Sir William Ramsay School

EMPOWERING EVERYONE TO ACHIEVE

Curriculum Map for Maths Year 13

YEAR 13	Autumn 1	Autumn 2
Topics	**Pure: Trigonometry & Parametric Equations** **Mechanics: Forces At Any Angle** **Statistics: Probability**	**Pure: Further Differentiation & Numerical Methods** **Mechanics: Applications Of Kinematics** **Statistics: The Normal Distribution**
Substantive Knowledge – The Knowledge Taught By The Teacher	• Students will learn about radians, small angles, secant, cosecant, cotangent, inverse trigonometrical functions, compound and double angle formulae, geometric proof of compound angle formula, r cos and r sin, proving trigonometric identities and solving problems in context. • Students will learn about converting between parametric and Cartesian forms. • Students will learn about curve sketching and modelling. • Students will learn about resolving forces. • Students will learn about friction forces (including coefficient of friction μ). • Students will learn about using set notation for probability and conditional probability. • Students will learn about questioning assumptions in probability.	• Students will learn about differentiating sinx and cosx from first principles, differentiating exponentials and logarithms, differentiating products, quotients, implicit and parametric functions. • Students will learn about second derivatives and rates of change problems. • Students will learn about location of roots, solving by iterative methods and Newton-Raphson method. • Students will learn about projectiles. • Students will learn about the Normal Distribution.
Disciplinary Knowledge – How The Knowledge Taught Is Applied	• Understand and use the standard small angle approximations of sine, cosine and tangent. • Understand and use the definitions of secant, cosecant and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent. • Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms. • Understand and use the $F \leq \mu R$ model for friction. • Understand and use mutually exclusive and independent events when calculating probabilities. • Understand and use conditional probability, including the use of tree diagrams, Venn diagrams, two-way tables.	• Understand and use the second derivative as the rate of change of gradient. • Understand that you can solve equations approximately using simple iterative methods. • Understand how change of sign methods can fail. • Understand motion under gravity using vectors. • Understand and use the Normal Distribution as a model.

Skills	• Use expressions for $a\cos\theta+b\sin\theta$ in the equivalent forms of $R\cos(\theta\pm\alpha)$ or $R\sin(\theta\pm\alpha)$. • Use double angle formulae; use of formulae for $\sin(A\pm B)$, $\cos(A\pm B)$ and $\tan(A\pm B)$; understand geometrical proofs of these formulae. • Use the definitions of secant, cosecant and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains. • Construct proofs involving trigonometric functions and identities. • Use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces. • Use parametric equations in modelling in a variety of contexts. • Use coefficient of friction; motion of a body on a rough surface; limiting friction and limiting equilibrium. • Resolving forces in 2 dimensions. Problems may be set where forces need to be resolved. • Modelling with probability, including critiquing assumptions made and the likely effect of more realistic assumptions.	• Differentiation from first principles for $\sin x$ and $\cos x$. • Differentiate e^{kx}, a^{kx}, $\sin kx$, $\cos kx$, $\tan kx$ and related sums, differences and constant multiples. Understand and use the derivative of ln x. • Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions. • Differentiate simple functions and relations defined implicitly or parametrically, for first derivative only. • Construct simple differential equations in pure mathematics and in context, (contexts may include kinematics, population growth and modelling the relationship between price and demand). • Solve equations using the Newton-Raphson method and other recurrence relations of the form $xn+1=g(x_n)$. • Use numerical methods to solve problems in context. • Model motion under gravity in a vertical plane using vectors; projectiles. • Find probabilities using the Normal distribution. • Link to histograms, mean, standard deviation, points of inflection and the binomial distribution. • Conduct a statistical hypothesis test for the mean of the Normal distribution with known, given or assumed variance and interpret the results in context.
Links To Prior Learning	• In Year 13, the knowledge, concepts and skills taught in Year 12 are added to, built upon and linked together.	• In Year 13, the knowledge, concepts and skills taught in Year 12 are added to, built upon and linked together.
Literacy/ Numeracy	• Language of trigonometry, cartesian and parametric form, probability and forces.	• Language of calculus, statistical distributions and kinematics.
Cross Curricular	• Links to Science, Technology and Psychology. • Link to statistics and kinematics in real life and kinematics.	• Links to Science, Technology, Geography 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 13	Spring 1	Spring 2 & Summer 1
Topics	**Pure: Integration 1 & 2** **Mechanics: Applications Of Forces** **Statistics: The Normal Distribution**	**Pure: Vectors - 3D** **Mechanics: Further Kinematics** **Statistics: The Normal Distribution**
Substantive Knowledge – The Knowledge Taught By The Teacher	• Students will learn about integrating x^n (including when $n = -1$), exponentials, trigonometric and parametrically defined functions. • Students will learn about using the reverse of differentiation and using trigonometric identities to manipulate integrals. • Students will learn about integration by substitution, integration by parts. • Students will learn about use of partial fractions, areas under graphs, trapezium rule and differential equations. • Students will learn about equilibrium and statics of a particle (including ladder problems). • Students will learn about dynamics of a particle. • Students will learn about the Normal Distribution as an approximation to the Binomial Distribution. • Students will learn how to select the appropriate distribution.	• Students will learn about vectors in three dimensions; students will learn about column vectors and i, j and k unit vectors. • Students will learn about constant acceleration (equations of motion in 2D; the i, j system). • Students will learn about variable acceleration (use of calculus and finding vectors $\dot{\mathbf{r}}$ and $\ddot{\mathbf{r}}$ at a given time). • Students will learn about statistical hypothesis testing for the mean of the Normal Distribution.
Disciplinary Knowledge – How The Knowledge Taught Is Applied	• Understand and use trigonometric identities to integrate. • Understand and use integration as the limit of a sum. • Understand Newton's Laws. • Understand and use the Normal distribution as a model.	• Understand vectors are used in 3D. • Understand that calculus is used in kinematics for variable acceleration. • Understand and use the Normal Distribution as a model.
Skills	• Integrate x^n, (including $1/x$) and integrate e^{kx}, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples. • Use a definite integral to find the area under a curve and the area between two curves. • Area under the curve to include finding area under the curve defined parametrically. • Carry out simple cases of integration by substitution and integration by parts; understand these methods as the inverse processes of the chain and product rules respectively. • Use Newton's Second Law for motion in a straight line. • Use Newton's Third Law; equilibrium of forces on a particle and motion in a	• Use vectors in three dimensions. • Knowledge of column vectors and i, j and k unit vectors in three dimensions. • Extend the constant acceleration formulae of motion to 2 dimensions using vectors. • Use calculus in kinematics for (variable acceleration) motion in a straight line. Extend to 2 dimensions using vectors. • Find probabilities using the Normal Distribution. • Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or the Normal model may not be appropriate. • Conduct a statistical hypothesis test for the mean of the Normal Distribution

	straight line; application to problems involving smooth pulleys and connected particles; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces. • Use addition of forces; resultant forces; dynamics for motion of a particle in a plane. • Moments: problems involving parallel and non-parallel coplanar forces e.g. ladder problems. • Find probabilities using the Normal Distribution. • Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or the Normal model may not be appropriate. • Conduct a statistical hypothesis test for the mean of the Normal Distribution with known, given or assumed variance and interpret the results in context.	with known, given or assumed variance and interpret the results in context.
Links To Prior Learning	• In Year 13, the knowledge, concepts and skills taught in Year 12 are added to, built upon and linked together.	• In Year 13, the knowledge, concepts and skills taught in Year 12 are added to, built upon and linked together.
Literacy/ Numeracy	• The language of calculus, statistics, vectors, forces and kinematics.	• The language of calculus, statistics, vectors, forces and kinematics.
Cross Curricular	• Links to Science, Technology, Geography and Psychology. • Link to statistics and kinematics in real life and kinematics.	• Links to Science, Technology, Geography 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. • A-Level Exam.	• Learning checks throughout with low stakes questioning and starters. • Summative assessment at the end of topic. • A-Level Exam.