JOHN PORT SPENCER ACADEMY

Further Mathematics

Curriculum Overview
Key Stage 5 – Y13

Joy | Progress | Success | Act with care, kindness, respect and integrity

Our curriculum is carefully sequenced to ensure cumulative knowledge and progression. Each unit builds on the last, with clear concepts that students must grasp to progress. We define end points to illustrate what mastery looks like by year-end.

Location of resources:	**JOHN Maths Staff - Documents** **John Port Spencer Academy Share Point – Maths Staff – Schemes of Work – KS5 – Further Maths**
Curriculum intent and rationale:	*Every student to be the best mathematician they can be.* Our aim is that every student has the opportunity to reach their potential mathematically and to be equipped to apply their mathematical knowledge to other subject areas, future courses, careers and everyday life. We aim for students to acquire substantive knowledge and procedural fluency along with conceptual understanding and the ability to apply reasoning and problem-solving skills. **Curriculum organisation**: Students have 3 lessons per week and are taught by 2 teachers
National Curriculum Links:	AQA | Mathematics | A-level | A-level Further Mathematics

What content needs to be covered? Key Knowledge and skills / misconceptions to address (with vocab in bold and spelling underlined)
By the end of the year students will know:

Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Students will learn key knowledge and skills about: • **Complex Numbers** • **Matrices** • **Graphs** • **Network Flows** • **Critical Path Analysis** • **Linear Programming** **Challenge:** **Students are challenged o develop reasoning, problem solving and communication skills as they a apply a more advanced knowledge of mathematics.** Planar graphs involve challenge with proving a graph is isomorphic to another graph. Gantt charts involve some challenge when creating them from a network flow. Flow augmentation paths require retention of different parts of information to then improve the flow in critical paths. The simplex algorithm with linear programming is extremely challenging with students – finding an optimal solution using a table form, working through multiple iterations of the algorithm.	**Students will learn key knowledge and skills about:** • **Further algebra & functions** • **Further vectors** • **Binary operations & group theory** • **Discrete Random Variables & expectation** • **Continuous random variables** **Challenge:** **Students are challenged o develop reasoning, problem solving and communication skills as they a apply a more advanced knowledge of mathematics.** Further group theory becomes challenging when proving a group is a subgroup of another group – proved by comparing the Cayley tables of each group. The cumulative distribution function can be challenging when applying it to more challenging functions.	**Students will learn key knowledge and skills about:** • **Further calculus** • **Exponential distribution** • **Chi tests for association** • **Type I and type II errors** **Challenge:** **Students are challenged o develop reasoning, problem solving and communication skills as they a apply a more advanced knowledge of mathematics.** The exponential function results in challenge with memorising and applying the formulae. Type I and type II errors build on knowledge from hypothesis testing in year 12, becoming more challenging	**Students will learn key knowledge and skills about:** • **Polar co-ordinates** • **Differential equations** • **Inference: 1 sample t distribution** • **Confidence intervals** • **Numerical methods** **Challenge:** **Students are challenged o develop reasoning, problem solving and communication skills as they a apply a more advanced knowledge of mathematics.** The t-tests topic is more challenging when trying to calculate the combined mean or variance if two samples are taken. The mid-ordinate and Simpson's rules have some more challenge when the question asks for the relative error of their estimate	**Students will learn key knowledge and skills about:** • **Differential equations** • **Hyperbolic functions** • **Revision for exams** **Challenge:** **Students are challenged o develop reasoning, problem solving and communication skills as they a apply a more advanced knowledge of mathematics.** Students find hyperbolic functions challenging. They struggle with solving equations with the exponential formulas and the proofs in this topic are particularly difficult. Students find integrals which result in hyperbolic answers challenging since you need to try a complicated substitution	**Students will learn key knowledge and skills about:** • **Revision for exams** **Challenge:** **Students are challenged o develop reasoning, problem solving and communication skills as they a apply a more advanced knowledge of mathematics.**

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Misconceptions: **Visualising geometrical relationship of 3 planes** The Kuratowski theorem often results in misconceptions when proving isomorphism. Converting a Gantt chart into a resource histogram creates issues for students, particularly when the number of workers is restricted.	**Misconceptions:** **Visualising lines and planes in 3D** Students often struggle to remember and apply Lagrange's theorem. Students struggle to remember whether to integrate or differentiate when using the cumulative distribution function, then they struggle with applying their regular maths A-level knowledge of complicated calculus. The rectangular distribution and uniform distribution can often be mixed up by students.	**Misconceptions:** **Applying calculus skills learned in A-Level Maths efficiently** Deciding when to use the exponential distribution is a common misconception. Students often forget when to use Yates correlation with chi tests for distribution. Students get confused with the term "power", and mixed up type I and type II errors, both with continuous or discrete situations (normal distribution vs binomial or Poisson distribution).	**Misconceptions:** **Applying techniques for solving differential equations to worded problems** Students often get confused when to use the t-distribution and when to use the normal distribution. A common misconception is mistaking which of Euler's improved methods to use for finding a solution, in certain situations. The mid-ordinate rule is often confused with the trapezium rule from the regular A-level. Students sometimes also get mixed up between the number of trips and the number of ordinates	**Misconceptions:** **Understanding direction of forces and acceleration when dealing with oscillations** Students often get the different hyperbolic functions mixed up, since they have to learn the exponential formulas off-by-heart. Another common misconception is the difference between the domain and range of reciprocal and inverse hyperbolic functions. Students get confused with surface area of revolution and length of arcs and how they link to hyperbolic functions.	**Misconceptions:** **Understanding the requirement for rigour in written solutions, using correct language and notation with reasoning clearly shown.**
Previous learning that is particularly relevant:					
From year 12 further maths learning: complex numbers, matrices, graph sketching, vectors		From Y12 maths: integration techniques		From Y12 maths: integration techniques, hyperbolic functions	
Future Learning - How content prepares students for future units?					
Students moving into Higher Education for a degree in subjects such as Maths, Physics, Engineering, Economics, Computer Science will be better prepared for their courses due to the depth and increased breadth of their knowledge.					
Outcomes: By the end of the year pupils will be able to:					
Apply the knowledge from the Further Maths Specification to exam style questions successfully.					
Assessment Strategy How we know our students are knowing and remembering more – Data from hunting not fishing, formative and summative assessment/s is used to adapt teaching and provide targeted challenge and intervention, supporting SEND and disadvantaged pupils.					
Formative: Discussion Questioning Whiteboard work Homework tasks Class tests		**Summative (& cumulative)** Class tests Mock exam		**Opportunities to revisit past learning:** **Most units build on knowledge from the previous year** **Revision time is built in prior to tests/exams** **DNA starters using exam questions** **Opportunities for homework (including apps):** Complete classwork from textbook Selected question on a worksheet for homework	

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How is the curriculum adapted to meet the needs of SEND and disadvantaged pupils, while maintaining high expectations?

Lessons are adapted in the light of assessment

Wider Curriculum and Enrichment – cultural capital and real world application -

Enriching experiences:
Senior Maths Challenge
Maths Ambassador
Lower school Maths support
After school drop-in/ revision sessions
Maths Inspiration trip

Our curriculum supports the school value of:

Joy	*Foster enthusiasm and engagement by* *Using manipulatives and a variety of representations to develop understanding. By creating challenge at a level where students can achieve success.*
Progress	*We monitor and support progress through* *The use of assessment strategies during lessons that support adaptive teaching strategies. Analysis of homework. Analysis of termly test data with feedback and development work.*
Success	*We celebrate success* by *Giving verbal praise, written comments.*
Act with care, kindness, respect, and integrity	*We build meaningful connections with our students by* *Ensuring a safe and supportive classroom environment with clear expectations of work and behaviour where there is mutual respect for all people in the room and all people feel valued.*

Literacy, Oracy and disciplinary language:
The correct use and understanding of notation, key words and terms is essential for students to be able to understand explanations and questions and to be able to participate effectively, with confidence in discussion and written work.

Key words are emphasised in lessons and used in discussion.

Cross-Curricular opportunities
Physics: SHM
Geography: Statistics

Our curriculum supports personal development by:
Students need to develop resilience as they as they are challenged with harder problems. Students need to deal with being incorrect and thinking further or discussing learning to ensure that this experience enhances learning.

Careers / Employability skills:
How does the curriculum link to the following employability skills:

Listening – Students need to listen carefully to explanations from their teacher and listen to their peers in class or group discussion

Speaking – students to need to speak their ideas for solutions to problems using correct terminology

Problem solving – All mathematical knowledge is applied to problem solving

Aiming high – Learning become incrementally more challenging as a unit progresses. Teachers aim to ensure students' progress as far as they are able.

Critical thinking – considering the information available to work with and deciding how best to use it and what calculations need to be done.

Staying positive – Questions can be challenging, and students need to remain positive, find out how to deal with the challenges and understand that being 'stuck' ultimately leads to learning if dealt with positively.

Leadership – Leading in a group activity or discussion. Feeding back to the whole class on behalf of a group.

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		Teamwork – working collaboratively when in a group or when working together as a pair. Helping each other with understanding challenging topics or questions. **Creativity –** finding novel solutions, writing a clear solution. **Employment Sectors discussed include:** Engineering Project management

Curriculum impact is evaluated through pupil study, work scrutiny, and progress data. Findings inform regular curriculum review to ensure continuous improvement.

When was this curriculum last reviewed? Include date	What changes were made and why?	How is ongoing improvement ensured?
June 2025	**N/A**	Regular review of Mocks and QLAs