Further Mathematics

Brief Overview of the Course
(for further details, please see our Sixth Form Prospectus
Sixth Form Prospectus • Sir Thomas Rich's School (strschool.co.uk)*)*

Exam Board: Edexcel

Specification web link:
https://qualifications.pearson.com/content/dam/pdf/A%20Level/Mathematics/2017/specification-and-sample-assesment/a-level-l3-further-mathematics-specification.pdf

Topics Covered:
Year 12

- Core Pure Maths (1/2 of content)
- Further Mechanics (1/4 of content)
- Decision Maths (1/4 of content)

There is no coursework element.

More details can be found on the Curriculum Map at the end of this module document.

Topics Covered:
Year 13

- Core Pure Maths (1/2 of content)
- Further Mechanics (1/4 of content)
- Decision Maths (1/4 of content)

There is no coursework element.

More details can be found on the Curriculum Map at the end of this module document.

Please follow the instructions in the boxes below. The aim of these activities is to introduce you to the study of this subject at Advanced Level by:

- reinforcing your core knowledge and understanding of your chosen subject;
- encouraging you to think more deeply about your subject;
- supporting you to develop a deeper understanding of and appreciation for your subject as an academic discipline.

Core Knowledge and Understanding Task

Whether you have studied this subject before or not, there are elements of core knowledge and understanding that you must have prior to starting the A Level course.

Many students who take Further Mathematics at A Level have been exposed to more stretching material through the AQA Level 2 Further Maths course or the OCR Additional Maths course.

Whilst it is not a strict entry requirement, as some schools don't offer any courses other than Maths GCSE, we believe it would be hugely beneficial for you to have met the content contained within the Additional Maths course before you embark on your A Levels.

If you have access to the Additional Maths textbook then you could read through the worked examples and try some of the questions from each of the exercises.

Those of you without the textbook can access notes and exercises from the course via the files kindly shared by a teacher at another school:

https://drive.google.com/drive/folders/1-JYEB3iukRlXEUsSVaPBRRXrnGvilU9b

You could also purchase an Additional Maths revision guide:

https://www.amazon.co.uk/Advanced-FSMQ-Additional-Mathematics-Level/dp/1847622976/ref=sr_1_4?dchild=1&hvadid=79989503089500&hvbmt=be&hvdev=c&hvqmt=e&keywords=additional+maths+revision+guide&qid=1589485164&sr=8-4

or

https://www.amazon.co.uk/Revision-Notes-Mathematics-Qualification-Additional/dp/1510449604/ref=sr_1_5?dchild=1&hvadid=79989503089500&hvbmt=be&hvdev=c&hvqmt=e&keywords=additional+maths+revision+guide&qid=1589485228&sr=8-5

The Bigger Picture Task

As well as reinforcing your core knowledge and understanding, our A Level curriculum will expose you to what are called the 'established orthodoxies' within each subject, which can include key research, important people who have contributed to the field, as well as broader methods and theories that exist within the subject.

Prior to starting the A Level course, it might be nice for you to have an awareness of the following themes and topics so that you can develop an understanding of how they contribute to some of the established orthodoxies within Mathematics.

- Leibniz and Newton: The Development of Calculus
- Newton's Laws of Motion
- Gauss' Impact on Mathematics
- Euler's Work: Calculus; Graph Theory and Topology; Analytic Number Theory; Euler's Formula (and Euler's Identity!)
- Descartes: Cartesian Geometry

Links to support:

There are many articles on these famous mathematicians, amongst others, that can be easily found on Google.

Some sites that might be of interest:

https://www.storyofmathematics.com/

https://www.britannica.com/science/mathematics

https://nrich.maths.org/famous-mathematicians

Recommended Reading List and the Department's 'Top Pick' Title

As an A Level student, we want you to value academic endeavour (scholarship) and develop a thirst for learning in your chosen subject. Our curriculum will help you to understand that scholarship is not just about learning facts, it is about nurturing powerful knowledge.

We will help you with this by directing you to resources that will not only deepen your knowledge and strengthen your understanding of the A Level content, but also broaden it beyond that of the exam board specification.

Please find the full subject reading list alongside our prospectus on the Sixth Form section of the STRS website here: https://strschool.co.uk/sixthform/prospectus. We would encourage you to explore as many of these titles as you can.

From the published reading list, the most highly recommended book to read before September is:

Fermat's Last Theorem by Simon Singh (1997)

Once you have read the recommended book/chapter/article, consider the following:

- What did you learn from the reading?
- Have you identified any patterns or made any connections?
- What unanswered questions has the reading left you with?
- Did you agree entirely with what you have read? If so, why? If not, why not?
- Are there any themes or topics that you would like to explore further?

Other Recommended Activities

Please find below a selection of suggested additional activities that the department feel it would be useful for you to explore prior to starting the A Level course in September.

In addition to the main task, you could also use your time to explore these excellent resources on offer, mainly to brush up on the key skills needed for single Maths – you will need these at your disposal immediately in order to keep pace with lessons:

- Transition resources from the A Level Mathematics Support Programme https://amsp.org.uk/resource/gcse-alevel-transition-resources
- Hegarty Maths 'Live Lessons' with downloadable resources https://www.youtube.com/playlist?list=PLxHVbxhSvleR5tntP2FxYBJCoY5-pD_Z8

Those of you who are interested in the History of Maths might wish to consider the following essay titles (you need not write one, just do some research perhaps):

1. Compare and contrast the mathematical achievements of the ancient Egyptians and Babylonian mathematics. Discuss, giving evidence, whether there is reason to believe that either or both of these civilisations cultivated mathematics for its own sake, rather than as a tool for solving practical problems.
2. Give a short account of Ptolemy's work on trigonometry. To what extent was this a practical or a theoretical endeavour?
3. Give an account of the roles of limits and infinite series in Newton's version of the calculus, contrasting his approach to that of Leibniz. To what extent were the same motivating problems responsible for the development of calculus by the two mathematicians?"

Some video clips / podcasts that might be of interest:

MathHist Youtube Channel
https://www.youtube.com/channel/UCXmbCtVR4DcJvR24o563D-A

The Story of Maths
https://www.bbc.co.uk/programmes/b00dxjls/clips

A Brief History of Mathematics
https://www.bbc.co.uk/programmes/b00srz5b/episodes/downloads

Further Mathematics A Level

Core Pure

Decision Further Mechanics

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Complex numbers: conjugates, solving quadratic cubic quartic equations

Argand diagrams: modulus and argument, loci, regions

Series: natural numbers, squares, cubes

Roots of polynomials: quadratic cubic quartic equations

Volumes of revolution

Matrices: multiplication, determinants, inverses

Linear transformations

Proof by induction

Vectors: 3D equation of a line, equation of a plane, scalar product

Algorithms: flow charts, sorting bin-packing

Graphs and networks

Algorithms on graphs: Kruskal, Prim, Dijkstra

Route inspection: Eulerian graphs

Linear programming: graphical methods

Critical path analysis: early/late event times, float , Gantt chart

Momentum and impulse: conservation of momentum

Work, energy and power: work done, kinetic and potential energy

Elastic collisions in one dimension: loss of KE

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Complex numbers: exponential form, De Moivre, nth roots

Series: method of differences, Maclaurin's series

Methods in calculus: improper integrals, mean of function, integrating inv. trig. functions and partial fractions

Volumes of revolution: parametric

Polar coordinates

Hyperbolic functions

Differential equations: 1st order, 2nd order homogenous, 2nd order non-homogenous, simple harmonic motion, damped/force harmonic motion

Graphs and networks: planarity algorithm

Algorithms on graphs: Floyd's algorithm

Route inspection: More than 4 odd nodes

Travelling Salesman

Simplex Algorithm

Critical path analysis: resource histograms, scheduling diagrams

Momentum and impulse: momentum as a vector

Elastic strings and springs: Hooke's law, elastic energy

Elastic collisions in two dimensions