	Subject: Pure Mathematics
Skills	**OT1 Mathematical Argument, Language and Proof** Construct and present mathematical arguments through appropriate use of diagrams using correct symbols and language, including set notation. **OT2 Mathematical Problem Solving** Understand the concept of a mathematical problem-solving cycle and be able to solve problems presented in an unstructured form, clearly communicating solutions in the context of the original problem. **OT3 Mathematical Modelling** Translate a situation in context into a mathematical model whilst using appropriate modelling assumptions.
Knowledge	**Pure 01 – Algebraic Expressions** Index laws, manipulation of surds, expanding brackets, collecting like terms, factorising **Pure 02 – Quadratics** Solve quadratic equations by factorising, using the formula, and by completing the square; quadratic graphs and their properties; the discriminant **Pure 03 – Equations and Inequalities** Simultaneous equations including where one is quadratic; solve linear and quadratic inequalities and represent graphically; and set notation. **Pure 05 – Straight Line Graphs** Equation of a straight line; gradients; parallel and perpendicular lines; midpoints **Pure 09 – Trigonometric Ratios** Sine, cosine and tangent for all arguments, use sine rule, cosine rules and area of a triangle; graphs of sine, cosine and tangent and their properties.
Rationale	Algebra is the basis of all higher mathematics. It allows for mathematics to be done with variables in place of numerical values, and so allows for solving and the expression of relationships with regard to these variables. Algebra also develops modelling, logic, and rationalisation skills which can be widely applied to other areas that do not have a direct application of algebra, and are necessary throughout the A-Level Mathematics course. The course begins with learners embedding and developing their algebraic knowledge and skills from the GCSE syllabus in areas including: indices; surds; simultaneous and quadratic equations; and straight-line graphs. These key skills are applied throughout the pure, statistics and mechanics elements of the course, so it is essential that learners are confident in these areas.

Year 12 Autumn Term Overview
AS Mathematics

Subject: Pure and Statistics	
Skills	**OT1 Mathematical Argument, Language and Proof** Construct and present mathematical arguments through appropriate use of diagrams, graphs and logical deductions using correct symbols and language. **OT2 Mathematical Problem Solving** Understand the concept of a mathematical problem-solving cycle and be able to solve problems presented in an unstructured form, clearly communicating solutions in the context of the original problem. **OT3 Mathematical Modelling** Translate a situation in context into a mathematical model whilst using appropriate modelling assumptions.
Knowledge	**Applied 01: Data Collection** Populations, samples, census, sampling techniques and their advantages/disadvantages **Applied 02: Measures of Location and Spread** Mean, median, mode, variation, standard deviation, range, interquartile range, inter-percentile range **Pure 04: Graphs and Transformations** Cubic, quartic and reciprocal graphs, intersection points, transformations of graphs. **Applied 03: Representations of Data** Outliers, box plots, cumulative frequency diagrams, histograms, comparing data sets **Applied 04: Correlation** Scatter graphs, bivariate data, causation, regression lines
Rationale	Statistics aims to introduce learners to the study of the collection, organisation, analysis, interpretation, and presentation of data. It deals with all aspects of data, including planning its collection in terms of the design of surveys and experiments. In the autumn term, learners are given a solid foundation in the knowledge and skills needed to succeed in Statistics. They are taught how and why various sampling techniques are used, how to analyse and interpret data using their calculators as well as written methods, and how to present data in an effective and meaningful way. Learners are introduced to the pure topic of Graphs and Transformations early in the autumn term in order to prepare them with the skills they need to access concepts in other topics such as: gradient functions in Differentiation; transformations of trigonometric functions in Trigonometry; and points of intersection in Circles.

Subject: Pure and Mechanics

Skills

OT1 Mathematical Argument, Language and Proof
Construct and present mathematical arguments through appropriate use of diagrams using correct symbols and language, including set notation.

OT2 Mathematical Problem Solving
Understand the concept of a mathematical problem-solving cycle and be able to solve problems presented in an unstructured form, clearly communicating solutions in the context of the original problem.

OT3 Mathematical Modelling
Translate a situation in context into a mathematical model whilst using appropriate modelling assumptions.

Knowledge

Applied 08: Modelling in Mechanics Mathematical models, SI units, scalar and vector quantities, modelling assumptions

Pure 11: Vectors Two dimensional vectors, vector arithmetic, magnitude, direction, position vectors, velocity, displacement

Applied 09: Constant Acceleration Kinematics graphs, constant acceleration formulae, vertical motion due to gravity

Applied 10: Forces and Motion Resultant forces, Newton's laws of motion, connected particles

Rationale

The Mechanics part of the AS level aims to introduce learners to key ideas about modelling and motion. The autumn term begins by considering mathematical modelling, and the compromise between accuracy and complexity of different types of models. Having a firm knowledge of the quantities and units used in mechanics is a necessary part of mechanics as a whole. It allows us to judge if the result gained from a calculation is expected, reasonable or even possible. The interactions between the base units that create more complicated units and variables deepen our understanding of the physical processes in place and how they are interconnected.

Learners then move to the pure mathematics topic of Vectors which enables them to consolidate their learning at GCSE and further this learning to new concepts including displacement and velocity. Vectors is taught at this point in the term as vectors are used throughout the remaining mechanics topics. It is therefore essential that students are able to manipulate and perform calculations with vectors.

Constant Acceleration gives learners the opportunity to develop mathematical and critical thinking skills about the appropriateness of a given model and giving sensible interpretation to results. Kinematics is the field of mechanics that deals with moving objects. Kinematics is therefore a core part of mechanics as a whole, and to the entire field of physics. Kinematics is also a logical and consistent framework while helps to develop problem solving and modelling skills.

Learners develop the knowledge they have gained in Vectors and Constant Acceleration and apply it to further scenarios in Forces and Motion. Having studied mechanical modelling at the start of the autumn term, learners are better equipped with the skills to set up force diagrams.

The learning of mechanics is interweaved with the pure elements throughout the course as we want learners to see mechanics as an application of Mathematics, rather than a stand-alone, additional topic.