



Further Mathematics

Examination Board: AQA

Examination Code: 7367

Outline of the Course

A level Further Mathematics is a second A level in Maths, designed to broaden and deepen the maths covered in A level Mathematics. You must also be choosing A level Mathematics and, for the most-committed students, it is possible to study Further Maths as a fourth A Level option.

Note: it is not essential to have studied the Level 2 Further Maths course.

Topics covered in (approximate) order, shared between two teachers. Please note that this is provisional and may change from year to year, depending on the share of teaching time between the two teachers.

Teacher 1

1. Matrices
2. Vectors
3. Inequalities
4. Rational Functions
5. Conic Sections
6. Linear Programming
7. Game Theory
8. Binary Operations and Group Theory
9. Dimensional Analysis
10. Momentum and Collisions
11. Work, Energy and Power
12. Circular Motion
13. Centres of Mass and Moments
14. Further Calculus
15. Further Algebra and Functions
16. Differential Equations

Teacher 2

1. Complex Numbers
2. Roots of Polynomial Equations

3. Summation of a Series
4. Proof by Induction
5. Graphs and Networks
6. Network Flows
7. Critical Path Analysis
8. Hyperbolic Functions
9. Polar Coordinates
10. Integration
11. Numerical Methods

What will you learn?

Further Maths extends many of the topics covered in A Level Maths and introduces some new concepts. As well as additional Pure Maths topic, students must follow two out of three optional units. Typically, we cover the Mechanics and Discrete Maths options, rather than the third option, Statistics.

Pure Mathematics (2/3 of the subject content)

Proof – Further methods of proof, including Proof by Induction.

Complex Numbers – Calculating and representing complex numbers; applications including De Moivre's Theorem.

Matrices – Calculations and matrix algebra; applications including transformations and simultaneous equations.

Algebra – Roots of polynomial equations, summing series, series expansions, limits, inequalities.

Rational Functions – Working with algebraic fractions.

Conic Sections – Properties of circles, ellipses, parabolas and hyperbolas.

Further Calculus – Further methods and applications, including the mean value of a function, and volumes and surface areas of revolution.

Vectors – Equations for lines and planes, scalar and vector products.

Polar Coordinates – Using polar coordinates, including graphs and their areas.

Hyperbolic Functions – Definitions, identities, calculus.

Differential Equations – Further methods for solving differential equations, including using an integrating factor; second order differential equations; applications including modelling oscillations; simultaneous first order differential equations.

Numerical Methods – Numerical integration and solution of differential equations.

Mechanics (1/6 of the subject content)

Dimensional Analysis – Finding the dimension of quantities and checking for consistency in a formula.

Momentum and Collisions – Modelling collisions in one and two dimensions.

Work, Energy and Power – Work done by a force, conservation of energy.

	<p>Circular Motion – Motion in a horizontal or vertical circle. Centres of Mass – Finding a centre of mass; application to sliding or toppling.</p> <p>Discrete Maths (1/6 of the subject content)</p> <p>Graph Theory – Properties and terminology. Networks – Finding the most efficient routes through a network, flows in a network. Linear Programming – Representing a problem using inequalities; solving graphically or using a Simplex Tableau. Critical Path Analysis – Representing a complex process as a network and identifying the critical path. Game Theory – Identifying the best strategies for a zero-sum game. Binary Operations – Understanding a binary operation; Group Theory.</p>
<p>Mark Breakdown and Assessment</p>	<p>Assessment is by three 2-hour written examinations, all taken at the end of the course in Year 13, with equal weighting of 33⅓% for each:</p> <p>Paper 1: Pure Maths Paper 2: Pure Maths Paper 3: Mechanics and Discrete Maths</p> <p>Questions on each paper are a mix of question styles, from short, single-mark questions to multi-step problems. The Pure Maths papers (1 & 2) can assess any of the Pure Maths topics.</p> <p>Calculators may be used on all papers. As for A Level Maths, we recommend the Casio fx991 CW calculator. Graphical calculators are allowed in the examinations (and allow students to explore mathematical functions independently), but these are not essential for the course.</p>
<p>Website links</p>	<p>Specification: https://www.aqa.org.uk/subjects/mathematics/a-level/mathematics-7367/specification</p> <p>The Advanced Maths Support Programme: https://amsp.org.uk/students/</p>
<p>Key Dates</p>	<p>Exams: May/June Year 13</p>

Further Information

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What can I do after I have completed the course?

Opportunities are as for A Level Maths. Further Maths enhances the options for applying to degree courses in Mathematics and other areas including Engineering, Sciences and Computing. It is seen as highly desirable by many of the more prestigious establishments.

See also:

<https://amsp.org.uk/students/studying-a-level-mathematics/whats-next/>