MATHS

Why is the study of MATHEMATICS important?

MATHEMATICS has two disciplines: Pure and Applied – Pure Mathematics is the abstract science of number, quantity and space as concepts and Applied Mathematics is where the knowledge learned is applied to other disciplines such as statistics, physics and engineering.

Initially your mathematics study focuses on building firm foundations, including your fluency and understanding in readiness for your future GCSE and even A level mathematics study. Our curriculum is carefully designed to ensure that all students get a firm grounding in the basic rules of number. This is differentiated by depth, as opposed to students racing onto the next topic. This approach develops more confident mathematicians as students move through the curriculum and helps them to retain their new learning for longer. Your study of mathematics at Outwood will make you think about the beauty of how different topics connect and how processes relate to each other. Mathematics encourages you to discover those connections for yourself, to make you a detective of mathematics and to explore how to solve problems. This enables you to become an analytical thinker, knowing that the answer is only the final part of a process. It will help you to learn how to make conjectures (a conclusion based on evidence, patterns and thought, but not yet confirmed with proof) to reason and to prove. It will enable you to be more logical in your approach to complex issues and be more analytical.

You will discover how the basic four rules can be applied to fractions, decimals, standard form and algebra and how multiplicative reasoning can be applied to many areas of maths, such as percentages, ratio, proportion and enlargement to name but a few. You will get to investigate the beauty of mathematics connected to shape, and the usefulness it brings in analysing data and solving mechanical problems.

Your study of Mathematics will encourage you to think deeply and help you to problem solve more effectively – a great life skill that all universities and employers will appreciate. Across your study you will explore number, proportion, algebra, shape & space and probability & statistics. Lessons will provide opportunities for constructing your own learning and discovering mathematical rules, through the use of concrete materials such as counters, through pictorial representations to demonstrate mathematical concepts and to apply these to solve problems, both abstract and from real-life.

Maths lessons will be full of discussion, questioning, proving and explaining. You are going to love it! Mathematics will expand your mind!

Big Questions such as: How tiny is the earth in comparison with the universe? How can solutions to difficult engineering problems be found using graphs and calculus? How do people predict what is going to happen in the economy? and other such seemingly bewildering questions will be answered … you just need to learn the basics, be an inquisitive learner, and the rest will follow.

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What skills will the study of Mathematics teach you?

You are a citizen in this world and you need to know the basic skills of number and how to apply them to a range of problems – known as 'being numerate'. It will teach you:

- Not to be afraid of "being lost" and having to struggle to find one's way through the problem – RESILIENCE!
- To use calculation to solve basic problems
- To be financially aware
- To make and use generalisations – often quite quickly. One of the basic abilities, easily detectable even at the level of primary school: after solving a single example from a series, a child immediately knows how to solve all examples of the same kind
- To have rapid and sound memorisation of mathematical material
- To be able to concentrate on mathematics for long periods without apparent signs of tiredness
- To be able to offer and use multiple representations of the same mathematical object. (For example, a mathematical function can be represented in tables, sequences graphs, and algebraic expressions)
- An instinctive tendency to approach a problem in different ways: even if a problem has been already solved, you are keen to find an alternative solution.
- To utilise analogies and make connections
- Skills to link two (or more) elementary procedures to construct a solution to a multi-step problem
- To recognise what it means to "know for certain"
- To know how to prove or disprove a conjecture through mathematical reasoning
- To be efficient, a distinctive tendency for "economy of thought," striving to find the most economical ways to solve problems, for clarity and simplicity in a solution
- To be aware of the presence and importance of an underlying structure, for example, a proportional relationship
- How to use algebra to generalise numerical and physical models

How does your study of MATHEMATICS support your study in other subjects?

Study of any subject in our curriculum takes full advantage of links with other subject areas – we term these as interdisciplinary links and we make the most of them because we know that deep learning requires the transference of knowledge and skills from one topic of learning to another. Once you can transfer your learning across topics and subject areas then you are really mastering what you know and how to apply your understanding and skills.

Mathematics impacts on many other subjects such as geography and science, any subject that analyses data, looks at trends and uses formulae. Computer Science is a subject that uses the algorithmic approach that many topics in mathematics also use. The ability to follow a process accurately is applicable to many other subjects too. The Social Sciences, particularly at Post 16 and at undergraduate level, have a strong need for the use of data, for understanding of exponential growth and decay and for manipulation of formulae – and this is one reason why the Core Maths AS Level was introduced.

Across the other subjects, teachers will make reference to your learning in maths and this will help you to develop your understanding. There may be opportunities to explore the links between science, technology, engineering and mathematics departments in STEM activities.

Outside of Mathematics lessons there are a range of initiatives that can help you deepen your understanding of mathematics such Numeracy Ninjas, Times Table Rock Stars; UKMT Maths Challenge, MESME Maths Circles, Maths Masters for our elite mathematicians; and online learning programmes such as the wonderful Sparx.

How are you assessed in MATHEMATICS?
Throughout the 5-year MATHEMATICS course you are assessed using the following assessment objectives, which ensure that you can cumulatively build your subject understanding in preparation for future GCSE and A Level study. There are termly assessment points throughout each year that we term Praising Stars©. For younger years we base our assessment on our subject mapping of the age-related expectations across the curriculum, assessing students' performance at their current stage of study against expectation. At GCSE, we make predictions informed by our holistic assessment of their progress against the key assessment objectives and their aspirational GCSE targets. These are also the basis for any appropriate support and intervention.

<u>Key Assessment Objectives</u>
AO1: Use and apply standard techniques
Students should be able to:
• accurately recall facts, terminology and definitions
• use and interpret notation correctly
• accurately carry out routine procedures or set tasks requiring multi-step solutions

AO2: Reason, interpret and communicate mathematically
 Students should be able to:
• make deductions, inferences and draw conclusions from mathematical information
• construct chains of reasoning to achieve a given result
• interpret and communicate information accurately
• present arguments and proofs
• assess the validity of an argument and critically evaluate a given way of presenting information

AO3: Solve problems within mathematics and in other contexts
Students should be able to:
• translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes

• make and use connections between different parts of mathematics

• interpret results in the context of the given problem

• evaluate methods used and results obtained

• evaluate solutions to identify how they may have been affected by assumptions made

GCSE specifications in mathematics should enable students to:

1. develop **fluent** knowledge, skills and understanding of mathematical methods and concepts

2. acquire, select and apply mathematical techniques to **solve problems**

3. **reason mathematically**, make deductions and inferences and draw conclusions

4. comprehend, interpret and **communicate mathematical information** in a variety of forms appropriate to the information and context

How can Mathematics support your future?

We believe all students should continue studying maths-based learning in some way.

However, whether you have chosen to study Mathematics into A level or not, you will have gained a lot from its study over the five years from years 7 to 11. We know that the depth of understanding we encourage and support you to achieve will set you up well to be not only numerate, but a really logical and analytical thinker, who is resilient and ready to solve problems.

A strong GCSE in maths opens doors for your future career – employers look favourably on this and it would put you in a very strong position when looking for jobs or placements post-16 and in colleges.

Careers that the study of MATHEMATICS supports include:

- Actuarial Analyst
- Actuary
- Chartered Accountant
- Chartered Certified Accountant
- Data Analyst
- Data Scientist
- Investment Analyst
- Research Scientist (maths)
- Secondary School Teacher

- Software Engineer
- Statistician
- Civil Service Fast Streamer
- Financial Manager
- Financial Trader
- Insurance Underwriter
- Meteorologist
- Operational Researcher
- Quantity Surveyor
- Software Tester

The Maths Core Scheme of Work for the Trust is shown below. Individual academies will make bespoke adjustments to this to cater to the individual needs of their students.

Year 7	1	2	3	4	5	6	7	8	9	10	11	12	13
Autumn	**Algebra 1** Generalisation		**Baseline Assessment**	**Proportion 1** Multiplicative reasoning Interpreting pie charts		**Number 1** Place value and powers of 10 Types of number, factors and multiples Basic HCF & LCM and primes, Addition and subtraction of decimals		**Proportion 2** Measurement and Decimals		Revise, Assess, and Respond	**Data 1 (Science)** Displaying data incl. scatter graphs The mean		
Spring	**Number 2** Addition and subtraction of fractions	**Shape 1** Lines, angles and 2D shapes		**Shape 2** Perimeter	**Number 3** Multiplication and division of fractions and decimals	**Shape 3** Area		**Proportion 3** Equivalence, conversion and ordering of fractions, decimals and percentages	**Number 4** Addition and subtraction of negative numbers	Revise, Assess and Respond	**Data 2** Averages and the range		
Summer	**Number 5** Types of number Product of prime factors HCF and LCM using Venn diagrams	**Number 6** Multiplication and division of negative numbers	**Algebra 2** Order of operations Simplifying incl. expanding brackets and factorising expressions			**Proportion 4** Percentage of amounts Percentage increase and decrease incl. using a multiplier	Revise, Assess and Respond		**Algebra 3** Substitution and solving equations with an unknown on one side			**Data 3** Probability	

Year 8	1	2	3	4	5	6	7	8	9	10	11	12	13
Autumn	**Algebra 4** Sequences and finding the nth term	**Proportion 5** Ratio and proportion		**Number 7** Rounding and estimating incl. error intervals	**Algebra 5** Coordinates Linear graphs			Revise, Assess and Respond	**Data 4** Two-way tables Venn diagrams Frequency trees		**Shape 4** Congruency Introduction to similarity Transformations		
Spring	**Shape 4** Congruency Introduction to similarity Transformations	**Proportion 6** Compound measures		**Number 8** Four operations with fractions & mixed numbers incl. problem solving		**Algebra 6** Equations with an unknown on both sides Changing the subject of a formula Substitution into scientific formulae Expanding double brackets			Revise, Assess and Respond	**Shape 5** Parts of circles Circumference of circles and arc length Perimeter of semi-circles, quarter-circles and compound shapes		**Number 9** Indices and surds	
Summer	**Number 10** Indices and surds	**Shape 6** Angles on parallel lines Angles in polygons			**Data 5** Pie charts	**Proportion 7** Fractional and percentage change		Revise, Assess and Respond		**Shape 7** Area of circles, semi-circles, quarter-circles and compound shapes	**Number 11** Standard form		

Year 9	1	2	3	4	5	6	7	8	9	10	11	12	13
Autumn	**Data 6** — Analyse data using averages and measures of spread; Stem and leaf; Scatter graphs		**Shape 8** — Constructions		**Proportion 8** — Writing and simplifying ratios; Combining ratios; Connecting ratio and fractions		**Algebra 7** — Solve linear simultaneous equations algebraically and graphically		Revise, Assess and Respond	**Data 7** — Use of data	**Algebra 8** — Expand and factorise quadratic expressions		
Spring	**Number 11** — Indices and surds; Rationalise the denominator; Fractional and negative indices		**Algebra 9** — Solve quadratic equations by factorising; Plotting quadratic graphs; Identify roots of quadratic equations graphically			**Shape 9** — Pythagoras' Theorem		Revise, Assess and Respond	**Proportion 9** Proportion problems; Introduce inverse proportion	**Shape 10** — Surface area		**Algebra 10** — Non-linear sequences incl. basic quadratic sequences	
Summer	**Algebra 11** — Non-linear sequences incl. basic quadratic sequences	**Shape 11** — Volume of cuboids, prisms, and cylinders		**Data 8** — Probability incl. tree diagrams		**Shape 12** — Similarity and trigonometry		Revise, Assess and Respond				**Key stage 4 ready**	

Year 10

Year 10	1	2	3	4	5	6	6	7	8	9	11	12	13
Autumn	**Number 1** Rounding and Estimate Product of primes HCF/LCM Standard form			**Algebra 1** Manipulating algebra Solving linear and quadratic equations		**Number 2** Higher only - Surds	**Data 1** Reading and constructing charts Average and mean		**Proportion 1** Working with FDP Ratio		**Geometry 1** Angles in polygons Angles in parallel lines	**Algebra 2** Gradient Types of Graphs	
Spring	**Geometry 2** Perimeter, area and volume			**Algebra 3** Simultaneous equations		**Data 2** Calculating probability from tables	**Proportion 2** Working with compound measures		**Geometry 3** Similar shapes Pythagoras Trigonometry		**Geometry 4** Trigonometry Column Vectors	Catch up	
Summer	**Algebra 4** Algebraic fractions Function machines Functions			**Proportion and Algebra** Direct and inverse proportion		**Geometry 5** Transformations Geometric vectors	Catch up		Revise, Assess		Recap /Respond	Recap/Respond	

Year 11	1	2	3	4	5	6	7	8	9	10	11	12	13
Autumn	**Higher Tier** - Combinations of transformation. Trigonometric graphs, transformations of graphs, recurring decimal proofs, working with surds and indices, working with percentages, finding the nth term of linear and quadratic sequences, sine and cosine rule, algebraic fractions, standard form **Foundation Tier** - working with standard form, estimation calculations, writing numbers as product of prime factors, HCF and LCM, working with percentages, working with ratio and unitary proportion, perimeter, area and volume, drawing and interpreting graphs including stem and leaf, bar charts, pictograms and scatter graphs. calculating probability							Assessment Fortnight		Recap and Respond **Higher Tier** - Circle theorems Trigonometry Algebraic proofs Algebraic direct/inverse proportion and graphs **Foundation** - Transformations, angle reasoning, averages and the range, using probability trees, plotting graphs from an equation			
Spring	Bespoke learning plan to prepare for GCSEs for each class based on praising stars assessment and assessments in lesson							Mock Fortnight		Bespoke learning plan to prepare for GCSEs for each class based on praising stars assessment and assessments in lesson			
Summer	Revise, assess and respond					GCSE Exams - Individual academy plans							

Each Y11 class will have a scheme of work that will be bespoke to the class and responsive to Praising Stars© and assessments in lessons. This will help ensure that all of the specification is covered before each student sits their GCSE in May/June.