Maths A Level

OCR Maths A level H240

This new A Level qualification builds on the skills, knowledge and understanding set out in the new GCSE (9-1) subject content for mathematics for 2015. The content is separated into three areas: Pure Mathematics, Statistics and Mechanics with all elements being
assessed through a written examination. All pupils must study all three topic areas.

Year 12
Manipulation of Indices and Surds. Advanced algebraic techniques. Exploration of graphical representation with links to coordinate geometry and transformations. Binomial expansion. Introduction to Calculus. Advanced Trigonometry and an introduction to trig
identities. Exponentials and Logarithms. Vectors. Representation of data – statistical measures and diagrams. Outliers. Probability of mutually exclusive and independent events. The Binomial distribution and hypothesis testing. SI units. Constant and non-uniform acceleration. Newton's Laws. Weight and Frictional forces.

Year 13
Extension of algebraic and numerical techniques including fractions & parametric equations. Iterative methods. Functions and graphs involving exponentials and logs. Sequences and sigma notation. Proof by contradiction. Further trigonometry. Further Calculus. Extension of the Binomial theorem. Differential equations. Set notation. Extension
of the Binomial Distribution. The Normal distribution leading to Central Limit Theorem. Correlation and hypothesis testing. Extension of work on acceleration, frictional forces and Newton's Laws. Gravity. Application of vectors in a plane. Statics.

Topics Covered per Half Term

Pure & Stats	Year 12
Co-ordinate geometry	- Midpoint and distance between two points - Equation of a straight line - Parallel and perpendicular lines - Equation of a circle - Solving problems with lines and circles
Logarithms	- Introducing Logarithms - Laws of logarithms - Solving exponential equations - Disguised quadratics
Exponential models	- Graphs of exponential functions - Graphs of logarithms - Exponential functions and mathematical modelling

Binomial Expansion	• Fitting models to data • The Binomial theorem • Calculating binomial coefficients • Applications of binomial theorem
Triangle Geometry	• The Sine rule • The Cosine rule • Area of a Triangle • Sketching derivatives
Differentiation	• Differentiation from first principles • Rules of differentiation • Simplifying into terms of the form axn • Interpreting derivatives and second derivatives
Applications of differentiation	• Tangents and normals • Stationary points • Optimisation
Integration	• Rules of integration • Simplifying into terms of the form axn • Finding the equation of a curve • Definite integration • Geometric significance of definite integration
Probability	• Combining probabilities • Probability distributions • The Binomial Distribution
Working with data	• A reminder of statistical diagrams • Standard deviation • Calculations from frequency tables • Scatter diagrams and correlation • Outliers and cleaning data • Populations and samples
Statistical hypothesis testing	• Introduction to hypothesis testing

	• Critical region for a hypothesis test
Conditional Probability	• Set notation and Venn diagrams • Two-way tables • Tree diagrams • Modelling with probability
Normal Distribution	• Introduction to normal probabilities • Inverse Normal distribution • Finding unknown mean and standard deviation • Modelling with the Normal Distribution

Topics Covered per Half Term

Pure & Mechs	Year 13
Indices and surds	• Using the laws of indices • Working with surds
Quadratic functions	• Review of quadratic equations • Graphs of quadratic functions • Completing the square • Quadratic inequalities • The discriminant
Polynomials	• Disguised quadratics • Working with polynomials including division • Factor theorem • Sketching polynomials
Using Graphs	• Intersections of graphs • Transforming graphs (inc discriminant revisited) • Direct and indirect proportion (inc Graphs of a/x and a/xsquared) • Sketching inequalities in two variables
Proof	• Mathematical structures and arguments • Inequality notation

	- Disproof by counterexample - Proof by deduction - Proof by exhaustion
Trig functions and equations	- Definitions and graphs of sine and cosine functions - Tangent functions and exact values - Trigonometric identities - Introducing trigonometric equations - Transformations of trig graphs - More complex trigonometric equations
Vectors	- Describing Vectors - Operations with vectors - Position and displacement vectors - Using vectors to solve geometrical problems
Introduction to kinematics	- Introduction to displacement, velocity and acceleration - Kinematics and calculus - Using travel graphs - Solving problems in kinematics
Motion with constant acceleration	- Deriving the constant acceleration formula - Using the constant acceleration formulae - Vertical motion under gravity - Multi-stage problems
Force and motion	- Newton's law of motion - Combining forces - Types of forces - Gravity and weight - Forces in equilibrium
Objects in contact	- Newton's third law - Normal reaction force - Further equilibrium problems

| | • Connected particles |
| | • Pulleys |

Further Maths

OCR Further Maths A Level H245

This new A Level qualification builds on the skills, knowledge and understanding set out in the new GCSE (9-1) subject content for mathematics for 2015. The content is separated into three areas: Pure Mathematics, Statistics and Mechanics with all elements being assessed through a written examination. All pupils must study all three topic areas. Further Maths cannot be studied in its own right and must be taken in conjunction with the single A Level Maths course. (Resulting in 2 maths qualifications).

Pure Maths learners will extend and deepen their knowledge of proof, algebra, functions, calculus, vectors and differential equations studied in A Level Mathematics. They will also broaden their knowledge into other areas of pure mathematics that underpin the further study of mathematics and other numerate subjects with complex numbers, matrices, polar coordinates and hyperbolic functions. In Statistics learners will explore the theory which underlies the statistics content in A Level Mathematics, as well as extending their tool box of statistical concepts and techniques. This area covers combinatorics, probability distributions for discrete and continuous random variables, hypothesis tests and confidence intervals for a population mean, chi-squared tests, non-parametric tests, correlation and regression. In Mechanics learners extend their knowledge of particles, kinematics and forces from A Level Mathematics, using their extended pure mathematical knowledge to explore more complex physical systems. The area covers dimensional analysis, work, energy, power, impulse, momentum, centres of mass, circular motion and variable force.

Topics Studied per Year

Topics	Year 12
Conditional probability	• Set notation and Venn Diagrams • Two-way Tables • Tree Diagrams
General Binomial Expansion	• General Binomial Expansion • Binomial expansions of compound expressions
Calculus of exponential and trig functions	• Differentiation • Integration
Further Differentiation	• Chain Rule

	- Product Rule - Quotient Rule - Implicit Differentiation - Differentiating Inverse functions
Further integration	- Reversing second derivatives - Integration by substitution - Integration by parts - Using trig identities in integration - Integrating rational functions
Further applications of calculus	- Properties of curves - Parametric equations - Related rates of change - Area between curves
Further Hypothesis testing	- Distribution of Sample means - Hypothesis tests for the mean - Hypothesis tests for correlation
Differential Equations	- Introduction to differential equations - Separable differential equations - Modelling differential equations
Numerical solutions	- Integration as the limit of a sum - Trapezium rule
Numerical Methods	- Locating roots of a function - Newton-Raphson - Limitations of Newton-Raphson - Fixed point iteration - Limits of fixed-point iteration

Topics Studied per Year

Topics	Year 13
Functions	- Functions Mapping and Functions - Domain and range - Composite functions - Inverse functions
Rational functions	- Introducing radian measure - Inverse trig functions - Modelling with trig functions - Arcs and sectors - Triangles and circles - Small angle approximations
Further transformations	- Combined transformations - Modulus functions - Modulus equations and inequalities
Further Trigonometry	- Compound angle identities - Double angle identities - R Cos - Reciprocal trigonometrical functions
Applications of vectors	- Describing motion in two dimensions - Constant acceleration equations - Calculus with vectors - Vectors in three dimensions - Solving geometrical problems
Projectiles	- Modelling projectile motion - Trajectory of a projectile
Sequences	- General sequences - General series and sigma notation - Arithmetic sequences - Arithmetic series

	- Geometric sequences - Geometric series - Infinite geometric series - Using sequences and series to solve problems
Proof	- Proof by contradiction - Criticising proofs
Rational functions	- Review of factor theorem - Simplifying rational functions - Partial fractions with distinct factors - Partial fractions with a repeated factor
Forces in context	- Resolving forces - Coefficient of friction - Motion on a slope
Moments	- Turning effect of a force - Equilibrium - Non-uniform rods - Further equilibrium problems