Sir William Ramsay School

EMPOWERING EVERYONE TO ACHIEVE

Curriculum Map for Maths Year 12

YEAR 12	Autumn 1	Autumn 2
Topics	**Pure: Algebra & Functions** **Statistics: Statistical Sampling, Data Presentation & Interpretation** **Mechanics: Quantities & Units In Mechanics & Kinematics 1 (Constant Acceleration)**	**Pure: Coordinate Geometry In The (x, y) Plane, Algebra & Functions & Further Algebra** **Statistics: Data Presentation & Interpretation** **Mechanics: Kinematics 1 (Constant Acceleration)**
Substantive Knowledge – The Knowledge Taught By The Teacher	• Students will learn about algebraic expressions, quadratic functions, equations, inequalities, graphs and transformations. • Students will learn about sampling terminology and sampling techniques. • Students will learn about calculation and interpretation of measures of location and measures of variation. • Students will learn about and use coding. • Students will learn about mathematical modelling and S.I. units and definitions of force, velocity, speed, acceleration, weight, displacement, vector and scalar quantities. • Students will learn about the graphical representation of velocity, acceleration and displacement.	• Students will learn about straight-line graphs, parallel/perpendicular, length and area problems. • Students will learn about circles – equation of a circle and geometric problems on a grid. • Students will learn about algebraic division, factor theorem and proof. • Students will learn about the binomial expansion. • Students will learn about diagrams for single-variable data; they will interpret scatter diagrams, calculate regression lines and recognise outliers. • Students will learn about motion in a straight line under constant acceleration; and vertical motion under gravity.
Disciplinary Knowledge – How The Knowledge Taught Is Applied	• Understand and use the laws of indices for all rational exponents. • Understand and use graphs of functions. • Understand the effect of simple transformations on the graphs. • Understand and use the terms 'population' and 'sample'. • Use samples to make informal inferences about the population. • Understand techniques to clean data. • Understand and use fundamental quantities and units in the S.I. system: length, time, mass. • Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph.	• Understand and use proportional relationships and their graphs. • Understand and use the equation of a straight line. • 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 informal interpretation of correlation. • Understand that correlation does not imply causation. • Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration.

Skills	• Use and manipulate surds, including rationalising the denominator. • Work with quadratic functions and their graphs. • Manipulating numbers and algebra. • The discriminant of a quadratic function, including the conditions for real and repeated roots. • Completing the square. • Solution of quadratic equations, including solving quadratic equations in a function of the unknown. • Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation. • Understand and use sampling techniques, including simple random sampling and opportunity sampling. • Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples can lead to different conclusions about the population. • Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency. • Connect to probability distributions. • Interpret measures of central tendency and variation, extending to standard deviation. • Be able to calculate standard deviation, including from summary statistics. • Understand and use derived quantities and units: velocity, acceleration, force, weight. • Understand, use and derive the formulae for constant acceleration for motion in a straight line. • Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g, and its value in S.I. units to varying degrees of accuracy.	• Be able to use straight line models in a variety of contexts. • Completing the square to find the centre and radius of a circle. • Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem. • Understand and use the binomial expansion of $(a+bx)^n$ for positive integer n; the notations $n!$ and ${}_nC_r$; link to binomial probabilities. • Interpret measures of central tendency and variation, extending to standard deviation. • Be able to calculate standard deviation, including from summary statistics. • Select or critique data presentation techniques in the context of a statistical problem. • Understand, use and derive the formulae for constant acceleration for motion in a straight line.
Links To Prior Learning	• We build on from the GCSE Specification to enable students to work with more complex numbers, algebra, geometry, data and probability concepts.	• We build on from the GCSE Specification to enable students to work with more complex numbers, algebra, geometry, data and probability concepts.
Literacy/ Numeracy	• Language of functions, kinematics and statistics.	• Language of coordinate geometry, algebra and kinematics.
Cross Curricular	• Links to Science, technology and Psychology.	• Links to Science, technology and Psychology. • Link to statistics and kinematics in real life and kinematics.

Assessment	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic.	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic.

YEAR 12	**Spring 1**	**Spring 2**
Topics	**Pure: Trigonometry, Algebra & Functions & Vectors (2D)** **Statistics: Probability** **Mechanics: Forces & Newton's Laws**	**Pure: Differentiation & Integration** **Pure: Integration** **Statistics: Statistical Distributions, Hypothesis Testing & Probability** **Mechanics: Forces & Newton's Laws**
Substantive Knowledge – The Knowledge Taught By The Teacher	• Students will learn about trigonometric ratios and graphs. • Students will learn about trigonometric identities and equations. • Students will learn about definitions, magnitude/direction, addition and scalar multiplication. • Students will learn about position vectors, distance between two points, geometric problems. • Students will learn about mutually exclusive and independent events. • Students will learn about Newton's first law, force diagrams, equilibrium, introduction to i, j system.	• Students will learn about differentiating polynomials and second order derivatives. • Students will learn about gradients, tangents, normals, maxima and minima. • Students will learn about integration as the opposite of differentiation and study indefinite integrals of x^n. • Students will learn about definite integrals and areas under curves. • Students will learn about discrete distributions and the binomial distribution. • Students will learn about hypothesis testing and significance levels. • Students will learn about Newton's second law and third law.
Disciplinary Knowledge – How The Knowledge Taught Is Applied	• Understand and use the sine, cosine and tangent functions, their graphs, symmetries and periodicity. • Understand and use position vectors; calculate the distance between two points represented by position vectors. • Understand and use mutually exclusive and independent events when calculating probabilities. • Understand the concept of a force; understand and use Newton's First Law.	• Understand and use the derivative of f (x) as the gradient of the tangent to the graph of y=f (x) at a general point (x,y); the gradient of the tangent as a limit; interpretation as a rate of change. • Understand and use the Fundamental Theorem of Calculus. • Understand discrete probability distributions. • Understand and apply the language of statistical hypothesis testing. • Understand the concept of a force.
Skills	• Understand and use $\tan\theta=\sin\theta/\cos\theta$. • Understand and use $\sin^2\theta+\cos^2\theta=1$. • Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle. • Use vectors in two dimensions. • Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form.	• Sketching the gradient function for a given curve. • Second derivatives. • Differentiation from first principles for small positive integer powers of x. • Differentiate x^n, for rational values of n, and related constant multiples, sums and differences. • Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points. • Identify where functions are increasing

	• Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars and understand their geometrical interpretations. • Link to discrete and continuous distributions. • Understand and use Newton's Second Law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2D (i, j) vectors). • Understand and use Newton's Third Law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles.	or decreasing. • Integrate xn (excluding $n=-1$), and related sums, differences and constant multiples. • Evaluate definite integrals; use a definite integral to find the area under a curve. • Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution. • 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 probability of incorrectly rejecting the null hypothesis. • Understand and use Newton's First Law. • Understand and use Newton's Second Law for motion in a straight line. Understand and use Newton's Third Law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles.
Links To Prior Learning	• We build on from the GCSE Specification to enable students to work with more complex number, algebra, geometry, data and probability concepts.	• We build on from the GCSE Specification to enable students to work with more complex number, algebra, geometry, data and probability concepts.
Literacy/ Numeracy	• Language of trigonometry, vectors, probability and forces.	• Language of calculus, statistics and forces.
Cross Curricular	• Sciences, Psychology and Social Sciences.	• Sciences, Psychology, Geography and Social Sciences.
Assessment	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic.	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic.

YEAR 12	**Summer 1**	**Summer 2**
Topics	**Pure: Exponentials, Logarithms, Algebra & Functions** **Statistics: Statistical Hypothesis Testing** **Mechanics: Kinematics 2 (Variable Acceleration)**	**Pure: Proof, Further Algebra, Algebraic & Partial Fractions, Functions & Modelling, Series, Sequences & The Binomial Theorem** **Mechanics: Moments** **Statistics: Regression & Correlation**

Substantive Knowledge – The Knowledge Taught By The Teacher	• Students will learn about exponential functions and natural logarithms. • Students will learn about hypothesis tests involving the binomial distribution. • Students will learn about variable force; Calculus to determine rates of change for kinematics. • Students will learn about use of integration for kinematics problems.	• Students will learn about proof by deduction, proof by exhaustion and disproof by counter example. • Students will learn about simplifying algebraic fractions. • Students will learn about partial fractions. • Students will learn about modulus functions, composite and inverse functions. • Students will learn about transformations and modelling with functions. • Students will learn about arithmetic and geometric progressions (proofs of 'sum formulae'). • Students will learn about sigma notation, recurrence and iterations. • Students will learn about Expanding $(a + bx)^n$ for rational n Students will learn about range of validity. • Students will learn about expansion of functions by first using partial fractions. • Students will learn about Forces' turning effect. • Students will learn about change of variable. • Students will learn about correlation coefficients. Statistical hypothesis testing for zero correlation.
Disciplinary Knowledge – How The Knowledge Taught Is Applied	• Understand and use the laws of logarithms. • Understand and apply the language of statistical hypothesis testing, developed through a binomial model. • Understand that kinematics can be linked with quadratics.	• Understand and use the structure of mathematical proof. • Understand rational expressions. • Understand and use composite functions; inverse functions and their graphs. • Understand and work with arithmetic sequences and series, including the formulae for nth term and the sum to n terms. • Understand and use the binomial expansion. • Understand and use moments in simple static contexts. • Understand and apply the language of statistical hypothesis testing.
Skills	• Know and use the function a^x and its graph, where a is positive. • Know and use the function e^x and its graph. • Solve equations of the form $a^x=b$. • 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	• 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 contradiction and the infinity of primes and application to unfamiliar proofs. • Simplify rational expressions including by factorising and cancelling and

	significance level is the probability of incorrectly rejecting the null hypothesis. • Use calculus in kinematics for motion in a straight line.	algebraic division (by linear expressions only). • Decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than 3 terms, numerators constant or linear). • Understand the effect of simple transformations on the graph of y = f(x) including sketching associated graphs and combinations of these transformations. • Use of functions in modelling, including consideration of limitations and refinements of the models. • Use sequences and series in modelling. • Understand and work with geometric sequences and series including the formulae for the nth term and the sum of a finite geometric series. • Understand and use the binomial expansion of $(a+bx)^n$ for rational n, including its use for approximation; be aware that the expansion is valid for $\|bx/a\|<1$ (proof not required). • Use moments in simple static contexts. • Apply the language of statistical hypothesis testing, extend to correlation coefficients as measures of how close data points lie to a straight line and be able to interpret a given correlation coefficient using a given p-value or critical value (calculation of correlation coefficients is excluded).
Links To Prior Learning	• At this stage in the course, students are still building on their GCSE knowledge but are also linking back to A-Level knowledge taught since the beginning of Year 12.	• At this stage in the course, students are still building on their GCSE knowledge but are also linking back to A-Level knowledge taught since the beginning of Year 12.
Literacy/ Numeracy	• Language of logarithms, exponentials, statistics and kinematics.	• Language of algebraic proof, statistics and forces.
Cross Curricular	• Sciences, Psychology, Geography and Social Sciences.	• Sciences, Psychology, Geography and Social Sciences.
Assessment	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic.	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic.