

## **Maths KS5 – Statement of Intent**

*“The study of mathematics, like the Nile, begins in minuteness but ends in magnificence.”* Charles Caleb Colton

Students who study maths A-level will have four lessons per week. We align the curriculum delivery to the school vision of *‘Living Well Together with Dignity, Faith and Hope.’* Students are taught to live well together through opportunities during the course, which draw on and develop social skills and personal virtues.

Maths requires that students develop skills through cooperation and collaboration. Students will be guided to consider the skills needed to be a successful Mathematician. Students will develop essential knowledge, and understanding, of different areas of the subject and how they relate to each other. They will:

- understand coherence and progression in mathematics and how different areas of mathematics are connected
- apply mathematics in other fields of study and be aware of the relevance of mathematics to the world of work and to situations in society in general
- use their mathematical knowledge to make logical and reasoned decisions in solving problems both within pure mathematics and in a variety of contexts, and communicate the mathematical rationale for these decisions clearly
- reason logically and recognise incorrect reasoning
- construct mathematical proofs
- use their mathematical skills and techniques to solve challenging problems that require them to decide on the solution strategy
- represent situations mathematically and understand the relationship between problems in context and mathematical models that may be applied to solve them
- draw diagrams and sketch graphs to help explore mathematical situations and interpret solutions
- interpret solutions and communicate their interpretation effectively in the context of the problem
- read and comprehend mathematical arguments, including justifications of methods and formulae, and communicate their understanding
- use technology such as calculators and computers effectively and recognise when their use may be inappropriate

SEND students are supported in lessons where needed by student support workers. Staff will support students directly in the lessons. Where appropriate the use of writing frames, coloured films, increased font size, extra time, scribes, readers and any other interventions as needed.

Pupil Premium students are provided with a free laptop and access to the Academy's online resources. The students are given workbooks and other resources that might be needed to remove barriers to learning.

High attaining students are challenged to think beyond the subject and to look for links between different topics and their other subjects. The use of 'thinking hard' style tasks which are active rather than passive will ensure the students are stretched so that they can develop the thinking agility needed to access the highest grades in maths.

## **Year 12**

### **Substantive Knowledge**

Students will cover three maths topics during Year 12. These are broad topics across Pure Mathematics, Mechanics and Statistics.

The first topic is Pure Mathematics, which will provide students with the basic core knowledge for mathematics in its rawest of forms, with regular applications of this field to the real world. Students will develop their learning on topics such as trigonometry, algebra and calculus from GCSE.

Students will learn how to understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion. They will need to be familiar with, and understand and use, the laws of indices for all rational exponents and surds and use these to solve situations involving quadratics. They will then need to use their knowledge of graphs to carry out transformations of functions and relationships. Students will then look at how their work on graphs from last year can be extended to look at straight-line graphs in situations involving both parallel lines and perpendicular lines. Students will also look at geometry of circles and similar relationships. There will be an introduction to the topic of binomial expansion, which in Year 12 is limited to  $n$  being a positive integer. Students will also look at geometric and arithmetic series and will see how these link to modelling of simple situations in the real world. Students will build on their previous work on trigonometry and will look at the use of trigonometry and how this links to problems involving geometry and graphical functions. They will also look at the key concepts in calculus, such as differentiation from first principles and an introduction to integration.

Students will also study both mechanics and statistics. They will learn about statistical sampling, data presentation and interpretation, probability and how this can be linked to modelling. Students will also study statistical distributions and statistical hypothesis testing. They will be introduced to the key mechanics concepts, such as quantities and units that are needed to provide meaning to real world problems. They will learn about kinematics and motion calculations. Finally, they will have the opportunity to learn about forces and Newton's laws of motion.

## **Disciplinary Knowledge**

Throughout Year 12 students will develop the skills needed to be successful and thoughtful mathematicians. These skills will cross all topics taught throughout Year 12. They will learn how to construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language (such as constant, coefficient, expression, equation, function, identity, index, term, variable). Students will also learn to develop skills needed to understand and use mathematical language and syntax as set out in the content. They will learn to understand and use language and symbols associated with set theory, and apply this to solutions of inequalities and probability. Our learners will also learn to use the definition of a function; domain and range of functions in order to solve problems effectively. Skills in proof will be key and students will be exposed to situation that will allow them to comprehend and critique mathematical arguments, proofs and justifications of methods and formulae, including those relating to applications of mathematics.

## **Year 13**

### **Substantive Knowledge**

The topics in the second year build on the content learned in Year 12. Students will study under similar topic headings, however, it is the depth of understanding that is largely changed.

Students will still study Pure Mathematics topics. They will learn about algebra and functions, but the content will focus on complex fractions. The functions topic will be extended to include modulus and inverse functions and students will give more consideration to range and domain. There will also be the opportunity to develop their understanding of geometry. Students will also study a topic on sequences and series that will build on the work they did last year on binomial expansion. This year students will look at binomial expansion with  $n$  as a negative integer and also as an irrational number. They will look at geometric and arithmetic sequences and series and sums to infinity. These topics will also build on work from last year and will increase in complexity with the introduction of negatives and irrationals. Students will extend their knowledge of trigonometry from last year, with the introduction of new trigonometric identities such as double angles, inverse trig functions and cosec, sec and cot. There will also be an extension to the work completed previously on exponentials and logarithms. The final part of the pure content is still focussed on calculus, however, it will introduce new concepts, such as chain rule and differentiation and integration of trig functions. Students will also have a vectors component, which will link nicely to some of the mechanics that has been studied during the previous year.

Students will have mechanics and statistics topics this year. These will also largely mirror work from last year but with added detail, concepts and complexity. There is also a new topic of moments in the mechanics part of the course. Students will still learn about quantities and units. They will also study kinematics, which will build upon the work from last year to include the importance of differentiation and integration of kinematic relationships. The final topic will still focus on Newton's laws and forces. It will however

focus on different sub-topics of friction and motion in 2D and specifically motion in a circle. There is also a brand new section on moments, torques and turning forces.

### **Disciplinary Knowledge**

Students will need to develop their skills from Year 12 in order to recognise the underlying mathematical structure in a situation, and simplify and abstract appropriately to enable problems to be solved. They will need to construct extended arguments to solve problems presented in an unstructured form, including problems in context and interpret and communicate solutions in the context of the original problem. They will also learn that many mathematical problems cannot be solved analytically, but numerical methods permit solution to a required level of accuracy. There will be opportunities to evaluate, including by making reasoned estimates using the accuracy or limitations of solutions, including those obtained using numerical methods. They will need to understand the concept of a mathematical problem-solving cycle, including specifying the problem, collecting information, processing and representing information and interpreting results, which may identify the need to repeat the cycle. They will also develop their skills in order to interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including within mechanics.