MATHS

MATHEMATICS:

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.

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.

Key Assessment Objectives

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 offer the study of A Level and Core Mathematics and we strongly encourage your continued study in this fantastic subject. In fact, 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.

Mathematics is offered at prestigious universities either as a single honours or a joint honours subject studied alongside other disciplines e.g. Statistics, Computer Science, Science, Philosophy, Engineering. Additionally, a high level of qualification in mathematics is a prerequisite for honours degrees in many engineering and physics related subjects.

An A level in maths demonstrates the very high level of analytical thinking that many universities are looking for in their applicants. The very fact that you have been able to study mathematical thinking post-16 will help your future applications be they for colleges, universities, apprenticeships or employment.

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 Plus Programme of Study for the Trust is shown below. Some students will follow a differentiated Programme of Study which is best for supporting their progress and some academies will make further 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
Weeks 1 - 13	Algebra 1 What is algebra and how can it help to solve problems in maths?		Baseline Assessment	Proportion 1 How is the multiplicative relationship between number identified?		Number 1 How does having good number sense help in different mathematical contexts?		Proportion 2 How are multiplicative relationships used to convert between measurements?		Revise, Assess and Respond	Data 1 (Science) Which is the most appropriate way of dispaying data?		
Weeks 14 - 26	Number 2 How are fractions added and subtracted?	Shape 1 How do the properties of shapes help us determine unkowns and how are they represented on diagrams?		Shape 2 What is perimeter and how can it be used?	Number 3 How are fractions multiplied and divided?	Shape 3 How is area calculated for different polygons?		Proportion 3 What is the connection between fractions, decimals and percentages?	Number 4 How are directed numbers added and subtracted?	Revise, Assess and Respond	Data 2 Which is the most appropriate way of analysing data?		
Weeks 27 - 39	Number 5 What is the fundamental theorem of arithmetic?	Number 6 How are directed numbers multiplied and divided?	Algebra 2 How do the four operations apply to numerical and algebraic expressions?			Proportion 4 What is a multiplier and how is it used with percentages?	Revise, Assess and Respond	Algebra 3 How are equations solved and values substituted into expressions?			Data 3 What are the chances of that?		

Year 8	1	2	3	4	5	6	7	8	9	10	11	12	13
Weeks 1 - 13	Algebra 4 What are sequences and in what contexts are they used?	Proportion 5 What is ratio?		Number 7 Why estimate?	Algebra 5 What is the connection between sequences, coordinates and linear graph?			Revise, Assess and Respond	Data 4 Which is the most appropriate way of representing categorical data?		Shape 4 What is the difference between congruence and similarity?		
Weeks 14 - 26	Shape 4 What is the difference between congruence and similarity?	Proportion 6 How are compound measures calculated?		Algebra 6 How can graphs be used to represent real-life scenarios?	Number 8 What calculations are needed for any given fraction problem?		Algebra 7 How are algebraic expressions manipulated and then used to solve equations?		Revise, Assess and Respond	Shape 5 How is the perimeter of a circle calculated?		Number 9 What are powers and roots?	
Weeks 27 - 39	Number 9 What are powers and roots?	Shape 6 How do known angle facts help to solve more complex problems?			Data 5 How are pie charts constructed and interpreted?	Proportion 7 How are different percentage problems solved?		Revise, Assess and Respond		Shape 7 How is the area of a circle calculated?	Number 10 How can very big and very small numbers be written efficiently?		

Year 9	1	2	3	4	5	6	7	8	9	10	11	12	13
Weeks 1 - 13	Data 6 How is the numerical interpretation of data connected to the graphical representation?		Shape 8 What equipment is essential for drawing accurate diagrams based on given information?		Proportion 8 How is ratio used in compound measure?		Algebra 8 What are simultaneous equations?		Revise, Assess and Respond	Data 7 How is a hypothesis tested?	Algebra 9 How are different forms of quadratic expressions manipulated?		
Weeks 14 - 26	Number 11 What are indices and surds and how do they extend knowledge of the number system?		Algebra 10 How is the shape of a graph determined by its formula and what does it tell us?			Shape 9 What is special about the relationship between sides in a right-angled triangle?		Revise, Assess and Respond	Proportion 9 What is inverse proportion?	Shape 10 What is surface area?		Algebra 11 What are non-linear sequences and in what contexts are they used?	
Weeks 27 - 39	Algebra 11 What are non-linear sequences and in what contexts are they used?	Shape 11 What is volume a measure of?		Data 8 How is the probability of combined events calculated?		Shape 12 What is special about the relationship between sides and angles in a right-angled triangle?		Revise, Assess and Respond			Key stage 4 ready		

Year 10	1	2	3	4	5	6	7	8	9	10	11	12	13
Weeks 1 - 13	Algebra 12 Why is the solution to an inequality different to the solution of an equation?		Data 9 Which is the most appropriate way of displaying continuous data?		Number 12 Which known number facts or skills are required to solve problems in different contexts?			Revise, Assess and Respond	Algebra 13 How are linear simultaneous equations solved?		Shape 13 How do known angle facts and algebra work together to solve more complex angle problems?		
Weeks 14 - 26	Algebra 14 How are the key features of the graph of a linear function determined and what do they tell us?			Shape 14 How is it determined whether a problem requires perimeter or area calculations?		Algebra 15 How are quadratic equations solved?		Data 10 How is the relationship between two sets of data described?	Revise, Assess and Respond	Shape 15 Which formula for volume is needed for different 3-D shapes?	Proportion 10 How are rates of change represented graphically?		
Weeks 27 - 39	Proportion 11 How is algebra used to solve proportion problems?	Algebra 16 How do methods applied to numerical fractions apply to algebraic fractions?	Revise, Assess and Respond	Shape 16 How is it determined whether a problem requires Pythagoras or Trigonometry, and in what form?			Proportion 12 How are ratio problems represented graphically?	Shape 17 What are bearings and how do they apply in real life?	Revise, Assess and Respond		Proportion 13 How is growth and decay related to repeated percentage change?		

Year 11	1	2	3	4	5	6	7	8	9	10	11	12	13
Weeks 1 - 13	Data 11 How is the probability of dependent events calculated?		Algebra 17 What are the key features of any graph and what do they tell us?	Shape 18 What is the minimum information needed to transform a shape in different ways?	Algebra 18 What are the key features of any sequence and what do they tell us?	Number 13 How does the accuracy of numbers used in calculations affect the final answer?	Algebra 19 How can knowledge of manipulating quadratics be applied to different contexts?	Revise, Assess and Respond		Shape 19 How are scale factors connected in 2D and 3D shapes?	Algebra 20 What is iteration and what is it used for?		
Weeks 14 - 26	Bespoke Learning Plan to prepare for GCSEs							Mock Fortnight		Bespoke Learning Plan to prepare for GCSEs			
Weeks 27 - 39	Bespoke Learning Plan to prepare for GCSEs				GCSE Exams - Individual academy plans								