KS5 Curriculum Overview

Further Mathematics

Exam Board & Syllabus: Edexcel

Curriculum Intent

Our students will be introduced to new areas of mathematics beyond the regular A-Level course and they shall expand upon their problem-solving and analytical thinking skills. Ideas from mechanics are developed enabling mathematical models to be more accurate and realistic. In addition, the Further course covers discrete mathematics. This includes study of the mathematics behind computer algorithms and that involved in codes and ciphers.

The aim is also to develop the student's skills of perseverance, resilience and independent study, as often Maths problems require a lot of determination and students may need to refer to several different sources of information to help them.

What do students *do* with this knowledge or these skills?

Students will use the knowledge and skills gained from both the A-Level Maths and Further Maths courses to be able to answer very complex problems in both pure, mechanics and discrete mathematics. As a result, students gain very strong research skills which are held in high esteem by employers.

The analytical, logical and problem-solving skills acquired by Further Mathematicians are also held in high regard by universities, providing a wealth of possible future careers. Studying A-Level Further Mathematics gives students who go on to study Mathematics or other related subjects a real advantage in the early part of their degree courses.

How does the KS5 curriculum build on that from KS4?

Students will utilise their KS4 algebra skills, as one half of the course material is based on Pure Mathematics, including topics such as: Proof, Complex Numbers, Matrices, Further Algebra and Functions, Further Calculus, Further Vectors, Polar coordinates, Hyperbolic functions, Differential equations, Trigonometry, Numerical Methods. Therefore, key areas areas such as factorising, rearranging equations and trigonometry will form the foundation for all new learning in KS5 Further maths and having this knowledge embedded will allow students to quickly and effectively add new KS5 topics to their knowledge base.

What new knowledge or skills are students taught?		
Term	**Year 12**	**Year 13**
Autumn	- Algorithms - Graphs and Networks - Algorithms on Graphs - Route Inspection - Travelling Salesman Problem - Linear Programming	- Complex Numbers - Series - Methods in Calculus - Volumes of Revolution - Polar Coordinates - Hyperbolic Functions
Spring	- The Simplex Algorithm - Critical Path Analysis - Complex Numbers - Argand Diagrams - Series - Roots of Polynomials - Volumes of Revolution	- Methods with differential equations - Modelling with differential equations - Momentum and Impulse - Work Energy and Power - Elastic Strings and Springs
Summer	- Matrices - Linear Transformations - Proof by Induction - Vectors	- Elastic Collisions in one dimension - Elastic Collisions in two dimensions
Rationale for this sequencing	The A-Level Further Maths course starts by covering all the discrete content. This enables students to see a substantially large amount of pure content in A-Level single Maths first, before they begin moving on to the Further Maths pure content. This is necessary because many of the pure topics in single maths act as pre-requisites to the pure topics in Further. The sequence is designed in a way that will enable students to form links between the topics and thereby access challenging questions.	Year 13 builds on the skills/topics learned in Year 12. For example, complex numbers moves on from multiplying complex numbers, complex conjugation and loci in the argand diagram to expressing complex numbers in exponential form and De Moivre's Theorem.

Additional support at home

Additional reading for enjoyment, enhancement and extension	• Mathematics: Queen and Servant of Science E.T. Bell (Spectrum, 1996) • Mathematicians: An Outer View of the Inner World Mariana Cook (Princeton University Press, 2009)
Online resources to practice, consolidate and revise	• Fantastic A-Level maths and further maths explanatory videos • Maths Genie A-Level worksheets and solutions • Exam Solutions A-Level questions and video solutions • Maths & Physics Tutor exam papers past papers and papers by topic • Save My Exams revision notes and questions by difficulty level • Dr Frost past paper and shadow questions • Quick skills based worksheets
Workbooks & revision guides to practice, consolidate and revise	• Online access to all the textbooks and practice books in line with the A-Level maths course • Solution bank contains all the solutions to the textbook question exercises • CGP Revision Guides for Edexcel A-Level Maths are highly recommended