Further Mathematics

Year Group 13

Half Term 1

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| Number of Hours | Topic |
| 20 | **Continuous Random Variables**  Probability Density Function; Expectation; Variance; Median; Mode; Piecewise PDF; Cumulative Distribution Function; Exponential Distribution; Functions of Continuous random Variables; Goodness of Fit for Continuous random variables |
| 10 | **Hyperbolic Functions**  Definition and graphs of Hyperbolic Functions and their inverses; Hyperbolic Identities; Hyperbolic Equations; Differentiation; Integration; |
| 6 | **Non-Parametric Tests**  Single Sample Sign Test; Single=sample Wilcoxon signed-rank test; Matched pairs tests; Wilcoxon rank-sum test; Normal approximations |
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| Reasons behind order of topic in this half term | |
| Continuous random variables is new but uses some ideas for A level Maths about integration, probability and reference to, but not using, Normal Distribution. It start with a recap of Year 12 work on this topic.  Hyperbolic Functions uses exponential function form Alevel Maths and analogies to Trigonometic Identities in A level Maths studied in Year 12 and the start of year 13  Non-Parametric Tests is a totally new topic which builds on te concets of Hypotheseis testing from Year 12 Maths & Further Maths | |

Further Mathematics

Year Group 13

Half Term 2

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| Number of Hours | Topic |
| 10 | **Further calculus Techniques**  Differentiation of inverse trigonometric and hyperbolic functions; Integration with inverse Trigonometric and hyperbolic functions; Use of partial fractions |
| 6 | **Series & Induction**  Recap Proof by Induction; Induction & Series; Using Standard series; Method of Difference |
|  | **Mocks 1** |
| 6 | **Applications of Calculus**  Maclaurin Series; Improper Integrals; Volumes of Revolution; Mean Value of a Function |
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| Reasons behind order of topic in this half term | |
| Further Calculus Techniques builds on A level calculus and the work on Hyperbolic Functions  Series and iNduction build supon work on Proof from A level Maths and Induction from Year 12 Further. Sequences build on A level an dFurther work in Year 12  Applications of Calculus builds on A level calculus and the work on Hyperbolic Functions and Further Calculus Techniques | |

Further Mathematics

Year Group 13

Half Term 3

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| Number of Hours | Topic |
| 8 | **Combining Random Variables**  Adding Independent random variables; Expectation & variance of sample mean; Unbiased estimate of mean & variance; Linear combinations of Normal variables; Distributions of means of large samples = CENTRAL LIMIT THEOREM |
| 4 | **Powers & Roots of Complex Numbers**  De Moivre’s Theorem; Complex Exponents; Roots of a Complex Number; Roots of Unity; Factorising; Geometry of Complex Numbers |
| 8 | **Complex Numbers & Trigonometry**  Multiple Angle Formulae; Applications to polynomial equations; Powers of trigonometric functions; Trigonometric Series |
| 6 | **Polar Co-ordinates**  Curves in Polar Co-ordinates; Converting between Polar & Cartesian Co-ordinates; Area enclosed by a polar curve; Area between two polar curves |
| 4 | **Hypothesis Tests and Confidence Intervals**  Hypothesis Test on Mean of a large sample; Confidence Intervals |
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| Reasons behind order of topic in this half term | |
| Combining Random Varaibles build on A level work on Normal Distribution and work on combining Discrete variables  Powers and roots of complex numbersbuilds on all previous complex number work  Complex Numbers and trigonometry builds on all previous complex number work and Alevel Trigonometry  Polar Coordinates is almost a totally new topic with no links to previously studied topics but does ananlogies to complex loci and trigonometry from GCSE and A level  Hypotheses Testing and Confidence Interval builds on previous hypothesis work and normal distribution from A level | |

Further Mathematics

Year Group 13

Half Term 4

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| Number of Hours | Topic |
| 8 | **Further Calculus**  Reduction Formula; Arc lengths; Surfaces of revolution |
| 2 | **Sequences and Series**  Solving Second Order Recurrence Relationships |
|  | Mocks 2 |
| 8 | **Differential Equations**  Definitions; First Order: Integrating Factor Method; Second Order: Homogeneous and Non-Homogeneous Differential Equations |
| 4 | **Applications of Differential Equations**  Forming Differential Equations; Simple Harmonic Motion; Damping & Damped Oscillations; Linear Systems |
| 4 | **Vectors**  Equation of a Plane; Intersection of a line & a plane; Angles between lines & planes; distances between points, lines and planes; linear simultaneous equations; intersections of planes |
| 2 | **Vectors**  Volumes of tetrahedral and Parallelepipeds; Triple scalar product |
| Reasons behind order of topic in this half term | |
| Further calculus introduces new techniques that build on all previous calculus work from Maths and Further Maths  Sequences and Series extends the work on recurrance relationships from Year 12  Differential Equations Build on A level Maths Differential equations and all calculus that has gone before  Vectors continues the work of 3D Vectores from Year 12 | |

Further Mathematics

Year Group 13

Half Term 5

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| Number of Hours | Topic |
| 2 | **Groups**  Isomorphism & Structure of groups |
| 4 | **Number theory**  Simultaneous linear Congruences; Quadratic Residues; Fermat’s little Theorem; The order of modulo p; Binomial theorem |
| 2 | **Surfaces and partial differentiation**  Find stationary points and describe them in 3D; Equation of Tangent plane in 3D |
|  | **Revision and consolidation** |
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|  | EXAMINATIONS |
| Reasons behind order of topic in this half term | |
| Groups – Final concept to build on Year 12 Group work  Number Theory - Final concept to build on Year 12 Group work  Surfaces and partial differentiation - Final concept to build on Year 12 Group work | |

Further Mathematics

Year Group 13

Half Term 6

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| Number of Hours | Topic |
|  | **Revision and consolidation** |
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|  | EXAMINATIONS |
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| Reasons behind order of topic in this half term | |
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