Curriculum Plans: Year _12____ (Maths)

	Topic	Knowledge: By the end of the unit students will know:	Skills: What skills will students have developed by the end of this unit?	Key terms: What new key terms and vocabulary will be learnt in this unit?	Summative Assessment: How will pupils be assessed in this unit?
Michaelmas 1	1) Quadratic Functions Equations & Inequalities 2) Graphs and transformations 3) Circles 4) Algebraic Methods 5) Trigonometric Ratios 6) Radians	• Solving quadratic Equations • Completing the square • Quadratic Graphs • The Discriminant • Modelling with Quadratics • Simultaneous equations • Inequalities • Graphs of functions • Points of Intersections • Transforming Graphs • Midpoints and Perpendicular Bisectors • Equation of a circle • Intersections of straight lines and circles • Tangent and Chord properties • Circles and Triangles • Algebraic Fractions • Dividing Polynomials	• Completing the square when a is not 1 • Determining and using the discriminant. Solving disguised quadratic equations using substitution. • Solving linear simultaneous equations by elimination and substitution. • Solving linear & quadratic simultaneous equations by substitution. $y-y_1=m(x-x_1)$ and $ax+by+c=0$ Be able to use straight line graphs to solve rate of change problems • Solving linear simultaneous equations by elimination and substitution. • Solving linear & quadratic simultaneous equations by substitution. • Solving linear inequalities. Solving quadratic inequalities. • Be able to express solutions with the correct use of 'and' and 'or', and using set notation. • e.g. {x: x>3} U {x: -2≤x≤4}. • Be able to represent solutions on a number line and inequalities graphically. Be able to use interval	**Quadratics** • **Quadratic Equation**: An equation of the form ax2+bx+c=0ax^2 + bx + c = 0ax2+bx+c=0. • **Roots/Solutions**: The values of xxx that satisfy the equation. • **Discriminant**: D=b2−4acD = b^2 - 4acD=b2−4ac; determines the nature of the roots. • **Vertex**: The highest or lowest point of the parabola. • **Axis of Symmetry**: The vertical line that passes through the vertex. • **Factoring**: Expressing a quadratic as a product of two binomials. **Equations** • **Linear Equation**: An equation of the first degree. • **Simultaneous Equations**: A set of equations with the	Assessment in class (November)

		• The Factors Theorem • Proof • Pascal's Triangle • Factorial Notation • The Binominal Expansion • Solving Binomial Problems • Binomial Estimation	notation. e.g. (2,3), [2,3), and [2,∞). Represent linear and quadratic inequalities such as y > x + 1 and y > ax2 + bx + c graphically (using the relevant shading, dotted and solid line conventions). • Be able to plot and sketch graphs (including their vertical and horizontal asymptotes) of quadratic, cubic, quartic, square root, reciprocal (both a/x and a/x^2) and exponential functions. • Be able to use a graph to identify the roots of an equation and graph intersections to solve equations. • Be able to interpret and use proportionality graphs. • nderstand and use the equation for a circle, centre (a,b) and radius r. • Be able to complete the square to convert circle equation of form $x^2 + y^2 + 2gx + 2fy + c = 0$ to • $(x-a)^2 + (y-b)^2 = r^2$ and vice versa • Finding the equation of a circle from its radius and a point on the circumference, and end points of a diameter. Be able to use the properties of a circle: • the angle in a semicircle is a right angle, • the perpendicular from the centre of a circle to a chord bisects the chord,	same variables that are solved together. • **Polynomial**: An expression involving variables raised to whole number powers. • **Rational Equation**: An equation involving fractions with polynomials in the numerator and denominator **Inequalities** • **Inequality**: A relation that holds between two expressions that are not equal (e.g., <,>,≤,≥<, >, \leq, \geq<,>,≤,≥). • **Interval Notation**: A way to describe sets of numbers (e.g., (a,b)(a, b)(a,b)). • **Graphing Inequalities**: Representing solutions on a number line or coordinate plane. **Graph Transformations** • **Translation**: Shifting a graph vertically or horizontally. • **Reflection**: Flipping a graph over a line (e.g., x-axis, y-axis). • **Stretch/Compression**: Changing the scale of a	

			• the radius of a circle at a given point on its circumference is perpendicular to the tangent to the circle at that point. • Be able to identify the co-ordinates of intersection of a straight line and a circle or two circles. • Algebraic fractions • Dividing polynomials • Factor Theorem • Methods of proof • Draw graphs of y=*a*sinb*x*, y=*a*cosb*x* and y=*a*tan*b*x, where *a* & *b* are constants and be able to use their symmetries and periodicities. • Derive the exact values of sin, cos & tan of 0°, 30°, 45°, 60° & 90° and equivalent larger/negative angles. • Be able to use the graphs of y=sinx, y=cosx, y=tanx to find all possible solutions. • Convert between degrees & radians and vice versa. • Draw graphs of trigonometric functions in radians. • Calculate the length of an arc and the area of a sector using radians. • Solving trigonometric equations using radians.	graph vertically or horizontally. • **Transformation**: A function applied to a graph that changes its position or shape **Circles** • **Circle Equation**: (x−h)2+(y−k)2=r2(x - h)^2 + (y - k)^2 = r^2(x−h)2+(y−k)2=r2 where (h,k)(h, k)(h,k) is the center and rrr is the radius. • **Diameter**: A line segment that passes through the center and connects two points on the circle. • **Circumference**: The distance around the circle, calculated as C=2πrC = 2\pi rC=2πr. • **Chord**: A line segment with both endpoints on the circle **Algebraic Methods** • **Factorization**: Breaking down an expression into simpler parts. • **Completing the Square**: A method used to convert a quadratic into vertex form.	

				• **Substitution**: Replacing a variable with another expression. • **Elimination**: A method for solving simultaneous equations by removing a variable. **Trigonometric Ratios** • **Sine (sin)**: Ratio of the opposite side to the hypotenuse in a right triangle. • **Cosine (cos)**: Ratio of the adjacent side to the hypotenuse. • **Tangent (tan)**: Ratio of the opposite side to the adjacent side. • **Reciprocal Ratios**: Cosecant (csc), secant (sec), and cotangent (cot). **Radians** • **Radian**: A measure of angle defined as the ratio of the length of the arc to the radius of the circle. • **Conversion**: 180∘=π180^\circ = \pi180∘=π radians; converting degrees to radians and vice versa.	

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				• **Unit Circle**: A circle with a radius of 1 used to define trigonometric functions	
Michaelmas 2	1) Binomial Theorem 2) Trig Identities and equations 3) Differentiation 4) Integrations	• Sine and Cosine Rule • Solving triangle problems • Graphs of Sine, Cosine and Tangent • Transforming trigonometric graphs • Angles in all four quadrants • Exact Trig Values • Trig Identities • Trig Equations • Gradients of curves • Finding the derivative • Differentiating x^n • Differentiating Quadratics • Gradients, tangents and normal • Increasing and decreasing functions • Second Order Derivatives	• Pascal's Triangle • Factorial notation • Binomial expansion • Binomial problem solving • Estimation • Derive and use the trigonometric identities; $\tan\theta=\sin\theta/\cos\theta$ and $\sin^2\theta+\cos^2\theta=1$. • Be able to solve trigonometric equations in a given interval, including quadratics equations in sin, cos, and tan, and equations involving multiples of the unknown angle. • Differentiation from first principles (for small positive powers of x) to find the gradient. • Differentiating simple polynomial expressions with positive and negative integer powers. • Finding stationary points of quadratic and cubic functions. • Find the range of x values for increasing and decreasing functions.	**Binomial Theorem** • **Binomial Expansion**: The expansion of expressions of the form (a+b)n(a + b)^n(a+b)n. • **Coefficient**: The numerical factor in front of a term in the expansion. • **Binomial Coefficient**: Denoted as $\binom{n}{k}$ it represents the number of ways to choose k elements from n elements. • **Term**: Each individual part of the expanded expression. • **Power**: The exponent n in $(a+b)^n$ **Trigonometric Identities** • **Pythagorean Identity**: $\sin^2(x) + \cos^2(x) =$	Assessment in class (January)

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		• Stationary Points • Sketching Gradient Functions • Modelling with differentiation. • Integrating X^n • Indefinite integrals • Finding Functions • Definite Integrals • Areas under curves • Areas under the x axis • Areas between lines and curves	• Basic curve sketching showing stationary points and y intercept. • Differentiate twice to find the rate of change of gradient and to find the nature of stationary points (points of inflection not included). • Find indefinite integrals of polynomials and be aware of possible exceptions. Find the equation of a function from its derivative and a point on the curve. Evaluate definite integrals, using relevant notation (including using calculator functions). • Use definite integration to find areas under curves. Evaluate improper integrals.	**Differentiation** • **Derivative**: The rate of change of a function; denoted as f'(x) or dy/dx • **Critical Points**: Points where the derivative is zero or undefined, indicating potential maxima or minima. **Integration** • **Integral**: The mathematical representation of the area under a curve. • **Indefinite Integral**: Represents a family of functions and includes a constant of integration. • **Definite Integral**: Represents the area under a curve between two points.	
Lent 1	1) Vectors 2) Exponentials and Logarithms 3) Large Data Set 4) Data Collections 5) Measures of Location and spread 6) Modelling in mechanics	• Representing Vectors • Magnitude and Direction • Position Vectors • Solving Geometric Problems • Modelling with Vectors • Exponential Functions • $Y=e^x$ • Exponential modelling	• Be able to represent vectors using column vectors, components of unit vectors and vector algebra, in two dimensions. • Calculate the magnitude and direction of a vector and convert between component	**Vectors** • **Vector**: A quantity with both magnitude and direction, often represented as an arrow or in component form. • **Magnitude**: The length of a vector.	Assessment in class (April)

	7) Constant acceleration	• Logarithms • Laws of Logarithms • Solving Equations using logarithms • Working with natural logarithms • Logarithms and non-linear data. • Population and samples • Sampling • Non-random sampling • Types of data • Measures of central tendency and spread • Variance and standard deviation • Coding • Constructing a model • Modelling assumptions • Quantities and units • Displacement-time graphs • Velocity-time graphs • Constant acceleration formulae • Vertical motion under gravity	form and magnitude/direction form. • Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations. • Understand and use position vectors; calculate the distance between two points represented by position vectors. • Use vectors to solve problems in pure mathematics and in context, (including forces). • Understand exponential functions of the form a^x (where a is positive, including e) and draw their graphs. • 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 definition of $\log_a x$ as the inverse of a^x (where a is positive, including e – ie.lnx). • Understand logarithms and convert between the exponential and logarithmic	• **Direction**: The orientation of a vector, often expressed as an angle or a unit vector. • **Unit Vector**: A vector with a magnitude of 1. **Exponentials** • **Exponential Function**: A function of the form f(x)=a^x • **Base**: The constant a in the exponential function. • **Growth/Decay**: Describes how quantities change over time; exponential growth increases rapidly, while exponential decay decreases. • **Natural Exponential Function**: Denoted ase^x, where e is Euler's number (≈2.718) **Logarithms** • **Logarithm**: The inverse of an exponential function. • **Common Logarithm**: The logarithm with base 10. • **Natural Logarithm**: The logarithm with base e. • **Change of Base Formula**: Allows conversion between logarithm bases.	

			forms of a function. i.e $a=b^c$ is equivalent to $c=\log_b a$. • Understand and use the laws of logs; i.e. $\log_a(xy)=\log_a x+\log_a y$, $\log_a(x/y)=\log_a x-\log_a y$, • $\log_a x^n=n\log_a x$, $\log_a a=1$ & $\log_a 1=0$. • Solve logarithmic and exponential equations. • Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y. (Plot log y against log x and obtain a straight line where the intercept is log a and the gradient is n Plot log y against x and obtain a straight line where the intercept is log k and the gradient is log b.) • Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models.	**Large Data Sets** • **Population**: The entire group being studied. • **Sample**: A subset of the population used for analysis. • **Outlier**: A data point that is significantly different from other observations. • **Data Distribution**: The way in which data values are spread or arranged. **Measures of Location and Spread** • **Mean**: The average of a data set, calculated as the sum of values divided by the number of values. • **Median**: The middle value when data is ordered from least to greatest. • **Mode**: The value that appears most frequently in a data set. • **Variance**: A measure of how much the values differ from the mean, calculated as the average of the squared differences. • **Standard Deviation**: The square root of the variance,	

			• Draw and transform exponential growth and exponential decay graphs. • Understand and be able to use sampling techniques, 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 calculate and interpret measures of central tendency and variation, including mean, median, mode, percentile, quartile, inter-quartile range, standard deviation and variance. • Includes understanding that standard deviation is the root mean square deviation from the mean. • 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.	representing the average distance from the mean. **Modelling in Mechanics** • **Model**: A simplified representation of a real-world situation used to make predictions or analyse behaviours. • **Assumptions**: Simplifications made in the model (e.g., treating objects as particles, ignoring air resistance). • **Force**: A vector quantity that causes an object to accelerate, measured in Newtons (N). • **Equilibrium**: A state where the sum of forces and moments acting on an object is zero. **Constant Acceleration** • **Acceleration**: The rate of change of velocity, measured in m/s2\text{m/s}^2m/s2. • **Kinematic Equations**: Equations that describe motion under constant acceleration:	

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			• Includes understanding that, in the case of a grouped frequency distribution, the calculated mean and standard deviation are estimates. • Understand the concepts of distance and speed as scalar quantities, and of displacement, velocity and acceleration as vector quantities. • Be able to sketch and interpret displacement/time (*t, x*) graphs and velocity/time (*t, v*) graphs. • Be able to use the equations of linear motion (SUVAT) to solve problems including constant acceleration, including vertical motion. • Be able to derive the SUVAT equations using velocity time graphs and substituting one equation into another.	• **Initial Velocity (u)**: The velocity of an object at the start of a time interval. • **Final Velocity (v)**: The velocity of an object at the end of a time interval. • **Displacement (s)**: The overall change in position of an object.	
Lent 2	1) Representations of Data 2) Probability 3) Conditional Probability 4) Statistical Distributions 5) Forces and Motion 6) Friction	• Outliers • Box Plots • Cumulative Frequency • Histograms • Comparing Data • Correlations • Linear regression • Calculating probabilities • Venn diagrams	• Be able to interpret tables and diagrams for single-variable data. e.g. vertical line charts, dot plots, bar charts, stem-and-leaf diagrams, box-and-whisker plots, cumulative frequency diagrams and histograms (with either equal or	**Representations of Data** • **Data Set**: A collection of related data points or values. • **Bar Chart**: A graphical representation using bars to compare quantities across categories.	Assessment (EOY)

		• Mutually exclusive and independent events • Tree diagrams • Probability distributions • The Binomial distribution • Cumulative Probabilities • Force Diagrams • Forces as Vectors • Forces and acceleration • Motion in 2 dimensions • Connected Particles • Pulleys	unequal class intervals). Includes non-standard representations. • Recognise and be able to interpret possible outliers in data sets and statistical diagrams. • Be able to clean data, including dealing with missing data, errors and outliers. • Recognise and be able to interpret possible outliers in data sets and statistical diagrams. • Be able to clean data, including dealing with missing data, errors and outliers. • Understand and be able to use simple, finite, discrete probability distributions, defined in the form of a table or a formula. • Be able to calculate probabilities using the binomial distribution, using appropriate calculator functions • Understand the vector nature of force and use directed line segments to represent forces in two dimensions.	• **Histogram**: A graphical representation of the distribution of numerical data, showing frequency of data within specified intervals. • **Box Plot (Box-and-Whisker Plot)**: A graphical summary of a data set that shows the median, quartiles, and potential outliers. • **Scatter Plot**: A graph that shows the relationship between two numerical variables. • **Pie Chart**: A circular statistical graphic divided into slices to illustrate numerical proportions. **Probability** • **Probability**: A measure of the likelihood of an event occurring, ranging from 0 to 1. • **Sample Space (S)**: The set of all possible outcomes of a random experiment. • **Event**: A subset of the sample space, representing outcomes of interest. • **Mutually Exclusive Events**: Events that cannot occur at the same time (e.g., rolling a 3 or a 5 on a die).	

			• Be able to identify the forces acting on a system and represent them in a forces diagram**.** • Use vector addition to find the resultant of two or more forces. • Be able to split a force into two perpendicular resolved forces. • Understand and be able to use Newton's 1st Law: 'A particle that is at rest (or moving with constant velocity) will remain at rest (or moving with constant velocity) until acted upon by an external force.' • 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. • Represent the contact force between two rough surfaces, the 'normal force' and 'frictional force'. Understand and use the concept of limiting friction and limiting equilibrium.	• **Independent Events**: Events where the occurrence of one does not affect the occurrence of the other. **Conditional Probability** • **Conditional Probability**: The probability of an event occurring given that another event has already occurred, denoted as P(A|B)P(A | B)P(A|B). **Statistical Distributions** • **Distribution**: Describes how values are spread or arranged; includes discrete and continuous distributions. • **Normal Distribution**: A continuous probability distribution characterized by a symmetric, bell-shaped curve defined by its mean and standard deviation. • **Binomial Distribution**: A discrete distribution describing the number of successes in a fixed number of independent Bernoulli trials. • **Poisson Distribution**: A discrete distribution used to model the number of events	

			• Apply Newton's 3rd Law to particles that are both at rest and moving with constant acceleration: 'Every action has an equal and opposite reaction'. • Solve problems which may be modelled as the motion of two particles connected by a light inextensible string. • Be able to solve problems involving simple cases of equilibrium of forces on a particle in two dimensions. • Resolve forces into components. • Solve problems involving smooth or rough inclined planes. • Understand friction and the coefficient of 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.	occurring in a fixed interval of time or space. • **Standard Normal Distribution**: A normal distribution with a mean of 0 and a standard deviation of 1. **Forces** • **Force**: A vector quantity that causes an object to accelerate, measured in Newtons (N). • **Newton's Laws of Motion**: Fundamental principles that describe the relationship between the motion of an object and the forces acting on it: 1. **First Law**: An object at rest stays at rest, and an object in motion stays in motion unless acted upon by a net external force. 2. **Second Law**: The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass	

			• Solve problems involving motion on rough or smooth inclined planes. • Solve problems involving connected particles that require the resolution of forces.	3. **Third Law**: For every action, there is an equal and opposite reaction. **Motion** • **Displacement**: The overall change in position of an object, represented as a vector. • **Velocity**: The rate of change of displacement, measured in m/s\text{m/s}m/s; can be average or instantaneous. • **Acceleration**: The rate of change of velocity. • **Kinematics**: The study of motion without considering the forces that cause it. **Friction** • **Friction**: The resistance force that opposes the motion of two surfaces in contact. • **Static Friction**: The frictional force that prevents two surfaces from sliding past each other. • **Kinetic Friction**: The frictional force acting on an object in motion.	

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				• **Coefficient of Friction**: A dimensionless scalar value that represents the frictional properties of the surfaces in contact; denoted as μ. • **Normal Force**: The perpendicular force exerted by a surface to support the weight of an object resting on it, counteracting gravity.	
Trinity 1	1) Hypothesis Testing 2) Application of Forces 3) Variable Acceleration.	• Hypothesis testing • Finding Critical values • One-tailed tests • Two-tailed tests	• 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	**Hypothesis Testing** • **Hypothesis**: A statement or assumption that can be tested; typically involves a null hypothesis (H0) and an alternative hypothesis (H1). • **Null Hypothesis (H0)**: The hypothesis that there is no effect or no difference; it is what we aim to test against. • **Alternative Hypothesis (H1)**: The hypothesis that represents an effect or a difference; it is what we hope to support. • **Significance Level (α)**: The threshold probability for rejecting the null hypothesis, commonly set at 0.05 or 0.01. • **Test Statistic**: A standardized value	Assessment (EOY)

			incorrectly rejecting the null hypothesis. • Work with vectors for displacement, velocity and acceleration when using the vector equations of motion. • Use calculus with harder functions of time involving variable acceleration. • Differentiate and integrate vectors with respect to time.	calculated from sample data that is used to determine whether to reject the null hypothesis. • **P-Value**: The probability of obtaining a test statistic as extreme as the one observed, under the assumption that the null hypothesis is true. • **Confidence Interval**: A range of values that is likely to contain the population parameter with a certain level of confidence (e.g., 95%). **Application of Forces** • **Resultant Force**: The single force that represents the combined effect of all forces acting on an object. • **Equilibrium**: A state where all forces acting on an object are balanced, resulting in no net force and no acceleration. • **Tension**: The force transmitted through a string, rope, or cable when it is pulled tight. • **Normal Force**: The perpendicular force exerted by a surface to support the	

				weight of an object resting on it. • **Frictional Force**: The force that opposes the relative motion of two surfaces in contact. • **Weight**: The force acting on an object due to gravity. **Variable Accelerations** • **Variable Acceleration**: Acceleration that changes over time; can be due to changing forces acting on an object. • **Differentiation**: The mathematical process used to find the instantaneous rate of change of a function, often used to find acceleration from velocity. • **Kinematic Equations for Variable Acceleration**: Equations that relate displacement, velocity, and time when acceleration is not constant, often requiring calculus for solutions. • **Velocity-Time Graph**: A graphical representation showing how velocity changes over time; the slope of the graph represents acceleration.	

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				• **Acceleration-Time Graph**: A graph showing how acceleration changes over time; the area under the graph represents change in velocity	
Trinity 2	1) Algebraic Methods	• Be able to add / subtract, multiply / divide algebraic fractions, and simplify them by cancelling down.			