POST 16 SUBJECT OVERVIEW

Name of Subject - A-level Further Mathematics

Which Examination Specification is Studied for this Course?

A-level Further Mathematics 7367
The Ofqual qualification accreditation number (QAN) is 603/1841/7

Why should I study this course? -

You probably have your sights set on Higher Education in a branch of Mathematics, Engineering or Sciences and you are specialising in this field of study already if you study Further Mathematics. You relish the academic challenge of extending your mathematical knowledge from GCSE, and exploring further and deeper than the Mathematics A level can on its own. Studying Further Mathematics will be completed alongside the Mathematics course, which means that a significant amount of your time at sixth form will be spent thinking about mathematics, if that doesn't sound too daunting then you are likely to find the combination of these subjects both stimulating and rewarding.

A levels in Mathematics and Further Mathematics would equally well prepare you for University courses including Computer Sciences, Earth Sciences and Social Sciences, Economics, Management Studies, Medicine, Dentistry, Optometry as well as many others but equally the skills developed are prized in both Higher Education and the workplace alike.

Mathematics has two disciplines: Pure and Applied – Pure Mathematics is the abstract science of number, quantity, algebra and space. When these concepts are used in Applied Mathematics they enable understanding of complex situations in fields such as statistics, physics and engineering.

If Mathematics is a language (and some say it is), then up to GCSE you will have learnt and mastered the equivalent of spelling, constructing a sentence and grammar. In A level Mathematics you will learn the equivalent of writing poetry, novels, or factual reports and in Further Mathematics develop an even deeper and broader understanding and the skills to "write" and structure more complex pieces.

Some of the topics you will encounter you will have seen before, but will be extended or be used in different contexts. Others will be totally new. At A level we introduce the concept of Calculus, a revolutionary and, when first proposed, divisive concept in Mathematics that is now fundamental to so many aspects of our lives. The applications of Calculus in Mechanics and Statistics, the two applied topics you will study at Outwood Academy Easingwold A level Further Mathematics, mean that problems previously inaccessible can be solved with relative ease. In Further Mathematics the use of Calculus is extended further enabling you to manipulate ever more complex functions and hence solve ever more complex problems.

At A level you will continue to explore number, algebra and geometry, linking them together in new ways. Geometry will be studied through algebra and graphs which is extended to more complex situation in Further Mathematics. Further Mathematics also introduces topics not seen in the Mathematics course including Matrices and Polar Coordinates which allow for different representations and understanding of geometry. The number system is extended off the "number line" to allow us to solve equations we had previously considered impossible.

In the Mechanics parts of the course ever more complex physical problems are solved and ideas developed in the Statistics elements of the Mathematics course are also extended. Both applied topics also include significant portions of content not considered in the Mathematics course, including for example methods to determine if two variables are dependent upon each other or not.

Being able to tackle a complex question and break down your thinking into logical steps is the essence of solving a maths problem and these skills are truly honed in the Further Mathematics course. These skills put you in good stead for embarking on further education, apprenticeships and/or entering the workforce.

Who is suitable to study this course? -

Prospective students need to have studied and enjoyed Higher tier GCSE Mathematics. This course is for those who really love the challenge of mathematics and are keen to extend their knowledge and understanding of maths. You are likely wishing to pursue a degree in Mathematics or a related field such as Engineering.

Resilience; the ability to not be scared of getting stuck, to be able to persist, and that oftentimes the mental struggle will be worth it.

Independence; the ability to problem solve by yourself, to be proactive at looking for solutions and not needing to rely on support (but in an environment where support will be there should you need it), to think for yourself and to be looking for links between the knowledge you already have and will gain throughout the course.

Planning and organisation; you will need to plan your time and resources to ensure that you've used them effectively.

Not least, a passion for developing your knowledge and deepening your understanding in mathematics. You must be committed to your studies as this course requires dedication and a strong work ethic.

What GCSE Qualifications Support the Study of this Course?

GCSE Mathematics at Higher Tier is required.

The study of GCSE Statistics, GCSE Physics or Level 2 Further Mathematics Certificate would be supportive but not essential.

What are the Qualification Requirements for this Course?

GCSE Mathematics Grade 7

You will need to study the A level Mathematics course alongside this course.

How is the Course Delivered? -

Lessons at Post 16 will continue to involve discussion and group work and provide opportunities for you to think deeply, applying your knowledge to investigate and solve problems. Review of previous learning, both from GCSE and earlier parts of A level will be regular so you can keep on top of your learning and take responsibility for it in a supportive environment.

The course will be delivered by two teachers in Year 12 and Year 13, sharing 4 hours of direct contact time. You will be expected to complete independent study for a similar amount of time and to attend additional study sessions such as after school enrichment and supervised study periods.

You will have copies of course text books to refer to and to give you access to exercise questions, your teachers will supplement this with their additional problems and notes.

Subject Overview		
Half Term	**Year 12**	**Year 13**
Autumn 1	**Radians**	**Revision of "Summer 2" topics**

	Complex numbers: **Manipulation** **Converting between forms** **Loci and Argand diangrams** **Solving equations** **Transformations of roots of polynomials** **Using standard summation formulae** **Method of differences** **Maclaurin series of special cases** **Matrices:** **Determinants** **Inverses** **Matrices (add, subtract, multiply)** **Transformations**	**Further Calculus (Part 2)** **Improper Integrals** **Using Partial Fractions** **Inverse Trig Functions** **Arc Length** **Surface of Revolution** **Reduction Formulae** **Standard Limits** **Further Vectors (Part 2)** **Equations of a Plane** **Vector Product and its uses** **Intersection of a Line and a Plane** **Further Algebra and Functions (Part 2)** **Maclaurin (Part 2)**

		L'Hôpital's rule
Autumn 2	**Rational functions, inequalities and asymptotes** **Polar Coordinates:** **Convert between Polar and Cartesian** **Sketching graphs** **Discrete Random Variables:** **Poisson Distribution** **Type I and Type II Errors** **Continuous Random Variables (introduction)** **Dimensional Analysis**	**Further Algebra and Functions (Part 2) (Continued)** **Modulus and graphs** **More rational functions** **Sketching Hyperbola** **Transformations of Hyperbola** **Further Calculus (Part 2) (Continued)** **Arc Length** **Surface of Revolution** **Reduction Formulae** **Standard Limits** **Numerical Methods** **Mid-ordinate rule**

		Simpson's rule **Eulers method** **Improved Euler's method** **Discrete Random Variables (Part 2)** **Continuous Random Variable (Part 2)** **Type I and Type II errors (Part 2)** **Dimensional Analysis (Part 2)**
Spring 1	**Volume of revolution** **Mean of a function** **Momentum and Collisions:** **Conservation of Momentum** **Coefficient of Restitution and Newtons Experimental Law** **Impulse**	**Momentum and Collisions (Part 2)** **Work, Energy and Power (Part 2)** **Circular Motion (Part 2)** **Chi Squared Tests (χ^2) (Part 2)** **Confidence Intervals (Part 2)** **Exponential Distribution**

	Work, Energy and Power **Work Done** **Gravitational Potential Energy** **Kinetic Energy** **Hooke's Law** **Elastic Potential Energy** **Variable Force** **Power** **Discrete Random Variables (Continued)** **Chi Squared Tests (χ^2)** **Confidence Intervals**	**Student's T distribution**
Spring 2	**Vector equation of a line** **Scalar product** **Angles between lines and planes**	**Centres of Mass** **For systems of Particles, composite bodies and lamina** **Moments**

	Proof by induction	**Sliding and Topppling** **Polar Coordinates (Part 2)** **Area enclosed by a polar curve** **Differential Equations (Part 2)** **Integrating Factor** **General and Particular solutions** **Auxillary equations** **The Homogeneous case and Particular Integral**
Summer 1	**Circular Motion** **Hyperbolic functions:** **sinh(x), cosh(x) and tanh(x)**	**Hyperbolic Functions (Part 2)** **Inverses** **Differentiation and Integration** **Uses in Integration**

	Revision of learning to date. **Assessments**	**Proof** **Differential Equations (Part 2) (Continued)** **Modelling kinematics** **Simple Harmonic Motion** **Damped Harmonic Motion** **Further Applications** **Revision** **(Year 12 and Year 13 topics)** **Exam technique** **Practice/Past Papers** **Analysis of Past Papers**

Summer 2	**Consolidation and post assessment work** **Complex Numbers:** **De Moivre's theorem** $e^{i\theta}$ **Matrices (Part 2)** **Extend to 3x3** **Solving simultaneous equtions and links to geometry** **Eigenvalues/ Eigenvectors** **Diagonalisation**	

How is the Course Assessed?

Throughout the course you will be informally assessed with "review sheet" homework which
will be marked and you will be expected to correct any mistakes. Once you have completed a review sheet for a topic and had the opportunity to address any issues, that topic will be assessed with a "mini-test". You will be expected to repeat each test until you can demonstrate that you understand the topic.

Less frequently you will receive more formal "exam" - style" assessments as part of the Praising Stars cycle.

Formal exams at the end of Year 13 consist exams, all of which permit the use of the scientific calculators used for the Post 16 Mathematics course and graphical calculators, there are no coursework or controlled assessment elements.. These external assessments are undertaken by way of three 2 hour papers. Paper 1 and 2 assess only pure content where the optional content of Mechanics and Statistics elements are only assessed in paper 3.

Each paper is out of 100 marks and contributes to equal weighting towards the final grade. There are a mixture of questions from one mark multiple choice to short and long answer questions.

What is our Recommended Subject Reading list to Support your Study? -

Prospective students will be given a pack of questions that they need to complete and fully understand over the course of the Summer Break. Students will continue to have access to HegartyMaths to enable them to practice or develop their mathematical skills. Revision guides such as "A Head Start to A level Mathematics" by CGP provide support for those key topics from GCSE that form the basis of the Alevel course. A good YouTube channel to support revision is ExamSolutions who provides many solutions to questions, tutorials on topics and live streams for students to work along with.

These are also a fun read:
"The Simpsons and Their Mathematical Secrets" by Simon Singh
"The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography" by Simon Singh,
"Do Dice Play God? The Mathematics of Uncertainty Ian Stewart"
"Humble Pi: A Comedy of Maths Errors" by Matt Parker
"Can you solve my problem?" by Allex Bellos
"Alex's adventures in numberland" by Allex Bellos

The youtube channels for Numberphile, 3Blue1Brown, and Stand-up Maths are also worth looking at.