Year: 13 **Subject:** **Maths A level**	**Curriculum Intent:** Students will understand mathematics and mathematical processes in a way that promotes confidence, fosters enjoyment and provides a strong foundation for progress to further study. Students to build on their year 12 foundations as they tackle the more complex challenges of the course. The course continues with pure, statistics and mechanics content, wuth a larger focus on modelling and problem solving. All assessments will be graded A* to E depending on a percentage grade boundary based on the exam grade boundaries from 2019.					
	Term 1		**Term 2**			
Topic Titles (in order of delivery)	1. Proof 2. Functions 3. Further Transformations 4. Probability 5. Normal Distribution	1. Differentiation 2. Further Integration 3. Further Calculus and Parametrics 4. Differential Equations	1. Hypothesis Testing 2. Numerical Solutions 3. Numerical Integration 4. Further Hypothesis	1. Further Vectors 2. Forces on a slope 3. Moments 4. Projectiles	1. Review and Revise	1. Review and Revise
Key knowledge / Retrieval topics	1. **Proof**: • Understand and be able to use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion. • Be able to show disproof by counter example. • Understand and be able to use proof by contradiction. 2. **Functions**: • Understand the effect of combinations of transformations on the graph of $y = f(x)$ including sketching associated graphs, describing transformations and	1. **Differentiation**: • Be able to differentiate using the product rule and the quotient rule. • Be able to differentiate using the chain rule, including problems involving connected rates of change and inverse functions. **2. Further Integration:** • Be able to integrate e^{kx}, $\frac{1}{x}$, $\sin k\,x$, $\cos k\,x$ and related sums, differences and constant multiples. • Be able to use a definite integral to find the area between two curves.	1. **Hypothesis Testing**: • Understand and be able to use 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. • Be able to conduct a statistical hypothesis test for the proportion in	1. **Further Vectors**: • Be able to use vectors to solve problems in kinematics. • Be able to extend the constant acceleration formulae to motion in two dimensions using vectors: $\boldsymbol{v} = \boldsymbol{u} + \boldsymbol{a}t$ $\boldsymbol{s} = \boldsymbol{u}t + \frac{1}{2}\boldsymbol{a}t^2$ $\boldsymbol{s} = \frac{1}{2}(\boldsymbol{u} + \boldsymbol{v})t$ $\boldsymbol{s} = \boldsymbol{v}t - \frac{1}{2}\boldsymbol{a}t^2$ • Be able to extend the application of differentiation and integration to two	1.	1.

	finding relevant equations. • Understand and be able to use inverse functions and their graphs, and composite functions. Know the condition for the inverse function to exist and be able to find the inverse of a function either graphically, by reflection in the line $y = x$, or algebraically. • Be able to use functions in modelling. • Be able to sketch the graph of the modulus of a linear function involving a single modulus sign. • Be able to sketch the graph of the modulus of a linear function involving a single modulus sign. • Understand and be able to use the definition of a function. Understand and be able to use the modulus function, including the notation $\|x\|$, and use relations such as $\|a\| = \|b\| \Leftrightarrow a^2 = b^2$ and $\|x - a\| < b \Leftrightarrow a - b < x < a + b$ in the course of solving equations and inequalities. 3. **Further Transformations**: • Understand the effect of simple transformations on the graph of $y =$	• Be able to carry out simple cases of integration by substitution. • Be able to carry out simple cases of integration by parts. • Be able to integrate functions using partial fractions that have linear terms in the denominator. **3. Further Calculus and Parametrics:** • Understand and be able to use the second derivative in connection to convex and concave sections of curves and points of inflection. • Be able to apply differentiation to find points of inflection on a curve. • Understand and be able to use the parametric equations of curves and be able to convert between cartesian and parametric forms. • Be able to differentiate simple functions and relations defined parametrically for the first derivative only. • Be able to use parametric equations in modelling in a variety of contexts.	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. **2. Numerical Solutions:** • Be able to locate roots of $f(x) = 0$ by considering changes of sign of $f(x)$ in an interval of x on which $f(x)$ is sufficiently well-behaved. • Understand how change of sign methods can fail. • Be able to solve equations approximately using simple iterative methods and be able to draw associated cobweb and staircase diagrams. • Be able to solve equations using the Newton-Raphson method and other recurrence	dimensions using vectors: $x = f(t)\,i + g(t)\,j$ $v = \frac{dx}{dt} = \dot{x}$ $= f'(t)i + g'(t)j$ $a = \frac{dv}{dt} = \dot{v} = \frac{d^2x}{dt^2}$ $= f''(t)i + g''(t)$ $x = \int v dt$ and $v = \int a dt$ • Be able to model motion under gravity in a vertical plane using vectors where $a = \begin{pmatrix} 0 \\ -g \end{pmatrix}$ or $a = -gj$. 2. **Forces on a slope**: • Be able to extend use of Newton's second law to situations where forces need to be resolved (restricted to two dimensions). • Be able to extend use of Newton's third law to situations where forces need to be resolved (restricted to two dimensions). • Be able to use the principle that a particle is in equilibrium if and only if the sum of		

	$f(x)$ including sketching associated graphs, describing transformations and finding relevant equations: $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$ and $y = f(ax)$, for any real a. 4. **Sequences and Series**: • Be able to work with sequences including those given by a formula for the nth term and those generated by a simple relation of the form $x_{n+1} = f(x_n)$. • Understand the meaning of and work with increasing sequences, decreasing sequences and periodic sequences. • Understand and be able to use sigma notation for sums of series. • Understand and be able to work with arithmetic sequences and series, including the formulae for the nth term and the sum to n terms. • Understand and be able to work with geometric sequences and series including the formulae for the nth term and the sum of a finite geometric series. • Understand and be able to work with the sum to	**4. Differential Equations:** • Be able to construct simple differential equations in pure mathematics and in context (contexts may include kinematics, population growth and modelling the relationship between price and demand). • Be able to evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions. • Be able to interpret the solution of a differential equation in the context of solving a problem, including identifying limitations of the solution.	relations of the form $x_{n+1} = g(x_n)$. 3. Understand and be able to show how such methods can fail. 4. **Numerical Integration**: 5. Understand and be able to use integration as the limit of a sum. 6. Understand and be able to use numerical integration of functions, including the use of the trapezium rule, and estimating the approximate area under a curve and the limits that it must lie between. 7. **Further Hypothesis**: • Be able to select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or normal model may not be appropriate. • Recognise that a sample mean, $\bar{X}$, can be regarded as a random variable	the resolved parts in a given direction is zero • Be able to resolve forces for more advanced problems involving connected particles and smooth pulleys. • Understand the term 'resultant' as applied to two or more forces acting at a point and be able to use vector addition in solving problems involving resultants and components of forces. • Be able to solve problems involving the dynamics of motion for a particle moving in a plane under the action of a force or forces. • Be able to represent the contact force between two rough surfaces by two components (the 'normal' contact force and the 'frictional' contact force). • Understand and be able to use the coefficient of friction and the		

	infinity of a convergent geometric series, including the use of $\|r\| < 1$ and the use of modulus notation in the condition for convergence. • Be able to use sequences and series in modelling. 5. **Probability**: • Understand and be able to use conditional probability, including the use of tree diagrams, Venn diagrams and two-way tables. • Understand the concept of conditional probability and calculate it from first principles in given contexts. • Be able to model with probability, including critiquing assumptions made and the likely effect of more realistic assumptions. 6. **Normal Distribution**: • Know and be able to use the formulae $\mu = np$ and $\sigma^2 = npq$ when choosing a particular normal model to use as an approximation to a binomial model. • Understand and be able to use the normal distribution as a model. • Be able to find probabilities using the normal distribution,		• Be able to conduct a statistical hypothesis test for the mean of a normal distribution with known, given or assumed variance and interpret the results in context. • Understand Pearson's product-moment correlation coefficient as a measure of how close data points lie to a straight line. • Use and be able to interpret Pearson's product-moment correlation coefficient in hypothesis tests, using either a given critical value or a p-value and a table of critical values.	$F \leq \mu R$ model of friction in one and two dimensions, including the concept of limiting friction. • Understand and be able to solve problems regarding the static equilibrium of a body on a rough surface and solve problems regarding limiting equilibrium. • Understand and be able to solve problems regarding the motion of a body on a rough surface. 3. **Moments**: • Understand and be able to use the unit for moment (N m). • Be able to calculate the moment of a force about an axis through a point in the plane of the body. • Understand that when a rigid body is in equilibrium the resultant moment is zero and the resultant force is zero. • Be able to use moments in simple static contexts. 4. **Projectiles**:		

	using appropriate calculator functions. • Understand links to histograms, mean and standard deviation.			• Be able to model the motion of a projectile as a particle moving with constant acceleration and understand the limitation of this model.		
Understanding / Sequence of delivery	1. Building on prior knowledge and making connections between topics.					
Assessment	End of Topic Assessed Homework Exam Style Questions Grade Boundaries based on A Level 2019		End of Topic Assessed Homework and Practice Papers Exam Style Questions Grade Boundaries based on A Level 2019		Practice Papers Grade Boundaries based on A Level 2019	
	POP Test Past Exam Questions Grade Boundaries based on A Level 2019		PPE Past Exam Questions Grade Boundaries based on A Level 2019		A Level Exams	