Year 13 Further Maths Curriculum Overview

Rationale: The Year 13 curriculum fully complements and develops the work completed in Year 12 Further Mathematics. Students will complete the entirety of the course consisting of 3 modules – Further Mathematics, Further Statistics and Decision Mathematics. Together they form a fascinating and rigorous approach to the deeper understanding of mathematics, and will aid any student who wishes to sit a course in science, engineering, ICT or Mathematics, and give an excellent grounding to a student's problem solving abilities and analytical reasoning, preparing them for University and lifelong learning.

Term/Length of Time	Outline	Assessment/Teacher Feedback Opportunities	Homework and Literacy resources
Autumn Term 3 lessons per week for approximately 15 weeks.	**Pure Mathematics** The Y13 course fully builds on the foundations set in year 12. Students must ensure they have a thorough knowledge of the entirety of the year 12 curriculum, as it will be built on and developed much further this year. Students will gain excellent insights into mathematical rigour, problem solving, spotting patterns and speed in deciphering and solving complex real life problems.	Assessments are spread out throughout the year. Students will complete 2 module tests approximately every 8 weeks, (1 from each side of the course), covering all content learnt so far. Students will also sit 1 summative test in February, leading to the final exams in the summer.	**Minimum homework expectation - to be set on G4S** *One piece of home learning lasting roughly an hour per lesson. These are self-marked, but teachers will check that they have been completed and that pupils do understand the content, and know how to correct any errors.* *FAR (Feedback, Action, Response) tasks are set roughly once per unit (twice for longer units) covering key concepts. These contain 20-30 marks worth of exam style questions on the topics, including a question which requires pupils to explain or critique a problem solving process. These are marked by teachers, with time given in a later lesson for pupils to refine their work and act on feedback.*
Approx 3-4 weeks	**Complex Numbers** Now introducing De Moivre's theorem, this module gives a deep understanding of complex numbers, and how to apply them to solve problems involving series, trigonometry and the nth roots of a complex number.	Module test Covering Complex numbers from Further Mathematics 2. Feedback and analysis given.	**Links to aid revision:** Complex Numbers Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx. 2 weeks	**Series**		**Links to aid revision:** Series

	Building on the techniques learnt in year 12, we now look at the method of differences and the Maclaurin series when solving problems involving series.		Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 2 weeks	**Methods in Calculus** Building again on the calculus learnt in A Level maths, this covers how to differentiate and integrate inverse trig functions and how to integrate challenging partial fractions problems with higher power denominators.	Module test covering series and calculus from Further Mathematics 2. Feedback and analysis given.	**Links to aid revision:** Methods in Calculus Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 2-3 weeks	**Volumes of Revolution** Using the new skills learnt in 'methods in calculus', and the volumes module from book 1, this module gives a rigorous approach to solving problems with a challenging algebraic form, including the use of parametric equations.		**Links to aid revision:** Volumes of Revolution Students are expected to fully complete every question from the Chapter Exercises in the textbook. ***Literacy Resources*** *Students are strongly encouraged to read around the subject. Potential books to supplement learning include:* *The Number Mysteries by Marcus Du Sautoy*
Autumn Term 2 lessons per week for approximately 15 weeks.	**Applied Mathematics – Decision Mathematics and Further Statistics** We will now complete both the textbooks Further Statistics 1 and Decision Mathematics 1, revising year 12 materials and building by using the full year 13 modules.		**For Autumn Term Applied**

Approx 3 weeks	**Statistics –** **The Geometric Distribution** Now introducing the Geometric and negative binomial distributions. Similar to year 12, how to recognise these distributions and be able to apply them in real life contexts, including finding hypothesis tests and the variance and mean.		**Links to aid revision:** Geometric and Negative Distribution Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 3 weeks	**Decision – Networks and Graphs** We now begin the concept of graph theory and the use of the travelling salesman problem, finding minimum spanning trees and the nearest neighbour algorithm.	Module test covering networks and the Geometric and negative binomial distributions. Feedback and analysis given.	**Links to aid revision:** Networks and Graphs Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 5 weeks	**Decision - The Simplex Algorithm** Not as simple as the name suggests. This module covers thoroughly how to solve complex linear programming problems using the simplex method, the two stage method and the big M method, using techniques developed from world war 2 to solve logistical problems as efficiently as possible.	Module test covering the simplex algorithm. Feedback and analysis given.	**Links to aid revision:** The Simplex Algorithm Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 2-3 weeks	**The Central Limit Theorem** This fundamental theorem shows how all distributions are related and revert to the Normal when a suitably large number of		**Links to aid revision:** Central Limit Theorem Students are expected to fully complete every question from the Chapter Exercises in the textbook.

	observations are made. Students will be able to make use of this to simplify greatly large sets of data.		
Spring Term 3 lessons per week for approximately 13 weeks.	**<u>Pure Mathematics</u>** **Polar Coordinates** Students will experience a new way of writing coordinates beyond the traditional Cartesian form. They will learn how to write one value as another and be able to draw graphs of equations using Polar form.	Module test covering Polar coordinates and the volumes of revolution from Further Mathematics 2. Feedback and analysis given.	**For Spring Term Core** **Links to aid revision:** Polar Coordinates Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 2-3 weeks	**Hyperbolic Functions** Extending all the work on trigonometry – this shows how the Hyperbolic functions are very closely related to trigonometry and how to successfully apply this knowledge to problem solve with calculus.		**Links to aid revision:** Hyperbolic Functions Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Approx 2 weeks	**Spring test revision** Time will be spent preparing students with exam style questions to prepare for the final set of mock exams before the real one in summer.	Spring mock exam covering all units taught so far in Year 13 and year 12. Feedback and analysis given.	**Links to aid revision:** Past paper Questions Additional resources can be found on the Digital Learning Hub.
Approx 2-3 weeks	**Differential Equations and Modelling** The final section in Further Mathematics Core. This solves first and second order differential		**Links to aid revision:** Complex Numbers Module 1 Argand Diagrams Module 2

	equations and shows how they can be used in real life contexts. This module brings together many aspects of integration learnt in the previous chapters and in A level maths.		Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Spring Term 2 lessons per week for approximately 13 weeks. Approx 2-3 weeks Approx 2-3 weeks Approx 2-3 weeks	**<u>Applied Mathematics – Decision Mathematics and Further Statistics</u>** **Statistics –** **Probability Generating Functions** Bringing together previously learnt materials on the Statistical distributions, this extends students learning into Probability Generating Functions how they work and how to find their mean and variance. **Quality of Testing** This final chapter extends student's knowledge of Hypothesis testing, introducing type I and II errors to see how effective any conclusions from the data might be. **Spring test revision** Time will be spent preparing students with exam style questions to prepare for the final set of mock exams before the real one in summer.	Spring mock exam covering all units taught so far in Year 13 and year 12. Feedback and analysis given.	**For Further Maths Applied** **Links to aid revision:** Probability Generating Functions Students are expected to fully complete every question from the Chapter Exercises in the textbook. **Links to aid revision:** Quality of Testing Students are expected to fully complete every question from the Chapter Exercises in the textbook. **Links to aid revision:** Past paper Questions Links to previous topics (requires login to school portal)

	Decision – **Critical Path analysis** Extending the work from Y12, this topic extends Gantt charts and introduces histograms and scheduling diagrams to see a deeper appreciation of how to use critical path analysis in a range of real life contexts.		**Links to aid revision:** Critical Path Analysis Students are expected to fully complete every question from the Chapter Exercises in the textbook.
Summer Term 3 lessons per week for approximately 4 weeks.	**Pure Mathematics** **Preparation for final exams** A large range of previous exam material coupled with the complete course notes will be given to all students to prepare them thoroughly for their final exams.	Summer Final exams with 2 Further Maths Core papers sat in May and June.	Final few weeks covering key topics of difficulty and completion of all past papers. Summation of course. **Links to aid revision:** Past paper Questions Additional materials are available on the Digital Learning Hub.
Summer Term 2 lessons per week for approximately 4 weeks.	**Applied Mathematics – Decision Mathematics and Further Statistics** **Preparation for final exams** A large range of previous exam material coupled with the complete course notes will be given to all students to prepare them thoroughly for their final exams.	Summer Final exams with 1 Decision Maths and 1 Further Statistics paper sat in June.	Final few weeks covering key topics of difficulty and completion of all past papers. Summation of course. **Links to aid revision:** Past paper Questions Additional materials are available on the Digital Learning Hub.