RPS Mathematics Department Intent Statement

Mathematics is incredibly important in our lives and, without realising it, we use mathematical concepts, as well as the skills we learn from doing maths problems, every day. The laws of mathematics govern everything around us, and with a good understanding of them, we can accomplish some truly exceptional things.

We want all our students to see the beauty of maths, to be proud of their achievements and be supported by passionate staff through incorporating their ASPIRE learning habits in their mathematical endeavours.

All students will have the opportunity to benefit fully from a broad, balanced and challenging programme, which supports their studies across all subjects. Our overarching aim is to develop the mathematical knowledge of students through the application and study of mathematical concepts, terminology, notation, facts, generalisations, methods and techniques.

KS5

We want students to be able to employ mathematical techniques to solve advanced problems in a pure and applied context. Students will be able to investigate mathematical and non-mathematical settings and evaluate the outcomes of their choice of models. We will encourage them to seek out mathematical publications that are outside the curriculum as a result of an interest being sparked in a lesson. We will offer a broad choice of options to encourage as many students as possible to continue their maths studies.

A-Level Further Mathematics – curriculum intent – OCR Further Mathematics A

The A-level in further mathematics is aimed at students who have a keen interest in furthering their understanding of mathematics, it encourages them to extend their range of mathematical skills and techniques; understand coherence and progression in mathematics and how different areas of mathematics are connected; apply mathematics in other fields of study and be aware of the relevance of mathematics to the world of work and to situations in society in general. This is a course designed to stretch and challenge our most determined mathematicians and is delivered by teachers who are both passionate about their subject and hugely experienced.

Throughout the course, learners will use their mathematical knowledge to make logical and reasoned decisions in solving problems both within pure mathematics and in a variety of contexts, and communicate the mathematical rationale for these decisions clearly; reason logically and recognise incorrect reasoning; generalise mathematically and construct mathematical proof. By the end of the course, students will be able to recognise when mathematics can be used to analyse and solve a problem in context; represent situations mathematically and understand the relationship between problems in context and mathematical models that may be applied to solve them especially in mechanics and statistics, making deductions and inferences and drawing conclusions by using mathematical reasoning.

Though the range of teaching, out-of-lessons tasks and internal assessments, students will read and comprehend mathematical arguments; demonstrate an ability to communicate their understanding; they will be stretched and challenged. There will also be numerous opportunities to use technology such as calculators and computers effectively, recognise when such use may be inappropriate and take increasing responsibility for their own learning and the evaluation of their own mathematical development.

OVERARCHING THEMES: A-LEVEL FURTHER MATHEMATICS

OT1	Mathematical argument, language and proof
	○ • Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable • Understand and use mathematical language and syntax as set out in the content • Understand and use the definition of a function; domain and range of functions • Comprehend and critique mathematical arguments, proofs and justifications of methods and formulae, including those relating to applications of mathematics
OT2	**Mathematical problem solving**
	• Recognise the underlying mathematical structure in a situation and simplify and abstract appropriately to enable problems to be solved • Construct extended arguments to solve problems presented in an unstructured form, including problems in context • Interpret and communicate solutions in the context of the original problem • Understand the concept of a mathematical problem solving cycle, including specifying the problem, collecting information, processing and representing information and interpreting results, which may identify the need to repeat the cycle • Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics
OT3	**Mathematical modelling**
	• Translate a situation in context into a mathematical model, making simplifying assumptions • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student) • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student) • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate • Understand and use modelling assumptions

Key themes as assessment objectives

Use and apply standard techniques (AO1 – 50%)

Learners should be able to:

- select and correctly carry out routine procedures; and
- accurately recall facts, terminology and definitions.

Reason, interpret and communicate mathematically (AO2 – at least 15%)

Learners should be able to:

- construct rigorous mathematical arguments (including proofs);
- make deductions and inferences;
- assess the validity of mathematical arguments;
- explain their reasoning; and
- use mathematical language and notation correctly.

Solve problems within mathematics and in other contexts (AO3 – at least 15%)

Learners should be able to:

- translate problems in mathematical and non-mathematical contexts into mathematical processes;
- interpret solutions to problems in their original context, and, where appropriate, evaluate their accuracy and limitations;
- translate situations in context into mathematical models;
- use mathematical models; and
- evaluate the outcomes of modelling in context, recognise the limitations of models and, where appropriate, explain how to refine them.

Extra-curricular opportunities

- Year 12 students to be involved in out of class problem solving such UKMT mathematics individual and team challenges, were appropriate inter-school and out of school enrichment session for example from the AMSP;
- Teachers to use opportunities to link learning with real-life situations and share these with their students, with a particular focus on modelling in statistics and mechanics, as well as advanced mathematics;
- Students are encouraged to extend their understanding of how mathematics fits in the wider world and links to advanced modern mathematics (particular focus on independent access to books, videos, talks).

Roundwood Park School Mathematics Department, Year 12 teaching calendar			
Summer	Year 12 (Pure + Mechanics) 2 hours	Year 12 (Pure + Statistics) 2 hours	NOTES
Autumn 1	**Matrices (language of matrices, addition and multiplication, linear transformations)**	**Complex numbers (language of complex numbers, basic operations, solution of equations)**	Depending on the split between single and further mathematics teachers it is possible for FM topics to be delayed to allow faster progress through the single mathematics content. The overall aim is to deliver all of the A-level mathematics to FM students within the first 7 half-terms of teaching. FM teachers should aim to complete all the pure FM Y12 content and some of the optional statistics/mechanics units. Conversely, single mathematics teachers will assist in the delivery of the further pure content in Y13.
Autumn 2	**Matrices (invariance, determinants, inverses and simultaneous equations)**	**Complex numbers (Argand diagrams and loci)**	
		Further Algebra (roots of equations and transformations)	

Roundwood Park School Mathematics Department, Year 12 teaching calendar			
Christmas	Year 12 (Pure + Mechanics) 2 hours	Year 12 (Pure + Statistics) 2 hours	NOTES
Spring 1	**Year 12 in class assessment**		
	Mathematical Induction	**Further Vectors (lines, scalar and cross product, intersections, planes, shortest distance)**	In most cases, FM teachers will ensure that they cover the single applied content that directly relates to their chosen FM option. To ensure this, the timing of these units may be postponed as long as single mathematics teachers can teach FM content later.
Spring 2	**Dimensional Analysis**	**Probability**	
	Work, Energy, Power (work)	**Discrete random variables (general distributions)**	

Roundwood Park School Mathematics Department, Year 12 teaching calendar			
Easter	Year 12 (Pure + Mechanics) 2 hours	Year 12 (Pure + Statistics) 2 hours	NOTES
Summer 1	**Work, Energy, Power (energy, conservation of energy)**	**Discrete random variables (binomial)**	
	Mocks (1 ½ weeks)		
	Work, Energy, Power (energy, conservation of energy)	**Discrete random variables (geometric and uniform)**	
	PLACEMENT WEEK		
Summer 2	**Work Energy, Power (Hooke's law, power)**	**Discrete random variables (Poisson)**	
	Linear momentum	**Series (series summation and method of the differences, induction)**	
	E WEEK – resit week		
	Linear momentum and impulse	**Series (series summation and method of the differences, induction)**	

Year ends

Roundwood Park School Mathematics Department, Year 13 teaching calendar

Summer	Year 13 (2 hours a week)	Year 13 (2 hours a week)	Year 13 (I hour a week)
Autumn 1	AS Internal Assessment		
	Work, Energy, Power (restitution)	Complex numbers (Euler's formula, De Moivre, n-th roots, roots of unity)	Hyperbolic functions (definitions, differentiation and integration, inverse hyperbolic functions)
	Motion in a circle (uniform motion, vertical circle)	Matrices (simultaneous solutions, equations of planes)	
Autumn 2	Centre of mass and rigid bodies	Continuous random variables (crvs, pdf and cdf) and linear combinations of random variables	Further Calculus (McLaurin series)
	MOCKS (1 and ½ weeks)		
		Further Calculus (improper integrals)	Mock reflection

<table>
<tr><th colspan="4">Roundwood Park School Mathematics Department, Year 13 teaching calendar</th></tr>
<tr><td>Christmas</td><td>Year 13 (2 hours a week)</td><td>Year 13 (2 hours a week)</td><td>Year 13 (1 hour)</td></tr>
<tr><td rowspan="2">Spring 1</td><td rowspan="2">Further Dynamics and Kinematics
(linear motion under variable force)</td><td>Hypothesis testing and confidence intervals (CLT, unbiased estimators, confidence intervals)</td><td rowspan="3">Further Calculus (Volumes of solids revolution, mean value and partial fractions)</td></tr>
<tr><td rowspan="3">Chi-squared tests (contingency tables and goodness of fit)</td></tr>
<tr><td rowspan="3">Spring 2</td><td rowspan="3">Differential Equations (general and particular solutions, modelling, integrating factors, second order homogenous and non-homogenous)</td></tr>
<tr><td>Non-parametric tests (tests and normal approximations)</td><td rowspan="2">Further Calculus (inverse trigonometric and hyperbolic functions, further integration)</td></tr>
<tr><td>Correlation and regression (pmcc, rcc and hypothesis testing)</td></tr>
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Roundwood Park School Mathematics Department, Year 13 teaching calendar			
Easter	Year 13 (2 hours a week)	Year 13 (2 hours a week)	Year 13 (1 hour)
Summer 1	**Differential Equations**	**Correlation and regression**	**Polar coordinates (language of, sketching, area)**
Summer 2	EXAMS		

Content Overview	Assessment Overview	
Mandatory Pure Core All learners will study the content of the Pure Core. Papers Y540 and Y541 both assess content from the whole of the Pure Core and all of the Overarching Themes.	Pure Core 1 (Y540) 75 marks 90 minute written paper	25% of total A Level
	Pure Core 2 (Y541) 75 marks 90 minute written paper	25% of total A Level
Optional Papers Learners will study any two areas* chosen from Statistics, Mechanics, Discrete Mathematics and Additional Pure Mathematics. These papers assess the relevant content area and all of the Overarching Themes.	Two of: • Statistics (Y542) • Mechanics (Y543) • Discrete Mathematics (Y544) • Additional Pure Mathematics (Y545) Each: 75 marks 90 minute written paper	25% of total A Level
		25% of total A Level