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-mathematics-specification-issue4.pdf

Topics Covered: **Year 12**	**Topics Covered:** **Year 13**
• Pure Maths (2/3 of content) • Mechanics (1/6 of content) • Statistics (1/6 of content) There is no coursework element. More details can be found on the Curriculum Map at the end of this module document.	• Pure Maths (2/3 of content) • Mechanics (1/6 of content) • Statistics (1/6 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

There are elements of core knowledge and understanding that you must have prior to starting the A Level course.

Mathematics is a subject in which the skills you use to solve problems require regular practice; the time between your last GCSE Mathematics lesson and the start of the A Level course can result in your skills diminishing and therefore making the transition into Y12 harder.

The A Level Mathematics course assumes you have a sound grasp of all of the hardest topics from GCSE and therefore we expect you to arrive in September with these skills at your disposal. Over the summer, we require you to spend time working through practice questions; a book titled "Head Start to A Level Maths" provides adequate revision material and can be purchased via Amazon:

https://www.amazon.co.uk/Head-Start-Level-Maths-2017-2018/dp/1782947922/ref=sr_1_1?dchild=1&hvadid=79852063783747&hvbmt=bb&hvdev=c&hvqmt=b&keywords=a+head+start+to+a+level+maths&qid=1589371185&sr=8-1
(you may have been lucky enough to download the Kindle copy for free whilst it was on offer)

We expect you to have covered the contents of the book by the time you arrive in September, following this schedule:

Week 1: Number

Week 2: Basic Algebra

Week 3: Quadratic Equations

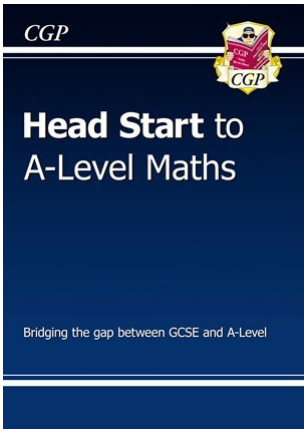
Week 4: More Algebra

Week 5: Graphs

Week 6: Trigonometry and Vectors

Week 7: Statistics and Probability

Week 8: Revision and Test Yourself



DURING YOUR FIRST WEEK AT STRS, YOU WILL BE TESTED ON THE MATERIAL CONTAINED WITHIN THIS BOOK. DEPENDING UPON YOUR RESULT, YOU MAY BE ASKED TO ATTEND EXTRA SESSIONS TO ENSURE THE NECESSARY SKILLS ARE IN PLACE. IF WE DECIDE TO USE SETTING, IT MAY ALSO AFFECT WHICH GROUP YOU ARE IN.

Links to support:

Another resource that you could use for supplementary practice can be found here, kindly shared by another school:

https://drive.google.com/file/d/1u9sS31HRkTnQhRZZJIC3xMmR4cEqAaC-/view

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:

- 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, you 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

Mathematics A Level

Pure

12

Algebraic Expressions: indices, surds
Quadratics: discriminant
Equations and Inequalities
Graphs and Transformations
Straight Line Graphs
Circles
Polynomials: factor theorem
Binomial Expansion
Trig: Sine/cosine rule, trig graphs
Trig. Identities and Equations
Vectors: magnitude, position vector
Differentiation: x^n, gradients, tangents/normals, stationary point
Integration: x^n, definite/indefinite, areas under curves
Exponentials and Logarithms

13

Algebraic Methods: partial fractions
Functions & graphs: composite functions, inverse functions, modulus
Sequences & Series: arithmetic series, geometric series, sigma notation
Binomial Expansion
Radians: arc length, areas, equations
Trig: Sec, cosec, cot; inverse trig. addition form., double-angle, $r\cos(\theta - \alpha)$
Parametric equations
Differentiation: trig, exp/logs, implicit, chain product quotient rule, parametric, rates of change
Numerical methods: Newton-Raphson
Integration: substitution, parts, trapezium rule, differential equations
Vectors: 3D

Statistics

Data collection: sampling, large data set
Measures of location/spread
Statistical diagrams
Correlation/regression
Probability: Venn/tree diagram
Distributions: binomial dis.
Hypothesis testing

Regression: exponential, measuring/testing regression
Conditional probability: set notation
Normal Distribution: approximating binomial dis., hypothesis testing

Mechanics

Modelling in Mechanics

Constant acceleration: suvat

Forces and motion: Newton's laws of motion

Variable acceleration

Moments: equilibrium, centre of mass

Forces and Friction: inclined planes, friction

Projectiles

Applications of Forces

Further kinematics: vector methods