

mathematics (with further mathematics)

A Level

Head of department: Anna Mawson

Email: amawson@esher.ac.uk

Exam board: Pearson Edexcel



What is this subject about?

The course consists of a broad range of topics in Pure Maths, Mechanics, Statistics and Decision Maths. It is equivalent to two A Levels in Mathematics – A Level Mathematics and A Level Further Mathematics. The pace is fast and topics are covered in more depth than in the single Mathematics A Level.

Pure Maths is the study of mathematical ideas and methods for their own sake and to give a 'toolkit' for solving mathematical problems. All Pure Maths is expressed in terms of algebra. Most of the course is Pure Maths but in addition to this you will study Statistics, Mechanics and Decision Maths.

Statistics involves learning how to draw conclusions from data. It is very different from Statistics at GCSE and focuses on probability. Mechanics involves using Maths to describe the motion of objects and how they respond to forces acting on them – from cars in the street to satellites revolving round a planet. It includes topics such as energy and collisions. Decision Maths involves maximising outputs given limited resources to work with.

What will I study over the two years?

In the first year you study Pure Maths with some Mechanics and some Statistics as well.

In the second year you study more Pure Maths and further topics in Mechanics, Statistics and Decision Maths. The course covers all the material for A Level Maths and A Level Further Maths.

What does Further Maths include that is not in ordinary Maths A Level?

The additional topics in Pure Maths include:

- Imaginary numbers – How negative numbers can have square roots and what the consequences are. This is the basis of chaos theory and is unexpectedly useful in electrical engineering.

- Maclaurin's Series – The Maths behind how values of \sin , \cos and \tan are found.
- Linear Algebra – The Maths behind how a computer can solve 102 simultaneous equations in 102 unknowns as easily as you can solve 2 equations in 2 unknowns.
- Second order differential equations – The Maths behind why bridges can wobble dangerously if people walk across them at a critical speed.
The additional topics in Mechanics include:
 - The Mathematics behind bungee jumping
 - The Mathematics of snookerThe additional work in Statistics and Probability includes, among other things, looking at the Maths behind how casinos ensure they almost always make a profit (and gamblers almost always make a loss!).

How is the course assessed?

The course is assessed through four written exam papers at the end of the second year.

What can the course lead to in terms of higher education and future careers?

Further Maths gives the strongest possible background for Maths based university courses such as Mathematics, Physics, Engineering, Computer Science and straight Chemistry degrees.

Further Maths is needed only for Maths at a small number of the most competitive universities. It is also more or less necessary for Physics, Engineering and Computer Science (and highly desirable for Chemistry too) at a couple of the most competitive universities. However, outside of this, A Level Maths is sufficient for all Maths based courses, including Maths itself.

What are the benefits of taking Further Maths?

- You go deeper into the theory of Maths.
- You learn the material in a more challenging and deeper way.
- You work alongside other good mathematicians.
- You develop greater maturity as a mathematician because you have more experience of solving problems and thinking mathematically.
- Doing Further Maths can help clinch a grade A in your A Level Maths.
- If you have already studied maths beyond GCSE, then taking Maths with Further Maths means you get onto new ideas more quickly than on the your A Level Maths courses.

What are the formal entry requirements for this course?

In addition to the general entry criteria that the College requires, you will need to have achieved a minimum of:

- Grade 7 in GCSE Maths

Additionally most Further Maths students have achieved mainly 7's, 8's and 9's across the board in their GCSEs and the approach and pace reflect this. However, if your Maths is sufficiently strong, taking two A Levels in Maths should be easier than taking two separate A Levels in two separate subjects, because the various parts of the subject reinforce each other.

What extra support/enrichment activities are on offer?

There is the opportunity to take part in the United Kingdom Maths Trust's Senior Maths Challenge and to take part in team based Maths competitions locally. We also give support from teachers experienced in the field for students needing to take additional tests (such as MAT or STEP). There is a maths club once a week where students tackle interesting problems which are not on the A Level syllabus. In the College's Wider Skills Week students explore cryptography (codes and codebreaking, with a visit to Bletchley Park). There is also the opportunity to learn to play Bridge.