Year: 12 **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 understanding of GCSE maths topics, especially algebra in the first term in order to develop solid foundatons for the more challenging topics in year 13. During year 12 students will be introduced to statistical techniques involving probability and hypothesis testing, and to basic mechanics involving kinematics and forces. Throughout the year students will develop their use of mathematical language and learn to produce work with sufficently detailed solutions. As each new topic is met, links to previous topics will be met as the students build upon this knowledge to solve more complex problems. All assessments will be graded A* to E depending on a percentage grade boundary based on the exam grade boundaries from 2019 and 2022					
	Term 1		**Term 2**		**Term 3**	
Topic Titles (in order of delivery)	1. Indices and Surds 2. Quadratics 3. Polynomials 4. Graphs 5. Coordinate Geometry	1. Kinematics 1 2. SUVAT 3. Vectors 4. Forces and Motion 5. Connected Particles	1. Working With Data 2. Binomial Expansion 3. Probability 4. Hypothesis Testing 5. Trigonometry	1. Differentiation 2. Integration 3. Kinematics 2 4. Logarithms 5. Exponential Models	1. Radian Measure 2. Further Trigonometry 3. Functions 4. Further Transformations	1. Rational Functions 2. General Binomial Expansion 3. Triangle Geometry 4. Radian Measure Cont. 5. Calculus of Exponential and Trig Functions
Key knowledge / Retrieval topics	1. **Indices and Surds**: • Understand and be able to use the laws of indices for all rational exponents. • Be able to use and manipulate surds, including rationalising the denominator. 2. **Quadratics**: • Be able to work with quadratic functions and their	**1. Kinematics 1** • Understand and be able to use the language of kinematics: position, displacement, distance, distance travelled, velocity, speed, acceleration, equation of motion 2. **SUVAT**: • Understand and be able to use the fundamental quantities and units	1. **Working with Data**: • Understand and be able to use the terms 'population' and 'sample'. • Be able to use samples to make informal inferences about the population. • Understand and be able to use sampling techniques,	**1. Differentiation**: • Understand and be able to 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) . • Be able to show differentiation from first principles for small positive integer powers of x.	**1. Radian Measure**: • Be able to work with radian measure, including use for arc length and area of sector. • Know and be able to use exact values of $sin\,\theta$ and $cos\,\theta$ for $\theta = 0, \frac{1}{6}\pi, \frac{1}{4}\pi, \frac{1}{3}\pi, \pi$ and multiples thereof., and exact values of $tan\,\theta$ for $\theta = 0, \frac{1}{6}\pi, \frac{1}{4}\pi, \frac{1}{3}\pi, \pi$ and multiples thereof.	• **Rational Functions**: • Be able to 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) • **General Binomial Expansion**:

	graphs, and the discriminant • Be able to complete the square of the quadratic polynomial • $ax^2 + bx + c$. • Be able to solve quadratic equations including quadratic equations in a function of the unknown. • Be able to solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions. • Be able to express solutions through correct use of 'and' and 'or', or through set notation. • Be able to represent linear and quadratic inequalities such as $y > x + 1$ and $y > ax^2 + bx + c$ graphically. 3. **Polynomials**: • Be able to manipulate polynomials algebraically.	in the S.I. system: length (in metres), time (in seconds), mass (in kilograms). • Understand and be able to use derived quantities and units: velocity (m/s or m s^{-1}), acceleration (m/s^2 or m s^{-2}), force (N), weight (N). 3. Understand, use and derive the formulae for constant acceleration for motion in a straight line: $v = u + at$ $s = ut + \frac{1}{2}at^2$ $s = \frac{1}{2}(u + v)t$ $v^2 = u^2 + 2as$ $s = vt - \frac{1}{2}at^2$ 4. **Vectors**: • Be able to use vectors in two dimensions. • Be able to calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form. • Be able to add vectors diagrammatically and perform the algebraic operations	including simple random sampling and opportunity sampling. • Be able to 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. • Be able to interpret tables and diagrams for single-variable data. • Understand that area in a histogram represents frequency • Be able to interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagrams which include distinct sections of the population. • Be able to understand informal interpretation of correlation. • Be able to understand that correlation does	• Be able to differentiate x^n, for rational values of *n*, and related constant multiples, sums and differences. • Understand and be able to use the gradient of the tangent at a point where $x = a$as: • the limit of the gradient of a chord as *x* tends to *a* • a rate of change of *y* with respect to *x*. • Understand and be able to sketch the gradient function for a given curve. • Be able to identify where functions are increasing or decreasing. • Understand and be able to find second derivatives. • Understand and be able to use the second derivative as the rate of change of gradient. • Be able to apply differentiation to find the gradient at a point on a curve and the equations of tangents and normals to a curve.	**2. Further Trigonometry**: • Understand and be able to use the definitions of secant ($sec\,\theta$), cosecant ($cosec\,\theta$) and cotangent($cot\,\theta$) and of $arcsin\,\theta$, arc $cos\,\theta$ and $arctan\,\theta$ and their relationships to $sin\,\theta$, $cos\,\theta$ and $tan\,\theta$ respectively. • Understand the graphs of the trigonometric functions and determine their ranges and domains. • Understand and be able to use $sec^2\,\theta \equiv 1 + tan^2\,\theta$ and $\text{cosec}^2\theta \equiv 1 + cot^2\,\theta$ • Understand and be able to use double angle formulae and the formulae for $sin(A \pm B)$, $cos(A \pm B)$ and $tan(A \pm B)$. • Understand the geometrical proofs of these formulae. • Understand and be able to use expressions for $a\,cos\,\theta + b\,sin\,\theta$ in the equivalent forms of $R\,cos(\theta \pm \alpha)$ or $R\,sin(\theta \pm \alpha)$. • Be able to construct proofs involving trigonometric	• Be able to extend the binomial expansion of $(a + bx)^n$ to any rational n, including its use for approximation. • Know that the expansion is valid for $\left\|\frac{bx}{a}\right\| < 1$. • **Triangle Geometry**: • Understand and be able to use the sine and cosine rules. • Understand and be able to use the area of a triangle in the form $\frac{1}{2}ab\,sin\,C$ • **Radian Measure cont.**: • Understand and be able to use the standard small angle approximations of sine, cosine and tangent: $sin\,\theta \approx \theta$, $cos\,\theta \approx 1 - \frac{1}{2}\theta^2$, $tan\,\theta \approx \theta$, where θ is in radians • **Calculus of exponential and trig functions:** • Be able to differentiate e^{kx} and a^{kx}, and related sums,

	• Be able to simplify rational expressions. 4. **Graphs**: • Understand and be able to use graphs of functions. • Be able to sketch curves defined by simple equations including polynomials. • Be able to sketch curves defined by $y = \frac{a}{x}$ and $y = \frac{a}{x^2}$ (including their vertical and horizontal asymptotes). • Be able to interpret the algebraic solution of equations graphically. • Be able to use intersection points of graphs to solve equations. • Understand and be able to use proportional relationships and their graphs. 5. **Coordinate Geometry**: • Understand and be able to use the equation of a straight line, including the forms $y = mx + c$, $y - y_1 = m(x - x_1)$	of vector addition and multiplication by scalars and understand their geometrical interpretations. • Understand and be able to use position vectors. • Be able to calculate the distance between two points represented by position vectors. • Be able to use vectors to solve problems in pure mathematics and in context, including forces. • Further Vectors: • Be able to use vectors in three dimensions. **5. Forces and Motion:** • Understand the concept and vector nature of a force. • Understand and be able to use Newton's first law. • Understand and be able to use Newton's second law ($F = ma$) for motion in a straight line for bodies of constant mass moving under the action of constant forces.	not imply causation. • Be able to calculate and interpret measures of central tendency and variation, including mean, median, mode, percentile, quartile, inter-quartile range, standard deviation and variance. • Be able to calculate mean and standard deviation from a list of data, from summary statistics or from a frequency distribution, using calculator statistical functions. • Recognise and be able to interpret possible outliers in data sets and statistical diagrams. • Be able to select or critique data presentation techniques in the context of a statistical problem. • Be able to clean data, including dealing with missing data, errors and outliers. 2. **Binomial Expansion**: • Understand and be able to use the	• Be able to apply differentiation to find and classify stationary points on a curve as either maxima or minima. **2. Integration**: • Know and be able to use the fundamental theorem of calculus. • Be able to integrate x^n where $n \neq -1$ and related sums, differences and constant multiples. • Be able to evaluate definite integrals. • Be able to use a definite integral to find the area between a curve and the x-axis. 6. **Kinematics 2**: • Understand, use and interpret graphs in kinematics for motion in a straight line. • Be able to interpret displacement-time and velocity-time graphs, and in particular understand and be able to use the facts that the gradient of a displacement-time graph represents	functions and identities. • Be able to use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces. **3. Functions**: • Understand the effect of combinations of transformations on the graph of $y = f(x)$ including sketching associated graphs, describing transformations and 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	differences and constant multiples.. • Be able to differentiate $\sin k\,x$, $\cos k\,x$, $\tan k\,x$ and related sums, differences and constant multiples. • Be able to show differentiation from first principles for $\sin x$ and $\cos x$. • Understand and be able to use the derivative of $\ln x$

	and $ax + by + c = 0$ • Be able to use the gradient conditions for two straight lines to be parallel or perpendicular. • Be able to use straight line models in a variety of contexts. • Understand and be able to use the coordinate geometry of a circle including using the equation of a circle in the form $(x-a)^2 + (y-b)^2 = r^2$ • Be able to complete the square to find the centre and radius of a circle. • Be able to use the following circle properties in the context of problems in coordinate geometry: ➢ the angle in a semicircle is a right angle, ➢ the perpendicular from the centre of a circle to a chord bisects the chord, ➢ the radius of a circle at a given point on its circumference is perpendicular to	• Understand and be able to use Newton's second law ($F = ma$) in simple cases of forces given as two dimensional vectors. • Understand and be able to use the weight ($W = mg$) of a body to model the motion in a straight line under gravity. • Understand the gravitational acceleration, g, and its value in S.I. units to varying degrees of accuracy. • Understand and be able to use Newton's third law. • Understand and be able to use the concept of a normal reaction force • Be able to use the model of a 'smooth' contact and understand the limitations of the model. • Understand the concept of a frictional force and be able to apply it in contexts where the force is given in vector or component form, or the magnitude and	binomial expansion of $(a + bx)^n$ for positive integer n and the notations $n!$ and ${}^nC_r$, ${}_nC_r$ or $\binom{n}{r}$, with ${}^nC_0 = {}^nC_n = 1$. Understand and know the link to binomial probabilities. 3. **Probability**: • Understand and be able to use mutually exclusive and independent events when calculating probabilities. • Be able to use appropriate diagrams to assist in the calculation of probabilities. • Understand and be able to use simple, finite, discrete probability distributions, defined in the form of a table or a formula such as: $P(X = x) = 0.05x(x + 1)$ for $x = 1,2,3$. • Understand and be able to use the binomial distribution as a model • Be able to calculate probabilities using the binomial	the velocity, the gradient of a velocity-time graph represents the acceleration, and the area between the graph and the time axis for a velocity-time graph represents the displacement. • Be able to use differentiation and integration with respect to time in one dimension to solve simple problems concerning the displacement, velocity and acceleration of a particle: $v = \frac{ds}{dt}$ $a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$ $s = \int v dt$ and $v = \int a dt$ 7. **Logarithms**: • Know and use the definition of $log_a x$ (for $x > 0$) as the inverse of a^x (for all x), where $a$is positive. • Understand and be able to use the laws of logarithms:	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. **4. Further Transformations**: • Understand the effect of simple transformations on the graph of $y = f(x)$ 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.	

	the tangent to the circle at that point. ➢ the angle in a semicircle is a right angle, ➢ the perpendicular from the centre of a circle to a chord bisects the chord, ➢ the radius of a circle at a given point on its circumference is perpendicular to the tangent to the circle at that point.	direction of the force are given. 6. **Connected Particles**: • Be able to use the concept of equilibrium together with one dimensional motion in a straight line to solve problems that involve connected particles and smooth pulleys. • Be able to solve problems involving simple cases of equilibrium of forces on a particle in two dimensions using vectors, including connected particles and smooth pulleys.	distribution, using appropriate calculator functions. 4. **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 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. 5. **Trigonometry**:	$log_a x + log_a y = log_a(xy)$ $log_a x - log_a y = log_a\left(\frac{x}{y}\right)$ $k\, log_a x = log_a x^k$ (including, for example, $k = -1$ and $k = -\frac{1}{2}$). • Be able to solve equations of the form $a^x = b$ for $a > 0$. **8. Exponential Models:** • Know and use the function a^x and its graph, where a is positive. • Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications. • Know and use the function $ln\, x$ and its graph. • Know and use $ln\, x$ as the inverse function of e^x • Be able to use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y. • Understand and be able to use exponential growth and decay and use the exponential		

			• Understand and be able to use the definitions of sine, cosine and tangent for all arguments. • Understand and be able to use the sine, cosine and tangent functions, their graphs, symmetries and periodicities. • Understand and be able to use $tan\,\theta \equiv \frac{sin\,\theta}{cos\,\theta}$ and $sin^2\,\theta + cos^2\,\theta \equiv 1$ • Be able to solve simple trigonometric equations in a given interval, including quadratic equations in $sin\,\theta$, $cos\,\theta$ and and $tan\,\theta$ equations involving multiples of the unknown angle.	function in modelling.		
Understanding / Sequence of delivery	1. Building on prior knowledge and making connections between topics. 2. Problem solving embedded, including in use of exam questions. 3. Ensure understanding of detail required in responses and when calculator can be used via exam Command words					
Assessment	End of Topic Assessed Homework on paper or online via Integral Exam Style Questions		End of Topic Assessed Homework on paper or online via Integral Exam Style Questions		End of Topic Assessed Homework on paper or online via Integral Exam Style Questions	
	POP Test		Topic tests		PPE	

	Past Exam Questions Grade Boundaries based on A Level 2019 & 2022	Past Exam Questions Grade Boundaries based on A Level 2019 & 2022	Past Exam Questions Grade Boundaries based on A Level 2019 & 2022