Curriculum Progression Pathway

MATHS

Mathematics

Why is the study of Maths important?

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

In Year 7 and 8 your mathematics study focuses on mastery; building 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. Your study of mathematics at Outwood will make you think about the beauty of how numbers 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, someone who sees that the answer is only the beginning. 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.

From Year 7 you will have the exciting opportunity to explore the four rules of number in great depth – how addition leads to multiplication, and how these two lead to subtraction and division. You will discover how these four rules can be applied to fractions, decimals 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, algebra, shape and space and statistics. Lessons will provide a wide range of opportunities for constructing your own learning and discovering your own rules, through the use of concrete materials such as counters, through pictorial representations to demonstrate mathematical concepts and learning how 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!

What skills will the study of Maths 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 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, switching easily between representations of the same function by tables, charts, graphs, and analytic 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 detect unstated assumptions in a problem, and either to explicate and utilise them, or to reject the problem as ill-defined.
- 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.
- To use rapid abbreviation, compression or a curtailment of reasoning in problem solving e.g. algebra.
- How to grasp encapsulation and de-encapsulation of mathematical objects and procedures.

What will you know and understand from your study of Maths?

- How to reason mathematically by following a line of enquiry, developing an argument, justification or proof.
- Solve problems by applying mathematical skills to a variety of routine and non routine problems with increasing sophistication.
- The ability to break down problems into a series of simpler steps.
- Develop a conceptual understanding and the ability to apply knowledge rapidly and accurately.

How does your study of Maths support you 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 touches on many other subjects such as geography and science, any subject that analyses data, looks at trends, 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, for manipulation of formulae – and this is one reason why the Core Maths AS Level was introduced recently.
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, engineering and mathematics departments in STEM activities.

How can you deepen your understanding of Maths?
The curriculum model is based on the principle that efficient and effective learning is a matter of overlaying multiple layers, multiple exposures to the same concepts getting ever deeper and richer.

The curriculum is designed to give a deep understanding of key mathematical principles that students can apply in lots of different situations. All students, whether they be gifted mathematicians and aiming to go further with their academic studies or they just need to have basic numeracy skills are given these skills to transfer into their everyday life. Cross curricular elements are continually highlighted including links with science, geography, art and product design. Scale drawings, rotational symmetry, reading charts and graphs, scientific formulae are just some of the skills that are transferred across the curriculum.

Memorable experiences are provided for students to ensure that they get a broad and balanced view. Trips to local colleges to take part in classes to develop basic skills take place and we take pride in our continued involvement in the UKMT challenges.

Through our curriculum we create mathematically literate students. We ensure that they understand the growing use of data in our technology rich society from topics such as the global spread of disease through to being able to calculate income tax and household bills. The students can relate their classroom experiences in everyday context and are provided with cross curricular links to show where their transferable skills facilitate success across the curriculum.

How are you assessed in Maths?
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 6 assessment points each year that we term Praising Stars©. In Year 7 and 8 we assess against age related expectations. In Years 9, 10 and 11 we assess against GCSE specification criteria.

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 Maths support your future?

We offer the study of GCSE and A Level Mathematics, Further Mathematics and AS Core Mathematics and we strongly encourage your continued study in this fantastic subject if you have demonstrated a passion for it, a flair and an ability.

However, whether you have chosen to study Mathematics into A level or not you will have gained a lot from its study over the 5 years from years 7-11. 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.

A high level of qualification in mathematics is a prerequisite for honours degrees in many engineering and physics related subjects.

It is also cited that 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

Curriculum Progression Pathway

	Term 1:1	Term 1:2	Term 2:1	Term 2:2	Term 3:1	Term 3:2
7	Introduction to algebra Multiplicative reasoning and interpreting pie charts Place value, properties of number and decimals	Measurement and decimals Data 1 - Displaying data (including scatter graphs) and Mean Add & Subtract Fractions Lines, Angles and 2D Shapes	Perimeter Multiply & Divide Fractions Area Fraction, Decimal and Percentages Add & Subtract Negative Numbers	Averages (Mode & Median) Properties of Number Multiply & Divide Negative Numbers	Order of operations & Simplifying Expressions Percentages of an amount	Substitution & Solving Equations Probability
8	Sequences Ratio & Proportion Rounding & Estimating Coordinates and Linear Graphs	Frequency Diagrams Congruency & Similarity	Compound Measures Real Life Graphs Fractions & Mixed Numbers	Solving Equations & Algebraic Manipulation Circumference of Circles Indices and Surds	Angles on Parallel Line & in Polygons Pie Charts Fractional & Percentage Change	Area of circles Standard Form
9	Statistical Analysis including scatter graphs Constructions Ratio & Combining Ratio	Simultaneous Equations Use of data Expanding and factorising quadratics	Solving Quadratic Equations Pythagoras' Theorem Direct & Inverse Proportion	Surface Area Non Linear Sequences	Volume Probability including tree diagrams	Similarity & Trigonometry End of Key Stage Assessment and introduction to KS4
10	Introduction to Algebra Analysing and Interpreting Data Prime Factors, Indices & Surds Additional Higher Content	Simultaneous Equations Angles Straight Line Graphs Additional Higher Content Circle Theorems	Perimeter & Area including Circles Quadratic Equations Scatter graphs and time series	Volume Compound Measures Direct and Inverse Proportion	Pythagoras' Theorem & Trigonometry Additional Higher Content Algebraic Fractions 3D Trigonometry	Proportion Problems Bearing & Scale Diagram Additional Higher Content Rates of Change

	Cumulative Frequency, Histograms & Box Plots					
11	Pythagoras' Theorem and Trigonometry Percentages Probability Bespoke Revision Additional Higher Content Algebraic Fractions Vectors	Graphs Transformation Sequences Bespoke Revision Additional Higher Content Upper & Lower Bounds	Bespoke Revision Additional Higher Content Proof Iterative Processes Graph Modelling	Bespoke Revision Additional Higher Content Transformation of graphs Vectors	Bespoke Revision & Exam Preparation	