Long term Plan Year 12 Mathematics 2022/2023

Term	Topic(s)	Assessed Work/Additional Resources
Autumn Term 1 (7 weeks/42 lessons)	**Pure** Problem Solving • Problem solving and modelling • Notation • Proof including by deduction, exhaustion, and using counterexamples to disprove conjectures Surds and Indices • Manipulate expressions involving square roots • Rationalising a denominator • Laws of indices Quadratic Functions • Factorising quadratic expressions, and solving quadratic equations using various methods (including factorising, completing the square, and the quadratic formula) • Writing a quadratic expression in the completed square form • Understanding the link between the completed square form, and the turning point of a quadratic • Sketching the graphs of quadratic functions (including on the graphical calculator) • Understanding the origins of the discriminant, and the different scenarios based on its value (both algebraically, and graphically) • EXTENSION: Proving the quadratic formula Polynomials • Add, subtract and multiply polynomial functions • Sketch the graphs of polynomials (including on the graphical calculator) • Dividing a polynomial by a linear expression • Using the factor theorem to test whether a linear expression is a factor of a polynomial function • Factorising a polynomial Equations and Inequalities • Understanding the underlying importance of simultaneous equations, and the need to have independent equations with the same number of unknowns as the number of equations to arrive at a unique solution • Solving linear simultaneous equations using the elimination method, substitution method, and equating method • Solving the combination of a linear and quadratic equation simultaneously • Solving linear and quadratic inequalities, including the use of graphical methods to deduce the inequality for quadratic examples Binomial Expansion • Introduction to Binomial expansion, and why it is important for binomials that are being raised to a higher power • Linking the binomial coefficients to Pascal's triangle • Introduce factorial notation, and illustrate the solution to 70!/69! • Using both formulae and the calculator to deduce the binomial coefficients • Using binomial expansion to expand binomial expressions, with a positive integer power Coordinate Geometry (Continued next half term) • Finding the length, midpoint and gradient of a line joining two points • Finding the equation of a straight line using y = mx +c	**Assessed Work** • Homework • End-of-topic assessments (completed in class, or at home following direction from the teacher) • Classwork **Additional Resources** • Integral, ask your teacher for login details • A Level Mathematics For Year 1 and AS 4th Edition Book (ISBN: 9781471852978) • Online access to the above book, ask your teacher for login details
Autumn Term 2 (7 weeks/42 lessons)	**Pure** Coordinate Geometry (Continued) • Understanding, and implementing the conditions for two straight lines to be parallel or perpendicular to each other • Solving coordinate geometry problems involving straight lines • Understanding the derivation of the equation for a circle centred at the origin (using Pythagoras' Theorem) • Finding the centre, and radius of a circle from its equation • Using circle properties to solve problems	**Assessed Work** • Homework • End-of-topic assessments (completed in class, or at home following direction from the teacher) • Classwork

	• Solving problems involving the intersection point(s) of a line and a circle Vectors • Working with vectors in two dimensions including working with scalar quantities, the modulus, magnitude, direction, position vector, unit vector, Cartesian components, equal vectors and parallel vectors • Adding, subtracting and multiplying vectors, and understanding the geometrical interpretation of these operations • Solving problems using vectors Trigonometry • Sketching the graphs for sine, cosine and tangent (including on the graphical calculator) • Understanding that the three trigonometric functions taught are continuous, and are never ending • Using two trigonometric identities $tan\ x\ =\ \frac{sin\ x}{cos\ x}$ and $sin^2 x\ +\ cos^2 x\ =\ 1$ • Learning exact values for sine, cosine and tangent • Finding the principal value of the solution using a calculator • Finding all roots of a trigonometric equation within a given range using the appropriate graph • Manipulating a trigonometric equation algebraically to get it in a form that you can solve directly • Using both the Sine and Cosine rules to find missing angles and sides in any triangles • EXTENSION: Proving the Sine and Cosine rules • Solving problems using the Sine and Cosine rules • Finding the area of any triangle using $\frac{1}{2}absin\ C$ Graphs and Transformations • Sketch graphs of functions of the form $y\ =\ x^n$ where n is a positive or negative integer (including on the graphical calculator) • Finding the intersection points of two graphs • Solving problems using proportional relationships and their graphs • Transformations applied to graphs including translation and stretching by a scale factor • Using the properties associated with the transformation of graphs to sketch the graphs of related functions Exponentials and Logarithms (Continued next half term) • Learn about exponential functions and the meaning of the word logarithm • Sketch and identify exponential and logarithmic graphs (including on the graphical calculator) • Learning the Laws of logarithms, and how to apply them • Solve equations of the form $a^x\ =\ b$ using logarithms Differentiation (Continued next half term) • Introduction to differentiation, and what is meant by the gradient of a curve • Supporting the idea that the gradient of a curve at a point can be thought of as the limit of the gradient of a chord to the curve • Differentiate polynomial functions • Using differentiation to find the equations of tangents and normals to curves	**Additional Resources** • Integral, ask your teacher for login details • A Level Mathematics For Year 1 and AS 4th Edition Book (ISBN: 9781471852978) • Online access to the above book, ask your teacher for login details
Spring Term 1 (6 weeks/36 lessons)	**Pure** Exponentials and Logarithms (Continued) • Introduction to the exponential function, e^x, the natural logarithm, $ln\ x$, and how they are the inverse of each other • Solving problems involving exponential growth and decay • Reducing equations of the form $y\ =\ ax^n$ to linear form, and using experimental data to draw a graph to estimate the values a and n • Reducing equations of the form $y\ =\ ab^x$ to linear form, and using experimental data to draw a graph to estimate the values a and b Differentiation (Continued) • Introduction of local maximum and minimum points, and being able to identify them by observing the gradient either side of a stationary point (turning point) • Understanding what is meant by an increasing and decreasing function, and being able to find the range of values of x for which a function is increasing or decreasing • Sketching the graph of a gradient function from the graph of the function • Finding the second derivative of a function, and use this to determine the nature of a stationary point (turning point)	**Assessed Work** • Homework • End-of-topic assessments (completed in class, or at home following direction from the teacher) • Classwork **Additional Resources** • Integral, ask your teacher for login details • A Level Mathematics For Year 1 and AS 4th Edition Book (ISBN: 9781471852978) • Online access to the above book, ask your teacher for login details

	• Interpreting and performing differentiation from first principles Integration • Understanding that integration is the opposite process to differentiation • Integrate functions of the form kx^n, where k is a constant and n is any real number other than -1 • Understanding the inclusion of the arbitrary constant (integration constant), and finding its value given relevant information • Calculating definite integrals for polynomial functions, and understanding the application of this to the area under the polynomial integrated • Sketching graphs to locate where they cross the x-axis before calculating the area under the curve, as areas below the x-axis will be negative **Statistics** Collecting and Interpreting Data (Continued next half term) • Understanding the terms population and sample, and how we can use samples to make informal inferences about the population • Introduction to sampling techniques, including simple random sampling and opportunity sampling • Forming the ability to select or critique sampling techniques used to solve a range of statistical problems • Gaining the understanding that different samples can lead to different conclusions about the population • Construct, use and interpret statistical diagrams including bar charts, dot plots, histograms, vertical line charts, pie charts, stem-and-leaf diagrams, box plots, frequency charts and cumulative frequency diagrams • Learning the terminology to describe distributions including symmetrical, unimodal, bimodal and skewed • Calculate and interpret measures of central tendency including the mean, mode and median • Calculate and interpret measures of spread including range, percentiles, quartiles, interquartile range, variance and standard deviation • Understanding the term outlier, and identifying outliers in terms of either the mean and standard deviation or the median and interquartile range	
Spring Term 2 (6 weeks/36 lessons)	**Statistics** Collecting and Interpreting Data (Continued) • To interpret scatter diagrams and regression lines for bivariate data • To understand what is meant by correlation, and that correlation does not mean causation • Introduction to the large dataset, with lessons planned with the use of Google Sheets or Microsoft Excel to make deductions between different variables within the large dataset • Students to create a presentation and statistical report on a specific aspect of the large dataset, with topic and structure guided by the teacher Probability • Calculate the probability of an event • Understand the relationship between the probability of an event and its complement • Using tree diagrams, sample space diagrams and Venn diagrams to assist in the calculation of probabilities • Understand the notion of mutually exclusive, and independent events • Introduction to discrete random variables, probability distributions, and discrete uniform distributions **Mechanics** Kinematics • Learn the difference between displacement, position, distance and distance travelled • Learn the difference between speed and velocity • Finding the average speed involving the distance travelled, and average velocity using the displacement • Draw and interpret a position-time graph, distance-time graphs or displacement-time graphs • Demonstration that the gradient of a position-time graph or a displacement-time graph gives velocity • Draw and interpret velocity-time graphs or speed-time graphs • Understand and calculate the acceleration using the gradient of a velocity-time graph • Understand and calculate that the area under a velocity-time graph represents displacement • Recognise when the use of the constant acceleration equations are appropriate • Solve kinematics problems using the constant acceleration equations	**Assessed Work** • **Mid-Year Assessments (Weeks 24 and 25)** • **Presentation and statistical report produced in groups based on the large dataset. Presented in class** • Homework • End-of-topic assessments (completed in class, or at home following direction from the teacher) • Classwork **Additional Resources** • Integral, ask your teacher for login details • A Level Mathematics For Year 1 and AS 4th Edition Book (ISBN: 9781471852978) • Online access to the above book, ask your teacher for login details • Large dataset for students sitting the A level/AS in the summer of 2023 • Large dataset for students sitting the A level/AS in the summer of 2024

	Newton's Laws (Continued next half term) • Draw force diagrams to represent the forces on an object that can be modelled as a particle • Understand the concept of equilibrium	
Summer Term 1 (6 weeks/36 lessons)	**Statistics** Binomial Distribution • Recognise situations which give rise to a binomial distribution • Calculating probabilities using the binomial distribution • Finding the mean of the binomial distribution Hypothesis Testing • Learn of the importance of hypothesis testing across different disciplines • Introduction to hypothesis testing with the associated terminology including the null hypothesis, alternative hypothesis, significance level, test statistic, p-values, critical value, critical region and acceptance region • Carry out a one-tailed test for the proportion in the binomial distribution and interpret the results • Understanding that the significance level is the probability of incorrectly rejecting the null hypothesis • Carry out a two-tailed test for the proportion in the binomial distribution and interpret the results **Mechanics** Newton's Laws (Continued) • Understand and interpret Newton's laws of motion • Applying and using New's second law of motion, $F = ma$ • To formulate and solve separate equations of motion for connected objects Variable Acceleration • Understand the derivative of an equation for position with respect to time results in an expression for velocity, and how to calculate this quantity • Understand the derivative of an equation for velocity with respect to time results in an expression for acceleration, and how to calculate this quantity • Understand the integral of an equation for velocity with respect to time results in an expression for position, and how to calculate this quantity • Understand the integral of an equation for acceleration with respect to time results in an expression for velocity, and how to calculate this quantity	**Assessed Work** • **End-of-Year Assessments (Weeks 35 and 36)** • Homework • End-of-topic assessments (completed in class, or at home following direction from the teacher) • Classwork **Additional Resources** • Integral, ask your teacher for login details • A Level Mathematics For Year 1 and AS 4th Edition Book (ISBN: 9781471852978) • Online access to the above book, ask your teacher for login details
Summer Term 2 (7 weeks/36 lessons due to CEW)	**Pure Year 2** Numerical Methods • Locate the roots of $f(x) = 0$ by considering changes of sign of $f(x)$ in an interval in which $f(x)$ is continuous • Understand the circumstances under which change of sign methods may fail to give an expected root or may give a false root • Use fixed point iteration after rearranging an equation into the form $x = g(x)$, and understand the significance of staircase and cobweb diagrams • Gain the understanding that not all iterations converge to a particular root of an equation • Learn and use the Newton-Raphson method to find a numerical solution to an equation • Approximate the value of a definite integral using the trapezium rule • EXTENSION: Prove the trapezium rule Vectors • Extend the work at AS to working with vectors in 3 dimensions • Finding the magnitude of a vector in 3 dimensions • Using vectors to solve problems in both 2 and 3 dimensions	**Assessed Work** • Homework • End-of-topic assessments (completed in class, or at home following direction from the teacher) • Classwork **Additional Resources** • Integral, ask your teacher for login details • A Level Mathematics For Year 2 4th Edition Book (ISBN: 9781471852985) • Online access to the above book, ask your teacher for login details