

**In the mathematics faculty we aim to inspire the mathematician in every student, developing fluency and confidence in using mathematics to reason and solve problems. We also aim to develop an appreciation of the beauty and humanity of mathematics and of its historical development and wider social relevance. We seek to do this without placing limits on the attainment of any student and while developing universal human values including anti-racism and challenging sexism, homophobia and other forms of discrimination.**

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| ***Year 12 and 13 A Level Maths Learning Journey*** |
| **Autumn year 12** |
| Term1 – **INTRODUCTION TO PROOF**: Showing it has to be true **RECAP OF GCSE ALGEBRA**: making sure you are solid on GCSE Higher algebra **CUBICS:** exploring the nature of these functions and their graphs **PARTIAL FRACTIONS:** an important new technique in algebra **LOGARITHMS**: a big new idea that you will use a lot in A Level Maths | Term 2 **– EVERYTHING BINOMIAL** – More algebra, infinite series expansions and linking it all to probability and statistics **SEQUENCES AND SERIES** : Arithmetic, geometric and periodic sequences – and summing them even sometimes when they are infinite **ALL ABOUT FUNCTIONS:** Starting now but running into Term 3 a big unit exploring all kinds of functions |
| *PROOF*1. Proof by deduction
2. Disproof by counter example
3. Proof by exhaustion

*RECAP GCSE HIGHER ALGEBRA*1. Indices
2. Surds
3. Rearranging
4. Solving linear equations
5. Quadratics
6. Simultaneous equations – two linear and one linear one quadratic

*CUBICS AND OTHER POLYNOMIALS*  1.Sketching cubics 2. Factor theorem 3. Factorising- inspection, equating coefficients, algebraic long division 4. Remainder theorem *PARTIAL FRACTIONS*  1. Quotient and remainder in fractions 2. Partial fractions in algebra with linear factors in denominator 3. Repeated linear factor in denominator 4. Improper partial fractions *LOGARITHMS*1. What is a logarithm2. Laws of logs3, Different bases4. Log equations5. Disguised quadratics with logs | *EVERYTHING BINOMIAL*1. Exploring with a binostat
2. Pascal and expanding brackets
3. Permutations and Combinations
4. Infinite binomial expansion and conditions for convergence
5. Approximations
6. Binomial Probability Distribution
7. Cumulative Binomial Distribution
8. Problems involving Binomial
9. Hypothesis tests for proportion with Binomial

*SEQUENCES AND SERIES*1. Arithmetic Sequences
2. Geometric Sequences
3. Periodic sequences
4. Recursive relations and definitions
5. Limits
6. Exploring the Fibonacci sequence
7. .Modelling with sequences

*ALL ABOUT FUNCTIONS 1*1. Quadratic functions- sketching, rearranging into all forms
2. The Discriminant and its uses
3. Quadratic inequalities
4. Range, domain, one to one, many to one, many to many mappings
5. Compound and inverse functions
6. Transformation of functions
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| **Spring year 12**  |
| Term 3 **COORDINATE GEOMETRY** a crucial skill in using mathematics to solve problems **ALL ABOUT FUNCTIONS (CONTINUED**) a whole host of new and important functions which will run into term 4 | Term 4 - **KINEMATICS -**the maths of motion |
| *COORDINATE GEOMETRY**1. Straight lines, equations, parallel and perpendicular lines, dividing lines in ratios**2. Shapes and proofs using coordinate geometry**3. Circles, equations, properties and proofs using coordinate geometry and circle geometry**4. Tangents and normals**ALL ABOUT FUNCTIONS 2*1.. Modulus functions2. Radians, arc lengths and sector areas3.Trig functions- properties, graphs, periodicities and symmetries4.Trig identities and trig equations and their multiplicity of solutions5.Inverse and reciprocal trig functions6. Introducing e7. Exponential functions8. Ln and natural logarithms9. Modelling with functions10. Parametric functions | *KINEMATICS*1. Distance-Time and Velocity Time graphs
2. Scalars and vectors
3. Deriving the constant acceleration equations
4. Using the constant acceleration equations in 1D
5. Vertical motion under gravity
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| **Summer year 12**  |
| Term 5 – **ALL ABOUT DIFFERENTIATION –** the mathematics of curves and change – will run into term 6 | Term 6 – **Introduction to Statistics –** the core ideas which we will then build on in year 13 **PPE1 exam will take place in summer term**  |
| *ALL ABOUT DIFFERENTIATION*1. Constant gradient and straight lines2. Gradient of a curve3. Limits and differentiation from first principles4. Power rule5. Differentiating other basic functions- trig and e and ln6. Tangents and normal with calculus7. Increasing and decreasing functions8. Maxima, minima and the second derivative9. Convex, concave and points of inflection10. The Chain Rule – composite functions11. The Product Rule12. The Quotient Rule13. dy/dx and dx/dy14. Connected rates of change15. Modelling with derivatives16. Parametric differentiation17. Implicit differentiation | *INTRODUCTION TO STATISTICS*1. Statistics and parameters-populations and samples2. Sampling methods3. Introduction to Large Data Set4. Summary statistics – central tendency and spread – including Standard Deviation5. Statistical diagrams – including scatter diagrams, box plots, cumulative frequency and histograms |

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| **Autumn year 13** |
| Term1 – **MORE PROOF** – new methods of mathematical proof **INTEGRATION –** the inverse of differentiation, techniques and finding areas (will run into term 2) | Term 2 **PPE 2 AT START of November. TRIGONOMETRY**: more advanced trigonometry- identities, compound angles, small angles, trig equations. **KINEMATICS WITH CALCULUS-** when acceleration is not constant **PROBABILITY:** going deeper with the mathematics of chance |
| *PROOF*1.More proof by exhaustion and deduction2. Proof by contradiction*INTEGRATION*1. Inverse of differentiation – anti-derivatives
2. Power rule
3. Anti derivatives of trig functions
4. Anti derivatives of e and ln
5. Area, Reimann sums, and Fundamental Theorem of Calculus
6. Definite integration to find area under curve, between curve and line, between two curves
7. More integration techniques- inverse chain rule or integration by inspection
8. Integration by substitution
9. Integration by parts
 | *TRIGONOMETRY* 1.Recap of functions, graphs, symmetries, periodicities2. Compound angle formulas3. Harmonic formulas4. Inverse and reciprocal trig functions- graphs, ranges, domains and properties5. More trig identities6. More trig equations7. Modelling with trigonometry*KINEMATICS WITH VECTORS and CALCULUS*1.Recap of kinematics from y122. Relation between displacement, velocity, acceleration expressed in calculus3. Solving problems with kinematics with calculus in 1D4. Canonical vectors – I and j5. Constant acceleration problems in 2D6. 2D Kinematics with calculus7. Projectiles*PROBABILITY*1.Basic laws of probability- notation, independent and mutually exclusive events2. Conditional Probability3. Using two way tables, Venn diagram, trees and other representations4. Discrete and continuous probability distributions |
| **Spring year 12**  |
| Term 3 **NORMAL DISTIBUTION**- a crucial continuous probability distribution with many applications **KINEMATICS WITH VECTORS:** extending ideas in kinematics to 2d **DYNAMICS:** the forces behind motion | Term 4 – **NUMERICAL METHODS** -approximations and when you can’t solve exactly **MOMENTS:** Turning forces **HYPOTHESIS TESTING-** extending to Normal distribution **DIFFERENTIAL EQUATIONS:** a new kind of equation **PPE 3 late February/early March** |
| *NORMAL DISTRIBUTION*1.Introduction to Normal- measurement errors2. Properties of Normal distribution3. Solving probability problems with Normal;4. The Standard Normal distribution5. Finding unknown means and standard deviations give probabilities6. Hypothesis Test for mean of population using Normal Distribution*DYNAMICS*1.Force and Newton’s Laws2. Equilibrium, vectors and resolving forces3. Smooth inclined planes4. Connected particles5. Friction6. Moments | *NUMERICAL METHODS*1.Change of sign2. Cobweb and staircase diagrams3. Newton -Raphson method4. Trapezium rule for definite integrals |