Further Mathematics Year 12 Curriculum Overview

What is the Year 12 Further Mathematics curriculum aiming to achieve?

What do we want our Year 12 Further Mathematicians to be like?	How are we building on prior learning?	How can parents/carers support their child's learning?
• Confident in working independently • Able to identify appropriate techniques to solve a problem • Enthusiastic about learning interesting and complex concepts • Excited about solving difficult problems • Prepared to be patient and persistent when challenged	• Sequences of lessons are planned to ensure pre-requisite knowledge from Maths is covered in advance • Concepts that build on prior learning have time allocated to review key skills • Checking retention using weekly homework tasks and half-termly assessments	• Ensure students are properly equipped with the correct textbooks • Encourage students to complete homework to the best of their ability • Give support in organising their time • Help students review and reflect on assessments and homework to identify areas for improvement

How are we organising the Year 12 Further Mathematics curriculum?

	Autumn Units	Spring Units	Summer Units
Threshold Concepts & Skills	**Matrices & Transformations**: calculations; transformations; invariant points & lines **Complex Numbers**: complex roots; calculate with complex numbers; Argand diagrams **Roots of Polynomials**: find roots of quadratic, cubic & quartic equations, including complex roots; **Sequences & Series:** summation formulas for r, r^2 and r^3; method of differences; proof by induction **Graphs & Networks**: model with graphs **Network Algorithms**: Kruskal's, Prim's and Dijkstra's algorithm; complexity **Network Problems**: critical path analysis; network flow; maximum flow-minimum cut theorem **Complex Numbers & Geometry**: multiply & divide in modulus-argument form; represent loci on Argand diagrams **Matrices & Inverses**: determinant and inverse of a matrix; solve simultaneous equations using matrices	**Vectors & 3D Space:** scalar product; angles between vectors; equation of a plane; angle between planes; arrangement of planes **Algorithms**: use algorithms; complexity; sorting & packing algorithms **Linear Programming:** formulate a linear programming problem & solve graphically **Simplex Method**: use the simplex algorithm to find an optimal solution **Modelling with Linear Programming:** indicator variables; formulate network problems as linear programming problems **Discrete Random Variables**: rules for E(X) and Var(X) for discrete random variables **Discrete Probability Distributions**: Binomial, Poisson, Uniform & Geometric distributions; associated rules for E(X) and Var(X) **Bivariate Data (Correlation Coefficients):** hypothesis tests with Pearson's product moment & Spearman's rank correlation coefficient	**Bivariate Data (Regression Lines):** Equation of a least squares regression line for y on x, or x on y; plot regression lines; use residuals **Chi-Squared Tests**: understand degrees of freedom; apply the Chi-Squared test to a contingency table; use a Chi-Squared test for goodness of fit of uniform, binomial, geometric or Poisson models; interpret results **Vectors 1**: equation of lines in vector or Cartesian form; angle between lines; determine whether lines are parallel, intersect or are skew; intersection of line and plane; angle between planes **Matrices**: determinants and inverses of 3x3 matrices; use matrices to solve simultaneous equations & find how three planes intersect **Series & Induction**: sum a series using partial fractions; use proof by induction in divisibility proofs **Vectors 2**: vector product; vector methods for finding distances
Enrichment within the curriculum	Students continually have opportunities to develop and practise problem-solving skills in advanced contexts, including more challenging extension questions. Concepts and skills will link to real-world applications wherever possible, with the applied units on Modelling with Algorithms and Statistics being especially appropriate for this. Full access to the Integral Maths website allows students to engage with a wide variety of support and enrichment resources, including extension work.		
Cross curricular links	• A good proportion of the content will be very useful in supporting and reinforcing the A Level Mathematics course • The content learned will support all the mathematical skills needed for Biology, Chemistry and Physics • Statistical skills will also be useful in Psychology, Economics, Business Studies and Geography • Algebra skills will be useful in Computing, and the Sciences • The Algorithms unit will support work in Computing		
Extra-curricular opportunities	Students have the opportunity to enrol in enrichment courses run by the Advanced Mathematics Support Programme, including regular problem-solving sessions and courses aimed at preparing students for university entrance examinations such as STEP, MAT and TMUA. Students will also have the opportunity to take part in the UKMT Senior Maths Challenge. Students are able to seek help from their teacher outside lessons at any time, and homework support is always available.		

What are the intended outcomes of the Year 12 Further Mathematics curriculum?

	Autumn	Spring	Summer
Opportunities to show progress (Assessments)	Weekly homework tasks One P10 assessment per fortnight Autumn 1 test – 1 hour (in class) Autumn 2 test – 1 hour (in class)	Weekly homework tasks One P10 assessment per fortnight Spring Mock – 2 hours (formal)	Weekly homework tasks One P10 assessment per fortnight Summer Mock – 2.5 hours (formal) Summer Mock – 1.25 hours (in class)
Impact on personal development (SMSC)	Studying Further Mathematics helps students develop the skills of thinking logically, analytically, strategically and independently. Students are also able to communicate in a clear, precise way, and explain their reasoning for decisions. Complex problems are not daunting to Further Mathematics students, who usually thrive on challenge. These will prove to be invaluable skills, both during education and in employment.		
Preparation for the next stage of education	Studying Further Mathematics will ensure that students are better prepared to make the transition to higher education and will certainly have a positive effect on their performance in A Level Mathematics due to the development of techniques and additional practice. A Level Further Mathematics is a preferred option for some university courses and studying it can make a university application stand out. Students also gain valuable confidence in being able to approach difficult problems independently, which will help them succeed in a broad range of subjects.		