Maths Faculty Rationale

To make mathematics enjoyable, exciting and interesting for all pupils, regardless of their ability, gender or ethnicity.

To create a balanced and supportive culture in which pupils are confident to work collaboratively, to apply logic and reasoning to mathematical problems and to apply methods that are efficient and reliable without engendering a fear of failure or derision.

To enable pupils to appreciate that mathematics is more than 'sums' so that they consider that it appears all around us and how it can be used in everyday life.

To equip all pupils with functional mathematical tools that can be used throughout their lives, particularly to promote interest in science, engineering and other

A Level Further Mathematics Aims at KS5

OCR A Level in Further Mathematics B (MEI) is designed for students with an enthusiasm for mathematics, many of whom will go on to degrees in mathematics, engineering, the sciences and economics. or any subject where mathematics is developed further than in A level Mathematics. OCR A Level in Further Mathematics B (MEI) is both deeper and broader than A level mathematics. AS and A Level Further Mathematics build from GCSE Level and AS and A Level Mathematics. As well as building on algebra and calculus introduced in A Level Mathematics, the A Level Further Mathematics core content introduces complex numbers and matrices, fundamental mathematical ideas with wide applications in mathematics, engineering, physical sciences and computing. The non-core content includes different options that can enable students to specialise in areas of mathematics that are particularly relevant to their interests and future aspirations. A Level Further Mathematics prepares students for further study and employment in highly mathematical disciplines that require knowledge and understanding of sophisticated mathematical ideas and techniques.

Core Year 1

	Content	Skills	Rationale / Link to Specification
Unit 1 Matrices and Transformations HT 1 Weeks 4-6	Introduction to Matrices, Multiplication, Transformations, Invariance.	See SOW objectives column	This unit introduces matrices and looks at operations involving matrices including how to multiply matrices. Their application to transformation is considered as well as how to calculate invariant points and lines. This unit provides the skills students need for much of the course.
Unit 2 Introduction to complex numbers HT 1 Weeks 1-3	Extending the number system, Division of complex numbers, Argand diagrams.		Another major topic in further maths is complex numbers. This unit looks at how to extend the number system to include imaginary numbers and operations performed with them. Representing these numbers on an Argand diagram is also studied.
Unit 3 Roots of Polynomials	Polynomials, Cubic and Quartic equations, Solving polynomials with complex roots.		The relationship between roots of different orders of polynomials is considered. This unit also build on Unit 2 and expands on skills leant in maths to solving polynomials which have

HT 2 Weeks 7-8			complex solutions.
Unit 4 Sequences and Series HT 2 Weeks 9-11	Using standard results, method of differences, proof by inductions.		This unit looks at how to summate a finite series using both the standard formulae and also the method of differences. Proof by induction is introduced. This is one of the most powerful concepts in mathematics and gives students their first idea of how this concept can be used to prove a wide range of theorems.
Unit 5 Complex Numbers and Geometry HT 2 Weeks 12-13	Modulus and argument, multiply and dividing, Loci in the Argand diagram.		Building on unit 2 complex numbers, students learn how to write a complex number in the more useful modulus argument form. Operations can then be considered on the number in this form. Students also look at how circles and lines can be represented using modulus and argument in the Argand diagram.
Unit6 Matrices and their inverses. HT 3 Weeks 14-15	Determinant of a matrix, inverse of a matrix, solving simultaneous equations.		Building on unit 1 matrices, the concept of determinant and inverse matrices is used first of all in terms of transformations and then as a method of solving simultaneous equations.
Unit 7 Vectors and 3D space HT 3 Weeks 16	Finding the angle between two vectors, the equation of a plane, intersection of planes.		Building on work done in maths on vectors, the dot product is used as a way of calculating the angle between two vectors. The equation of a plane is found and the arrangement of these planes in three dimensions is considered.

Numerical Methods			
Unit 1 Approximation HT 3 Weeks 17	Absolute and relative error, rounding and chopping,		The first unit gives pupils the ideas of errors, it looks at relative error and how these can be used when considering approximations to exact answers. The effect of these errors in calculations.
Unit 2 Solutions of Equations HT 3 Weeks 18-20	Bisection method, method of false position, fixed point iteration, Newton-Raphson and secant method.		This unit gives students various method of how to solve equations where no quick analytical method exists. The work on fixed point iteration builds on work covered at GCSE.
Unit 3 Numerical Integration HT 4 Weeks 21-22	Trapezium rule, mid point rule and Simpsons rule.		Having already met integration and the trapezium rule in maths, this unit explores the method of Mid-Point rule as another way of approximating the area under a curve. Both of these methods are then used to give a better estimate using Simpson's Rule.

Unit 4 Approximating Functions HT 5 Weeks 25-26	Newton's forward difference interpolating formula, Lagrange's form.		Given a set of data, students are taught methods of how to construct an interpolating formula for this data. Two different methods are used, dependant upon the data. This topic has real-life examples and is used in areas such as science and economic forecasting.
Unit 5 Numerical Differentiation HT4 Weeks 23-24	Forward difference formula, central difference formula.		Having already studied differentiation in maths, this topic looks at expanding students' understanding of how to give a numerical approximation to a tangent using two different ways.
Unit 6 Rates of convergence. HT 5 Weeks 25-26	Rates of convergence in sequences, convergence of numerical integration and differentiation.		Having been taught various methods, this unit introduces the ideas of rates of convergence in sequence and the order of convergence. The types of method of mid-point, trapezium and Simpsons are looked at using the ratio of differences.

Modelling with Algorithms			
Unit 1 Algorithms HT 1 Weeks 1-4	Algorithm complexity, packing, sorting.		Students are introduced to the idea of solving problems using a finite procedure. The complexity of an algorithm is considered in relation to the time taken. The different algorithms of packing and sorting objects are studied.
Unit 2 Modelling with Graphs and Networks HT 1 Weeks 5-8	The language of graphs and networks, modelling with graphs, modelling with networks.		The notation of graphs and networks is considered for the first time. Students are introduced to the idea of nodes and arcs. Students are then introduced to networks with real life examples such as mileage charts and graphs. This unit is a prerequisite for Unit 3.
Unit 3 Network algorithms HT 2 Weeks 9-10	Algorithms for minimum connector problems, finding the shortest path, calculating algorithmic complexities		Having already look at networks, this unit considers algorithms for solving minimum connector problems on networks, such as the travelling salesman. Prim's, Kruskal's and Dijkstra's algorithms are all introduced as a way of solving shortest path methods.
Unit 4 Further Network Problems HT 2 Weeks 11-13	Critical path analysis, network flows.		This unit looks at activity networks where one unit is dependant upon other. The idea of minimum completion time in real life situations is looked at. Network flows are look at, real life examples include distribution problems, as well as pipelines at what would happen in case of cuts to the system.

Unit 5 Linear Programming HT 3 Weeks 14-16	Formulating linear programming problems, graphical solutions		Linear programming was developed during WW2 to solve logistical problems. The idea of optimising a given problem subject to restraints are considered. This unit only looks at graphical methods and is a prerequisite for Unit 6.
Unit 6 Simplex Method HT 3 Weeks 17-18	Using a simplex tableau, Non-standard forms		Building upon the ideas of linear programming introduced in Unit 5, the simplex method is introduced as an algorithm for solving linear programming programs.
Unit 7 Reformulating network problems as linear programming problems. HT 4 Weeks 19-22	Modelling paths and flows, modelling allocation problems		Building on the previous units involving networks, this unit looks at how to convert these network problems into linear programming problems. Real life examples include allocation problems and transportation problems.