Programme of study for year 12 AS 24-2025

Autumn (1st term)	Autumn (2nd term)	Spring (1st term)	Spring (2nd Term)	Summer (1st term)	Summer (2nd term)
Topic / Big Question: **Pure:** Algebraic expressions; Quadratics; Equations and Inequalities. **Applied Maths**: Mechanics- Modelling in Mechanics Constant Acceleration	Topic / Big Question: **Pure:** Graphs and Transformations; Coordinate Geometry – straight lines; Circles Algebraic Methods **Applied Maths** Forces and Motion .	Topic / Big Question: **Pure:** Binomial Expansion Trigonometric ratios. Trigonometric Identities and Equations. Differentiation **Applied Maths** Statistics: Data Collection Measures of Location and Spreads Representation of Data	Topic / Big Question: **Pure:** Integration, Vector, Exponential and logarithms **Applied Maths** Statistics: Correlation Probability Mechanic: Variable acceleration	Topic / Big Question: **Pure:** Revision, Review and Re-teach, Examination preparation **Applied Maths** Statistics: Statistical Distributions Hypothesis Testing	Topic / Big Question: Pure: YEAR 2 Algebraic Methods Functions and Graphs Sequences and Series **Applied Maths:** Statistics (Yr. 2): Regression, correlation and Hypothesis Testing

Skills (students should be able to do):	**Skills** (students should be able to do):	**Skills** (students should be able to do):	**Skills** (students should be able to do):	**Skills** (students should be able to do):	**Skills** (students should be able to do):
Solve linear, quadratic and simultaneous equations and inequalities. Simplify surds and indices. Understand what the discriminant tells us. Represent inequalities on a graph. Sketch straight line graphs. Find the equation of a straight line and the equation of a perpendicular bisector of a line. Find the point of intersection of two lines. Distinguish between vector and scalar quantities. Make neat, clear diagrams using given information. Apply SUVAT equations Draw a force diagram. Understand Newton's 3 laws and how they can be applied to a simple set of forces acting on a particle. Solve problems involving connected particles, lifts and pulley systems	Sketch quadratic, cubic, quartic, reciprocal and trigonometric graphs. Apply transformations to curves for a range of functions. Find the equation of a circle. Use tangent and chord properties to solve geometric problems. Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; Simplify algebraic fractions. Use long division in algebra. Use factor theorem. Understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof, including proof by deduction, proof by exhaustion, disproof by counter-example	Understand and use the binomial expansion of $(a+bx)^n$ for positive integer n; the notations $n!$ and nCr link to binomial probabilities Solve problems involving sine and cosine rule. Understand the ambiguous case for the sine rule. Know the exact trigonometric ratios. Find all the solutions to trigonometric equations. Solve trigonometric equations involving identities. Understand what differentiation is used for. Differentiate from first principles. Apply the rules of differentiation. Understand how to find and use the gradient function. Use differentiation to solve problems involving	Understand how differentiation and integration are linked. Know and use the Fundamental Theorem of Calculus Integrate related to sums, differences and constant multiples Find the area under a curve. Know the difference between a definite and indefinite integral. Use the correct notation when integrating. Find the original function if given the gradient function Use vectors in two dimensions. Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form. Add vectors diagrammatically and perform the algebraic operations of vector	Understand and be able to use simple, discrete probability distributions, including the binomial distribution. Identify the discrete uniform distribution. Calculate probabilities using the binomial distribution. Carry out a hypothesis test for zero correlation	Use partial fractions to expand fractional expressions Understand and use the modulus function. Understand mappings and functions and use domain and range. Combine two or more functions to make a composite function. Know how to find the inverse of a function graphically and algebraically. Sketch the graphs of modulus functions. Apply a combination of two (or more) transformations to the same curve. Transform the modulus function Know the difference between an arithmetic and geometric sequence. Know the difference between a sequence and series.

		gradients, tangents and normal to curves. Use differentiation to solve optimisation problems. Make interpretations about data based on measures of location and spread. Calculate variance and standard deviation. Understand how to use coding techniques. Compare sets of data using a variety of statistical techniques. Understand what is meant by an outlier. Understand the key data included in the large dataset. Know how to clean data to deal with missing data, errors and outliers. Interpret scatter diagrams and regression lines. Identify the explanatory and response variables	addition and multiplication by scalars and understand their geometrical interpretations. Understand and use position vectors; calculate the distance between two points represented by position vectors. Use vectors to solve problems in pure mathematics and in context, (including forces) Sketch the graphs of exponential and logarithmic functions. Know how to apply the three rules of logarithms. Solve equations containing exponentials and logarithms. Understand how exponentials can be used to model real life situations. Use logarithms to manage and explore non-linear trends in data. Understand exponential models in bivariate data		Recall and use the formulae for the nth term and summations of arithmetic and geometric sequences and series. Generate sequences using recurrence relations. Model real-life situations with sequences and series. Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, p-value. Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context. Understand that a sample is being used to make an inference about the population and appreciate that the significance level is the

			Use a change of variable to estimate coefficients in an exponential model. Understand and calculate the product moment correlation coefficient Draw and interpret box plots, cumulative frequency diagrams and histograms. Use a Venn Diagram or a Tree Diagram to solve a probability problem. Understand the terms mutually exclusive and independent. Prove statistical independence. Use calculus to solve problems involving variable acceleration. Know how to interpret scatter diagrams and regression lines for bivariate data. Recognise the explanatory and response variables; be able to make predictions using the regression line and understand its limitations.		probability of incorrectly rejecting the null hypothesis.

			Understand informal interpretation of correlation. Understand that correlation does not imply causation. Select or critique data presentation techniques in the context of a statistical problem.		
Key Learning Outcomes By the end of the sub-unit, students will be able to perform all the skills highlighted above.	Key Learning Outcomes (students should know): By the end of the sub-unit, students will be able to perform all the skills highlighted above	Key Learning Outcomes (Students should know): By the end of the sub-unit, students will be able to perform all the skills highlighted above	Key Learning Outcomes (students should know): By the end of the sub-unit, students will be able to perform all the skills highlighted above	Key Learning Outcomes (students should know): By the end of the sub-unit, students will be able to perform all the skills highlighted above	Key Learning Outcomes (students should know): By the end of the sub-unit, students will be able to perform all the skills highlighted above
Autumn Term – centrally planned, standardised and teacher marked piece(s) of work Formative assessment as per calendar		Spring Term – centrally planned, standardised and teacher marked piece(s) of work At the beginning of Spring 1, pupils will be sitting their first Mock examination on the following topic: **Pure:** In addition to the GCSE grade 9 topics, Algebraic expressions; Quadratics; Equations and Inequalities; Graphs and Transformations; Coordinate Geometry – straight lines; Circles, Algebraic Methods. **Applied Maths**: Mechanics- Modelling in Mechanics Constant Acceleration- Forces and Motion Formative assessment as per calendar		Summer Term – centrally planned, standardised and teacher marked piece(s) of work **A final mock examination** of all content will be administered in April (Summer 1). Pupils will be sitting the end of year exams which will be covering all the AS content and the following: Pure: Algebraic Methods Functions and Graphs Sequences and Series Applied Maths: Statistics (Yr. 2): Regression, correlation and Hypothesis Testing Formative assessment as per calendar	

Building understanding: Rationale / breakdown for your sequence of lessons:	Building understanding: Rationale / breakdown for your sequence of lessons:	Building understanding: Rationale / breakdown for your sequence of lessons:	Building understanding: Rationale / breakdown for your sequence of lessons:	Building understanding: Rationale / breakdown for your sequence of lessons:	Building understanding: Rationale / breakdown for your sequence of lessons:
This POS is based upon a one-year delivery model for AS level Mathematics. It is broken up into units and sub-units, so that there is greater flexibility for moving topics around to meet planning needs as well as to ensure that all the prior knowledge contents that are linked to other topics are done with a greater level of efficacy allowing for the pupils to make a meaningful and continuous learning. The pure mathematics content that is covered this term forms the foundation of knowledge that the rest of A level mathematics builds upon. This content revisits key algebra and geometry topics from GCSE to ensure students have secure knowledge and fluency in algebra. Modelling questions challenge and extend student knowledge and the modelling questions covered this term link	The next mechanic topic to be taught is forces and motion. This will follow through easily as it continues from the previous half term. Doing it at this instance will allow for a better appreciation of year 1 Mechanics. The continuation of the Pure part of the specification will follow easily as it lends itself to continuous learning for all pupils.	Doing Binomial expressions at this instance will allow the learners to further develop and or apply a good understanding of the laws of indices when expanding binomial expressions, so teaching this topic having done all the algebraic topics ahead of it lends itself to a greater appreciation and applicability of the same. Many learners fail to make connections between what they are learning and how that knowledge will be used. They struggle to understand the concepts in mathematics unless they can see the relevance to their everyday lives. Differentiation and its applications will give the pupils the insight to make this true. This will open up real application of maths as it will lead to them understanding how to optimise. Doing Differentiation at this point will eliminate the	Prior to working on statistical distributions, it highly recommended that the learners have a firm understanding of the rules of probability (building upon GCSE and the content from section) and they should have experience of creating basic probability distributions from known probability situations. This should be a core component of the initial approach. As such the pupils will be able to use Venn diagrams, tree diagrams and table of outcomes to solve probability problems. Knowledge of statistical measures and their interpretation and the ability to calculate these, including the variance and standard deviation of a data set would also be beneficial to the understanding of the statistical distributions and their applications, hence	Prior to working on statistical distributions, it highly recommended that the learners have a firm understanding of the rules of probability (building upon GCSE and the content from section) and they should have experience of creating basic probability distributions from known probability situations. This should be a core component of the initial approach. As such the pupils will be able to use Venn diagrams, tree diagrams and table of outcomes to solve probability problems. Knowledge of statistical measures and their interpretation and the ability to calculate these, including the variance and standard deviation of a data set would also be beneficial to the understanding of the statistical distributions and their applications, hence	Having completed all the contents for year 1, the first two to three chapters of A2 Pure and Statistics will be taught. This will allow for a more effective use of the time, giving a greater advantage to the pupils as they will have had a jump-start at the seconds years content. A greater link will be seen and appreciated by the pupils of the continuity in doing hypothesis testing concurrently. Proof by deduction can be practised in contexts such as: properties of graphs; trigonometric identities; logarithms; differentiation from first principles; vector results; probability results and series formulae. It is then fitting to be introducing proof at this instance. Generally, in mathematics proof by exhaustion one will need to use to establish results some probabilities or binomial coefficients and having seen these concepts prior

directly into the skills required for AS Mechanics. For the applied module, students start with Mechanics – this supports the further mathematicians who will begin AS Further Mechanics in the Spring. Modelling in mechanics can be taught any time after the Pure Quadratics module and Kinematics 1 can be taught after Coordinate geometry – straight line graphs.		abstractness of Variable acceleration that will be taught in the next half term. They will then be able to appreciate the meaningful relationship between abstract ideas and practical applications in the real world. This in turn, will lead to greater motivation, enjoyment through discovery, improved confidence, independent thinking and better retention of skills. The topic on trigonometric ratios covered this term will be taken to the extent that's prescribed by the examination board so as to ensure that all pupils are adequately prepared to do an examination at the end of the year. This will allow for the pupils to make vital connections with year 2 content when we are there. This is so, as it will be needed as a prerequisite to be built on in year 2. The calculus (differentiation and integration) is taught in the spring term, as opposed to the order suggested by textbooks. The rationale	teaching the distribution at this point is apt as all the prerequisites would have been done prior to this point. Coupling to the above, the pupils will also benefit from having a good understanding of the binomial expansion and its uses.	teaching the distribution at this point is apt as all the prerequisites would have been done prior to this point. Coupling to the above, the pupils will also benefit from having a good understanding of the binomial expansion and its uses.	to this instance makes it very apt and useful to all pupils. The different types of proof allow for application and practice of contents that all pupils would have seen at this point. Many results in Statistics and Mechanics are useful for practising proof, particularly the latter. Simply asking students to show given results, or to justify their working, is enough to develop many of the ideas and techniques. Proof is developed in Further Mathematics, both within the mandatory pure content and in aspects of the optional content.

		for this is that all the necessary algebra has been covered in the first term and the further mathematicians need strong differentiation skills in order to tackle FP1 topics such as Conic Sections. Integration is also required before Kinematics 2 can be taught. In addition, FP1 Covers t-formulae, meaning that trigonometric identities need to be covered this term.			
Home – Learning: Mixed exercise e-platform "Integral"	Home – Learning: Mixed exercise e-platform "Integral"	Home – Learning: Mixed exercise e-platform "Integral"	Home – Learning: Mixed exercise e-platform "Integral"	Home – Learning: Mixed exercise e-platform "Integral"	Home – Learning: Mixed exercise e-platform "Integral"
Reading / High Quality Text: Modelling Exam style questions	Reading / High Quality Text: Modelling Exam style questions	Reading / High Quality Text: Modelling Exam style questions	Reading / High Quality Text: Modelling Exam style questions	Reading / High Quality Text: Modelling Exam style questions	Reading / High Quality Text: Modelling Exam style questions
Numeracy:	Numeracy:	Numeracy:	Numeracy:	Numeracy:	Numeracy:

Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):

Algebraic Expression: Engineers use algebraic expressions extensively in designing structures, analyzing data, and solving problems related to mechanics, thermodynamics, fluid dynamics, and electrical circuits. For example, in structural engineering, algebraic expressions are used to calculate stress, strain, and deformation in materials. They are also used in economics to model relationships between variables such as supply and demand, production costs, revenue, and profit. Economists use algebraic equations to analyze market behavior, optimize decision-making, and predict economic outcomes. Overall, algebraic expressions provide a concise and powerful framework for representing and solving a wide range of problems across various disciplines. They enable scientists, engineers, economists, and researchers to model complex phenomena, make predictions, and derive meaningful insights from data and observations.

Modelling in Mechanics: Modeling techniques are used to describe fluid flow, pressure distribution, turbulence, and other phenomena. Differential equations such as the Navier-Stokes equations are fundamental to modeling fluid dynamics, guiding the design of systems ranging from aircraft wings to pipelines. In summary, modeling is an indispensable tool in mechanics, enabling engineers and scientists to understand, predict, and optimize the behavior of mechanical systems across various scales and applications.

Constant Acceleration: Rockets experience constant acceleration as they propel through space. Engineers utilize principles of constant acceleration to plan trajectories, optimize fuel consumption, and ensure precise navigation during space missions. Athletes often aim to achieve constant acceleration to maximize their performance. Concepts of constant acceleration can be applied in analyzing movements in sports like sprinting, long jump, and javelin throw.

Straight Lines: Straight lines are crucial in construction for accurate measurements, cutting materials, and ensuring structural integrity. In woodworking and carpentry, straight lines are used as guides for cutting, shaping, and assembling components.

Circles: Circles are commonly used in engineering and architecture for designing structures, machinery, and objects. They are used to create curves, arcs, and circles in architectural designs, mechanical components, and civil engineering projects. For example, wheels, gears, pulleys, and bearings often have circular shapes or components.

Algebraic Methods: Algebraic techniques are employed to solve optimization problems. In economics, for instance, maximizing profit or minimizing cost involves setting up and solving algebraic optimization models.

Trigonometric Ratio: Trigonometric ratios are crucial in navigation, especially in marine and aviation industries. They help in calculating distances and directions between points on the Earth's surface using techniques like triangulation.

Data Collection: In academic and scientific research, data collection is essential for generating evidence to support hypotheses, theories, or conclusions. Researchers collect data through experiments, surveys, observations, or archival sources to analyse patterns, trends, and relationships.

Forces and Motion: Forces and motion play a crucial role in various modes of transportation. For instance: Cars: The engine generates a force to propel the car forward, overcoming friction and air resistance.

Airplanes: Thrust generated by engines helps overcome drag, allowing planes to move through the air.

Ships: Engines provide a force to push the ship through water, while buoyancy counteracts the force of gravity.

Hypothesis Testing: In medical research, hypothesis testing is used to evaluate the effectiveness of new treatments or interventions. Researchers compare treatment outcomes between experimental and control groups and use statistical tests to determine whether any observed differences are statistically significant.

Statistical Distributions: Statistical distributions are used in clinical trials to model the distribution of treatment effects and assess the efficacy of medical interventions. Outcome measures, such as survival times and disease incidence rates, are often assumed to follow specific distributions.

Vectors: Vectors are used in GPS and navigation systems to represent positions, velocities, and directions of travel. Satellite navigation systems utilize vector calculations to determine the user's location, calculate routes, and provide real-time navigation guidance.

Variable acceleration (Mechanics): Aircraft experience variable acceleration during take-off, climb, cruising, descent, and landing phases. Engineers study variable acceleration to design aircraft engines, wings, and control systems for safe and efficient flight operations.

Correlation: Correlation analysis is used in risk management to assess the relationship between different risks. For example, in banking, correlation analysis can help assess the correlation between credit risk and market risk.

Integration: Integration is used in geography and cartography to calculate areas of irregular shapes or regions. By integrating the area element over a region's boundary, one can determine its total area.

Exponents and logarithms: Exponential functions describe growth and decay phenomena in various natural and social systems. For instance, population growth, radioactive decay, bacterial growth, and the spread of infectious diseases can often be modelled using exponential functions, which involve exponents as their key components. Logarithms are employed in signal processing for dynamic range compression and expansion. Logarithmic transformations are applied to signals to compress their dynamic range, making them more manageable for storage, transmission, and processing, while preserving perceptual fidelity.

Binomial Expansion: In finance, the expansion is used in risk management for modelling asset price movements and estimating the probabilities of various market scenarios. By incorporating the expansion into risk models, financial institutions can assess and mitigate market risks more effectively.

Measures, location and Spreads: In In financial analysis, the mean is used to calculate average returns on investments or assets over a specific period. In weather forecasting, identifying the mode of temperature or precipitation levels can aid in predicting weather patterns and extreme events. In Healthcare, Quartiles of patient wait times in emergency rooms help healthcare providers understand service efficiency and patient satisfaction.

Trigonometrical Identities and Equations: Trigonometric identities and equations are used in navigation and surveying to calculate distances, heights, and angles. For instance, trigonometric functions are used in triangulation methods to determine the position of an object based on angles measured from multiple known points.