 3-D shapes. Solve simple problems involving shape and measure.	

	Recognise place value for 2 and 3-digit numbers. Use <, > and = signs.				
KS2	Count in multiples of 4, 6, 7, 8, 9, 25, 50, 100, 1000. Multiplication facts up to 12x12. Recognise place value in 3-digit numbers. Read, write, compare and order numbers up to 1000000. Solve number problems. Add, subtract, multiply and divide mentally and using written methods. Use inverse operations to check answers. Manipulate and calculate with fractions including, addition and subtraction, fractions of amounts and dividing a fraction by a whole number. Recognise and convert between mixed numbers and improper fractions. Understanding and interpretation of negative numbers. Rounding to the nearest decimal place, 1, 10, 100, 1000, 10000, 100000.	Use simple formulae. Generate and describe linear number sequences. Express missing number problems algebraically. Find pairs of numbers that satisfy an equation with two unknowns. Enumerate possibilities of combinations of two variables.	Solve problems involving the relative sizes of 2 quantities using known multiplication facts. Solve problems involving percentages, including comparison. Solve problems involving scale factor.	Measure, compare, add and subtract measures. Understand and find perimeter and area of squares, rectangles, parallelograms and triangles and their units. Tell the time and understand Roman numerals and convert between 12-hour and 24-hour times. Draw and make 2-D and 3-D shapes and their nets. Understand, measure and identify right angles, acute, obtuse and reflex angles. Know and use angle rules Recognise horizontal, vertical, parallel and perpendicular lines. Convert between different units of measure. Use estimations of different measures. Classify geometric shapes based on their properties.	Interpret and present data using bar charts, time graphs, pie charts, pictograms and tables. Use a scale in charts. Interpret and solve problems with timetables. Calculate and interpret the mean as an average.

	Identify and find multiples, factors and primes including common multiples and factors. Recognise percentages. Convert between fractions, decimals and percentages.			Illustrate and name parts of circles. Identify lines of symmetry. Describe and plot co-ordinates. Understand approximate equivalences between metric and imperial units. Carry out and describe translations and reflections.	
KS3	Understand, represent and apply number. Use the 4 operations. Understand fractions, decimals and percentages. Apply understanding of number to solve complex problem solving questions in an unfamiliar context.	Understand and manipulate expressions, equations etc. Solve equations and inequalities. Draw different types of graphs. Recognise and use different types of sequences. Understand the meaning of the equation of a graph. Find and use the nth term of a sequence. Use algebraic knowledge to solve problems.	Understand and use ratio and proportion. Apply knowledge of ratio and proportion to solve more complex problems.	Calculate perimeter and area of common 2D shapes and volume and surface area of common 3D shapes. Construct and transform 2D shapes. Know and understand the properties of 2D and 3D shapes. Know and use angle facts including with parallel lines. Understand and use Pythagoras' theorem to find the hypotenuse and know the trig ratios. Know and use the criteria for congruent triangles.	Understand and use experimental and theoretical probability for single events. Draw, interpret and compare frequency tables and diagrams. Calculate averages and range for a set of data. Draw, use and interpret scatter diagrams. Solve probability problems algebraically. Know what can and cannot be inferred in statistical settings. Calculate averages and range for a set of algebraic terms.

				Solve problems involving geometric reasoning.	Know and understand extrapolation.
KS4	Understand, represent and calculate with numbers, including decimals, fractions and surds. Calculate and solve problems involving percentages. Understand and use primes, factors and multiples including LCM and HCF. Know and use the laws of indices including standard form. Use rounding and error intervals, including truncation and solve problems involving upper and lower bounds.	Know and use algebraic conventions and apply to solving equations and inequalities. Manipulate and solve quadratic expressions and equations. Re-arrange the subject of a formulae, including complex operations. Plot and understand the equations of straight line graphs, including parallel and perpendicular lines. Plot and understand a range of graphs including; quadratic, cubic, reciprocal, exponential, trigonometric and circles. Manipulate and solve simultaneous equations. Find and use the nth term of a sequence including arithmetic, quadratic and geometric.	Understand and use ration including with fractions and percentages to solve problems. Use compound units. Compare lengths, areas and volume of similar shapes. Understand and use direct and inverse proportions. Calculate using rates of change. Solve problems including repeated growth and decay (compound interest). Find and interpret the gradient of a point on a curve. Work with the iterative process.	Understand and use the angle rules, including the circle theorems. Identify and apply the properties of circles. Know and apply formulae to calculate area and volume. Know, use and apply Pythagoras' Theorem and the trigonometric ratios including the exact values. Use and apply the sine and cosine rules of trigonometry. Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors	Relate relative frequencies to probability theory and expected outcomes. Enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams. Calculate the probability of independent and dependent combined events. Infer properties of populations or distributions from a sample, while knowing the limitations. Interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms, vertical line charts, tables, line graphs, cumulative frequency diagrams, box plots and histograms.

					Interpret, analyse and compare the distributions of data sets. Use and interpret scatter graphs of bivariate data.

Module Title: Statistics, Further Pure Mathematics & Additional Further Pure Mathematics 1	Module Title: Statistics, Further Pure Mathematics & Additional Further Pure Mathematics 2	Module Title: Statistics, Further Pure Mathematics & Additional Further Pure Mathematics 3
Learning Intent for this module: Students in this first module will develop further mathematics around topics that require no knowledge of A level Mathematics , but which build upon the knowledge acquired at GCSE From the Further Pure Unit, students begin by looking at quadratic equations and the case where at GCSE they had an understanding of no solutions which we introduce a complex number. They develop the basic then more sophisticated arithmetic skills including + - x and division using conjugates before looking at square roots of complex numbers and simultaneous equations.	Learning Intent for this module: From the Statistics Unit the students revisit Discrete Random Variables which they will have met in A level Mathematics. This further deepens their knowledge and skills in probability. They develop their knowledge to more depth and look at theoretical E(X) and V(X) linking it with mean and variance when analysing data A level Maths From the Further Pure Unit the students revisit the idea of proof from A level Maths by studying Induction. This also involves recapping work from complex numbers and matrices. From the Statistics Unit the students revisit Discrete Random Variables and look at special	Learning Intent for this Module: From the Further Pure Mathematics the students revisit Vectors from GCSE and A level and extend it into 3 dimensions looking at the equations of lines and intersections as well as scalar products From the Additional Further Pure Mathematics the students look at Groups. This links with previous work on Modular arithmetic Matrices and complex numbers studied in earlier modules. From the Additional Further Pure Mathematics the students revisit vectors and in particular look at Vector Product and its applications

Complex numbers in a plane develops their graphical skills from GCSE and knowledge of the circle through the drawing of loci. From the Statistics Unit students then look at the work on correlation and lines of best fit from GCSE and extend it to the use of Pearson's PMCC, Spearman's Rank and Regressions lines and are introduced to the concept of a Hypothesis test. From the Further Pure Unit the students look at matrices. They develop the basic then more sophisticated arithmetic skills including + - x of matrices. How to find inverse matrices. From the Further Pure Unit the students look at polynomials They revisit complex numbers and look at polynomials of order up to 4 which have complex roots and how to solve them From the Statistics Unit the students look at probability and how it is linked to Permutations and Combinations. This builds on the probability the students developed at GCSE and that they are also studying in A level Mathematics (though knowledge of the A level is not required). From the Further Pure Unit the students revisit matrices. They look at applications of matrices including solving simultaneous equations and applications to transformations	distribution: Uniform, Binomial, Geometric & Poisson. This deepens knowledge of probability and their skills in applying models to probability scenarios. From the Further Pure Unit the students revisit polynomials and in particular roots of polynomials and how coefficients link to the roots. They also revisit complex numbers and look at polynomials of order up to 4 which have complex roots. From the Statistics Unit the students revisit the idea of Hypothesis Testing and in particular Chi-Squared distribution and how it can be used to test if data is of a certain distribution with goodness of fit tests From the Additional Further Pure Mathematics the students look at sequences, the revisit GCSE work and look at new and different ways to describe them, in particular recurrence relationships and how we solve these relationships. From the Additional Further Pure Mathematics the students look at Number Theory. This totally new area of maths to the students builds on basic rules of divisibility from GCSE, number bases such as binary and Modular arithmetic	From the Additional Further Pure Mathematics the students look at Surfaces and partial differentiation. They look at the equations of shapes in 3D and learn to use contours and sections to construct an image of the shape. They develop their calculus skills from A level Maths by extending it to partial differentiation and use this to find the coordinates of maxima, minima and saddle points in 3D From the Statistics Unit the students revisit probability by looking at Continuous Random Variables and their definition in terms of a probability density function. They look at calculating E(X) V(X) median and mode for a CRV as well as probabilities

Finally from the Statistics Unit the students revisit the idea of Hypothesis Testing and in particular Chi-Squared distribution and how it is used to analysis contingency Tables		
Key Content to be learned: *Teacher 1* • Complex Numbers 1: Arithmetic and Loci • Correlation & Regression • Matrices 1: Arithmetic, Inverses • Complex Numbers 2: Roots of equations • Permutations and Combinations • Matrices 2: Applications • Chi-Squared Tests 1: Contingency Tables	Key content to be learned: *Teacher 1* • Discrete Random Variables 1: General distributions • Induction • Discrete Random Variables 2: Special distributions • Roots of Polynomials • Chi-squared Tests 2: Goodness of Fit • Sequences & Series • Number Theory	Key Content to be learned: *Teacher 1* • Vectors • Groups • More Vectors • Surfaces & Partial Differentiation • Continuous Random Variables 1
Key tasks for this module: • Key Task 1 – Correlation & Regression • Key Task 2 – Permutations & Combinations • Key Task 3 – Complex Numbers • Key Task 4 – Matrices • Key Task 5 – Chi-Squared Tests	Key tasks for this module: • Key Task 1 – Induction • Key Task 2 – Discrete Random Variables • Key Task 3 – Roots of Polynomials • Key Task 4 – Sequences & Series • Key Task 5 – Chi-Squared Tests	Key tasks for this module: • Key Task 1 – Number theory • Key Task 2 – Groups • Key Task 3 – Vectors • Key Task 4 – Surfaces & Partial differentiation • Key Task 5 – End of Year Exam

Year 13 Further Maths

Module Title: Statistics, Further Pure Mathematics & Additional Further Pure Mathematics 4	Module Title: Statistics, Further Pure Mathematics & Additional Further Pure Mathematics 5	Module Title: Statistics, Further Pure Mathematics & Additional Further Pure Mathematics 6 & REVISION
Learning Intent for this module: From the Statistics Unit students revisit CRV from year 12 and extend their work to look at cumulative distribution functions and chi-squared goodness of fit. This extends year 12 knowledge and recaps Year 12 A level work on Normal Distribution. New distributions such as uniform and exponential distributions are introduced. From Further Pure students are introduced to hyperbolic functions but analogy with trigonometry from GCSE and A level is made From the Statistics Unit students revisit Hypothesis testing looking at Non -Parametric test.	Learning Intent for this module: From Further Pure students look at the applications of calculus including mean value and volumes of revolution. This means revisiting all previous calculus studied to enable students to recap and apply knowledge From the Statistics Unit students look at combining CRV. This involves recapping A level work on the Normal Distribution. From Further Pure students revisit Complex numbers and look in more depth at De Moivre's Theorem and how it can be applied to proving trigonometric identities from A level Maths and to simplify integration of trigonometric functions.	Learning Intent for this Module: From Further Pure Mathematics students revisit differential equations from A level and extend the techniques to cover integrating factors and second order equations From Further Pure Mathematics students revisit Vectors , recap and look at the equations of planes and line There now follow a series of Revision/Teach lessons which revise the material previously studied and adds the final piece of the jigsaw to complete the work. They all relate to Additional Further Pure:

From Further Pure students revisit calculus from A level and Year 12 Further Maths and discover new techniques including one linked to previous work on hyperbolic functions. From Further Pure students revisit the topic of series from A level maths and extend and deepen their knowledge. they then look again at Induction and how it can be used to prove results about series of numbers	From Further Pure students are introduced to polar coordinates and how to graph functions. Recapping of calculus techniques is needed in order to calculate area and curve lengths From the Statistics Unit students revisit Hypothesis testing looking at different hypothesis test around normal distribution, Central Limit theorem and confidence intervals and their applications From Additional Further Pure students revisit integration by parts and see how it can be extended to Reduction Formula and surface area and arc lengths From Additional Further Pure students revisit Sequences and recurrence relationships and extend them into second order problems	Groups -Isomorphism's Number Theory – Fermat's Little Theory Surfaces – More saddles
Key Content to be learned: *Teacher 1* • Continuous Random Variables 2 • Hyperbolic Functions • Non-Parametric Tests • Further Calculus Techniques • Series and Induction •	Key content to be learned: *Teacher 1* • Applications of Calculus • Combining Random Variables • Complex Numbers and Trigonometry • Polar Coordinates • Hypothesis tests and Confidence intervals • Further Calculus • Sequences and Series – 2nd order	Key Content to be learned: *Teacher 1* • Differential Equations • Applications of differential equations • Vectors - planes • Groups – Isomorphism's • Number theory Fermat's little theory • Surfaces – more saddles • Revision
Key tasks for this module: • Key Task 1 – Continuous Random Variables	Key tasks for this module: • Key Task 1 – Combining Random Variables	Key tasks for this module: • Key Task 1 – Differential Equations and applications

• Key Task 2 – Hyperbolic Functions • Key Task 3 – Non Parametric Tests • Key Task 4 – Mock • Key Task 5 – Series and Induction	• Key Task 2 – Complex numbers and Trig • Key Task 3 – Polar Coordinates • Key Task 4 – Mock 2 • Key Task 5 – Further Calculus	• Key Task 2 –Additional Further Pure extra mock