YEAR 13 MATHEMATICS A LEVEL

Overall Intent:
In year 13, students continue to prepare for the Edexcel A-level Mathematics which incorporate Pure Maths, Statistics and Mechanics. The year 13 curriculum builds on the skills, knowledge and understanding from higher tier GCSE and from the first year of the A-Level course. Through their study, students will be able to demonstrate the knowledge and skills of mathematical argument, language and proof, mathematical problem solving and mathematical modelling. These will be applied, along with associated mathematical thinking and understanding, across the following topic areas: proof; algebra and functions; coordinate geometry in the (x,y) plane; sequences and series; trigonometry; exponentials and logarithms; differentiation; integration; numerical methods; vectors; data; statistical distributions; statistical hypothesis testing; regression; quantities and units in mechanics; kinematics; forces and Newton's laws; moments, projectiles. Many of these topic areas were first encountered in year 12; in year 13 students will further develop their expertise.

Y13 A Level		Topic	Knowledge	Skills	Assessment
AUTUMN TERM 1	PURE BOOK 2	Algebraic Methods	Factorise quadratic expressions Simplify algebraic fractions Use algebra to perform simple proof of mathematical statements	Use proof by contradiction to prove statements Multiply and divide two or more algebraic fractions Add or subtract two or more algebraic fractions Convert an expression with linear factors in the denominator into partial fractions Convert an expression with repeated linear factors in the denominator into partial fractions Divide algebraic expressions Convert an improper fraction into partial fraction form	
		Sequences and Series	Identify term to term rules for arithmetic and geometric sequences Use logarithms to solve equations of the type $a^x = b$ Find the nth term of an arithmetic sequence Prove and use the formula for the sum of the first n terms of an arithmetic series	Find the nth term of a geometric sequence Prove and use the formula for the sum of a finite geometric series Prove and use the formula for the sum to infinity of convergent geometric series Use sigma notation to describe series Generate sequences from recurrence relations Model real-life situations with sequences and series	

					AP1
		Trigonometric Functions	Solve simple trig equations by sketching graphs Prove simple trig identities Solve trigonometric equations in radians	Understand the definitions of secant, cosecant and cotangent and their relationship to cosine, sine and tangent Understand the graphs of secant, cosecant and cotangent and their domain and range Simplify expressions, prove simple identities and solve equations involving secant, cosecant and cotangent Prove and use sec2x ≡ 1 + tan2x and cosec2x ≡ 1 + cot2x Understand and use inverse trigonometric functions and their domains and ranges	AP1
	PURE BOOK 2	**Functions and Graphs**	Rearrange formulae to change the subject Simplify algebraic expressions involving expanding brackets, factorising and performing operations on fractions Sketch graphs of different types (e.g. exponential, cubic, trig) and identify intersection of axes Understand and use function notation	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 the modulus function $y = |f(x)|$ and $y = f(|x|)$ Apply a combination of two (or more) transformations to the same curve Transform the modulus function	
		Numerical methods	Understand and use function notation Find inverse functions, including exponentials, logarithms and trig Use recurrence relations to find terms in a sequence	Locate roots of f(x) = 0 by considering changes of sign Use iteration to find an approximation to the root of the equation f(x) = 0 Use the Newton-Raphson procedure to find approximations to the solutions of equations of the form f(x) = 0 Use numerical methods to solve problems in context	
		Trigonometry and modelling	Use exact values of trig ratios for angles in radians Prove trig identities involving secant, cosecant and cotangent	Prove and use the addition formulae Understand and use the double-angle formulae Solve trigonometric equations using the double-angle and addition formulae Write expressions of the form $a\cos\theta \pm b\sin\theta$ in the form $R\cos(\theta \pm \alpha)$ or $R\sin(\theta \pm \alpha)$ Prove trigonometric identities using a variety of identities Use trigonometric functions to model real-life situations	

AUTUMN TERM 2	**PURE BOOK 2**	**Parametric Equations**	Rearrange equations to change the subject Identify the ranges of functions Use coordinate geometry and equations of circles to find points of intersection between lines and circles	Convert parametric equations into Cartesian form by substitution Convert parametric equations into Cartesian form using trigonometric identities Understand and use parametric equations of curves and sketch parametric curves Solve coordinate geometry problems involving parametric equations Use parametric equations in modelling a variety of contexts	
	STATISTICS BOOK 2	**The normal distribution**	Understand and use simple discrete probability distributions to calculate probabilities Understand the binomial distribution and calculate probabilities	Understand the normal distribution and the characteristics of a normal distribution curve Find percentage points on a standard normal curve Calculate values on a standard normal curve Find unknown means and/or standard deviations for a normal distribution Approximate a binomial distribution using a normal distribution Select appropriate distributions and solve real-life problems in context Carry out a hypothesis test for the mean of a normal distribution	
	MECHANICS BOOK 2	**Forces and friction**	Use and apply Newton's Laws with vectors Use trigonometry to calculate angles	Resolve forces into components Solve problems involving smooth or rough inclined planes Understand friction and the coefficient of friction Use $F \leq \mu R$	AP2
		Projectiles	Use 'suvat' equations Use trigonometry Given tan x as a fraction, work out sin x and cos x	Model motion under gravity for an object projected horizontally Resolve velocity into components Solve problems involving particles projected at an angle Derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile	

	PURE BOOK 2	Integration	Differentiate and integrate polynomials Use limits to find definite integrals of polynomials Use integration to find the area under a curve, between limits, for polynomial functions	Integrate standard mathematical functions including trigonometric and exponential functions and use the reverse of the chain rule to integrate functions of the form f(ax + b) Use trigonometric identities in integration Use the reverse of the chain rule to integrate more complex functions Integrate functions by making a substitution, using integration by parts and using partial fractions Use integration to find the area under a curve Use the trapezium rule to approximate the area under a curve Solve simple differential equations and model real-life situations with differential equations	
SPRINBG TERM 1	STATISTICS BOOK 2	Regression, Correlation and	Use logarithms to convert a non-linear equation of the form y = ab^x into the form of a linear equation (y = mx + c form) so that straight line can be plotted and interpreted. From pure maths year 1.	Understand exponential models in bivariate data Use a change of variables to estimate coefficients in an exponential model Understand and calculate the product moment correlation coefficient Carry out a hypothesis test for zero correlation	AP3
	MECHANICS BOOK 2	Applications of forces	Know and understand moments Know and understand forces and friction	Find an unknown force when a system is in equilibrium Solve statics problems involving weight, tension and pulleys Understand and solve problems involving limiting equilibrium Solve problems involving motion on a rough or smooth inclined plane Solve problems involving connected particles that require the resolution of forces	
SPRING TERM 2	STATISTICS BOOK 2	Conditional probability	Draw Venn diagrams and use probability notation to represent different probabilities and outcomes. Calculate probabilities for mutually exclusive and independent events Draw and use probability tree diagrams	Understand set notation in probability Understand conditional probability Solve conditional probability problems using two-way tables and Venn diagrams Use probability formulae to solve problems Solve conditional probability using tree diagrams	

	MECHANICS BOOK 2	Further Kinematics	Be able to differentiate and integrate Be able to add and subtract vectors and work out a unit vector Apply 'suvat equations'	Work with vectors for displacement, velocity and acceleration when using vector equations of motion Use calculus with harder functions of time involving variable acceleration Differentiate and integrate vectors with respect to time	
	PURE BOOK 2	Vectors	Represent 2D vectors as column vectors as well as **i** and **j** form Multiply vectors by scalars, add and subtract vectors Find the magnitude of vectors and work out unit vectors Solve geometric problems involving 2D vectors and position vectors	Understand 3D Cartesian coordinates Use vectors in three dimensions Use vectors to solve geometric problems Model 3D motion I mechanics with vectors	AP4
SUMMER TERM 1			Revision		External A Level Exams