Curriculum Map: A Level Mathematics

YEAR 13

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Content Declarative knowledge 'I Know'	**Trigonometry** Identities involving $\cot^2\theta$, $\sec^2\theta$ and $\text{cosec}^2\theta$ Understand the definitions of arcsin, arccos and arctan; understand their graphs, their ranges and domains **Differentiation** The derivatives of $\sin x$, $\cos x$ and $\tan x$. The derivative of $\ln x$ The definition of concave and convex What a point of inflection is **Sequences** Increasing, decreasing and periodic sequences Notation for terms such as u_1 Sigma notation for sums of series Formulae for the nth term of an A.P. and a G.P. Formulae for the sum to n terms of an A.P. and a G.P. Sum to infinity of a convergent G.P.	**Compound angles and harmonic form** Double angle formulae and formulae for $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$; geometrical proofs of these formulae Expressions for $a\cos\theta + b\sin\theta$ in the equivalent forms of $r\cos(\theta \pm \alpha)$ or $r\sin(\theta \pm \alpha)$ **Algebraic fractions and Partial fractions** Algebraic division The factor theorem and remainder theorem for division by expressions of the form $(ax + b)$ Partial fractions **Numerical Methods** What the change of sign method is What iteration, convergence and divergence are What the Newton-Raphson method is What a cobweb or staircase diagram is What numerical integration is	**Differential equations** What a differential equation is What it means to solve a differential equation What the separation of variables is What a general solution is What a particular solution is **Parametric and implicit functions** What a parametric equation is What an implicit function is **Proof** What proof by contradiction entails **Probability** What conditional probability is The conditional probability formula $\text{P}(A\|B) = \frac{\text{P}(A \cap B)}{\text{P}(B)}$	**Kinematics in Two Dimensions** 3D column vectors and **i**, **j**, **k** notation Suitable assumptions to make when modelling projectile motion Differentiation and integration techniques from pure mathematics **Equilibrium and Resolving Forces** What it means to resolve a force into components What coplanar forces are Newton's Second Law for motion in situations where forces need to be resolved in 2D **Statistical Distributions** The criteria for, and properties of, the Normal distribution	**Moments** What moments are The S.I. units (Nm) for moments What the centre of mass is What a lamina is The centre of mass of uniform beams and rectangular laminae can be determined by symmetry **Statistical Hypothesis Testing** The correlation coefficient Statistical hypothesis tests for the mean of a Normal distribution with known, given or assumed variance. **Revision for public exams**	**Public examinations**

	Integration The integral of $sin\ x, cos\ x$ and $\frac{1}{x}$ A number of integration techniques, including integration by parts and integration by substitution	What an ordinate is Lower and upper limits for the approximate area under a curve **Binomial Expansion** The binomial theorem for any rational n	**PPE Revision** Revisiting content and techniques covered previously to refresh and deepen understanding			
Skills Procedural Knowledge 'I know how to'	**Trigonometry** Solve equations involving radians and/or sec θ, cosec θ and cot θ, using identities when necessary Produce graphs of arccos, arcsin and arctan by reflection in $y = x$ Produce exact values for sec, cosec and cot of key angles Apply simple transformations to graphs of sec, cosec and cot, arccos, arcsin and arctan **Differentiation** Differentiate e^{kx} and a^{kx}, $sin\ kx$, $cos\ kx$, $tan\ kx$ and ln x and related sums, differences and constant multiples Use the product rule, the quotient rule and the chain rule Find convex and concave sections of curves and points of inflection	**Compound angles and harmonic form** Use the addition formulae, for instance to derive the double angle formulae Use the double angle formulae to solve equations and within integration Use harmonic form to solve equations or describe features of the resulting wave function Construct proofs involving trigonometric functions and identities Use trigonometric identities to integrate trigonometric functions such as sin^2x **Algebraic fractions and Partial fractions** Simplify rational expressions including by factorising and cancelling, and algebraic division	**Differential equations** Construct simple differential equations in pure mathematics and in context Evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions Interpret the solution of a differential equation in the context of solving a problem **Parametric and implicit functions** Convert between Cartesian and Parametric forms Differentiate functions and relations defined parametrically or implicitly **Proof** Proof by contradiction (including the proof of the irrationality of √2 and proof of the infinity of primes)	**Kinematics in Two Dimensions** Derive and use the formulae for constant acceleration for motion in 2D using vectors Use calculus in kinematics for motion in 2D using vectors Model motion under gravity in a vertical plane using vectors Calculate with projectiles **Equilibrium and Resolving Forces** Resolve forces in 2D and use Newton's Second Law for motion e.g. on an inclined plane Resolve forces in 2D to analyse equilibrium of a particle under coplanar forces **Statistical Distributions** Find probabilities using the Normal distribution	**Moments** Answer questions in which forces act in perpendicular directions Calculate clockwise, anticlockwise and resultant moments **Statistical Hypothesis Testing** Apply correlation coefficients as measures of how close data points lie to a straight line Interpret a given correlation coefficient using a given p-value or critical value Conduct a statistical hypothesis test for the mean of a Normal distribution with known, given or assumed variance and interpret the results in context **Revision**	**Public examinations**

	Find the derivative of inverse functions **Sequences** Work with sequences including those given by a formula for the nth term and those generated by a simple relation of the form $x_{n+1} = f(x_n)$ Work with sigma notation for sums of series Work with arithmetic and geometric sequences and series Find a limit, L **Integration** Integrate e^{kx}, $\frac{1}{x}$, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples Use a definite integral to find the area between two curves Carry out cases of integration by substitution and integration by parts; understand these methods as the inverse processes of the chain and product rules respectively	Use the factor and remainder theorem Decompose rational functions into partial fractions Integrate functions that have been decomposed into partial fractions **Numerical Methods** Locate roots of $f(x) = 0$ by considering changes of sign Rearrange an equation to an iterative form Solve equations approximately using simple iterative methods Draw associated cobweb and staircase diagrams Solve equations using the Newton-Raphson method and other recurrence relations of the form $x_{n+1} = g(x_n)$ Use the trapezium rule Determine graphically whether an approximation over- or under-estimates the area under a curve Improve an approximation by increasing the number of ordinates or strips used in numerical integration	**Probability** Use conditional probability, including the use of tree diagrams, Venn diagrams, two-way tables Use the conditional probability formula $\mathrm{P}(A\|B) = \frac{\mathrm{P}(A \cap B)}{\mathrm{P}(B)}$ Model with probability, critiquing the assumptions made and the likely effect of more realistic assumptions **PPE Revision** Apply content and techniques covered previously to practice exam questions	Link the Normal distribution to histograms, mean, standard deviation, points of inflection and the binomial distribution		

		Binomial Expansion Expand binomials raised to rational and negative powers. Use Binomial expansions for approximation				
Strategies Conditional Knowledge 'I know when to'	**Trigonometry** Use trigonometric identities to rewrite the integrand Select appropriate steps in trigonometric proofs **Sequences** When to evaluate a result on the calculator and when to provide an exact form When a sum to infinity can be found Use sequences and series in modelling, for instance with compound interest **Differentiation** When to use the product rule, the quotient rule, the chain rule and combinations of these in differentiation problems Apply differentiation to find points of inflection and concave and convex sections of curves. Apply differentiation to problems involving connected rates of change	**Compound angles and harmonic form** Use trigonometric identities within proof and integration **Algebraic fractions and Partial fractions** When to use substitution or a comparing coefficients techniques, or a combination of these, to decompose rational functions into partial fractions. When to apply the factor theorem and remainder theorem to a range of problems Decompose rational functions into partial fractions in order to integrate them **Numerical Methods** When change of sign methods can fail When the Newton-Raphson method may fail **Binomial Expansion** When the expansion is valid and why	**Differential equations** Consider limitations and refinements to the models and solutions **Parametric and Implicit functions** When to use implicit and parametric differentiation techniques. **Probability** When to draw tree diagrams, Venn diagrams or two-way tables to assist in probability problems When to simplify problems or make assumptions in order to use probability rules and formulae **PPE Revision** Determining which content is relevant and which strategies will be efficient and effective for a given question	**Kinematics in Two Dimensions** Select appropriate techniques for solving a problem in up to 3D in kinematics, for instance using vectors and trigonometric functions Use vectors and trigonometric identities to solve projectile motion problems If appropriate when making calculations about projectile motion, select one solution from a quadratic equation and justify the rejection of the other value **Statistical Distributions** Use the Normal distribution as a model. Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when a Binomial or Normal model may not be appropriate	**Statistical Hypothesis Testing** When to use Normal probabilities in statistical hypothesis tests. When to use the standard error of the mean in hypothesis tests **Revision**	**Public examinations**

	Integration Integrate by substitution, integrate by parts or integrate by inspection.					
Key Questions	Questions will use the following question stems to assess the understanding of the content above: Evaluate… Find… Simplify… Express in the form… Solve… Sketch… Justify… Prove that… State your modelling assumptions.	Questions will use the following question stems to assess the understanding of the content above: Evaluate… Find… Simplify… Express in the form… Solve… Sketch… Justify… Prove that…	Questions will use the following question stems to assess the understanding of the content above: Evaluate… Find… Simplify… Express in the form… Solve… Sketch… Justify… Prove that… State your modelling assumptions.	Questions will use the following question stems to assess the understanding of the content above: Evaluate… Find… Simplify… Express in the form… Solve… Sketch… Justify… Prove that… State your modelling assumptions.	Questions will use the following question stems to assess the understanding of the content above: Evaluate… Find… Simplify… Express in the form… Solve… Sketch… Justify… Prove that… State your modelling assumptions.	
Assessment topics	PPE retests (Sept) if needed Topic testing (‘10^{th} lesson testing’) each fortnight	Topic testing (‘10^{th} lesson testing’) each fortnight	Topic testing (‘10^{th} lesson testing) each fortnight	Testing A level Pure Mathematics during PPE fortnight	Final testing prior to public examinations in Pure Mathematics, Statistics and Mechanics	
Cross curricular links/ Character Education	Links to Business and Economics (compound interest) Links to Science and Engineering (differentiation and integration) Aspiration and Challenge, Persistence and Resilience, Initiative and Confidence, Communication and Mutual Support	Links to Science (wave forms and equation solving) Aspiration and Challenge, Persistence and Resilience, Initiative and Confidence, Communication and Mutual Support	Links to Science, Economics and Business (probability) Science (differential equations and probability) Aspiration and Challenge, Persistence and Resilience, Initiative and Confidence, Communication and Mutual Support	Links to Science, Psychology, Economics, Business and Geography (statistical distributions) Links to Science (kinematics and forces) Aspiration and Challenge, Persistence and Resilience, Initiative and Confidence, Communication and Mutual Support	Links to Science, Psychology and Geography (hypothesis testing) Links to Science and Design (centres of mass and moments) Aspiration and Challenge, Persistence and Resilience, Initiative and Confidence, Communication and Mutual Support	