Curriculum Progression Pathway

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, either as abstract 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. 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.

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 and proportion 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 & space and probability & statistics. Lessons will provide opportunities for constructing your own learning and discovering mathematical rules through the use of concrete materials and through pictorial representations to demonstrate mathematical concepts. You will learn 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!

Big Questions such as: How tiny is the earth in comparison with the universe? How can solutions to difficult engineering problems be found by 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 numbers 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.

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 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.

Outside of Mathematics lessons there are a range of initiatives that can help you deepen your understanding of mathematics such as, Timetable Rock Stars, UKMT Maths Challenge led by Leeds University, 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 assessment points each year that we term Praising Stars©. For KS3 these are termly and for KS4 these are every half term. 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 informed 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 strongly encourage you to continue studying Mathematics post 16, 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 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 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 7 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 9 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 10 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 8 Solve linear simultaneous equations algebraically and graphically		Revise, Assess and Respond	Data 7 Use of data	Algebra 9 Expand and factorise quadratic expressions		
Spring	Number 11 Indices and surds Rationalise the denominator Fractional and negative indices		Algebra 10 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 11 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	1	2	3	4	5	6	7	8	9	10	11	12	13
Autumn	Algebra 12 Equations and inequalities		Data 9 Analysing and interpreting data		Number 12 Further indices and surds Calculations using standard form Recurring decimal proof Combinations and the product rule for counting			Revise, Assess and Respond	Algebra 13 Linear simultaneous equations		Shape 13 Angles on parallel lines Angles in polygons Basic circle theorems		
Spring	Algebra 14 Plotting linear graphs from a table y=mx+c (incl. parallel and perpendicular lines) Identifying non-linear graphs			Shape 14 Perimeter and area incl. circles, arcs and sectors Worded problems with money links to algebra		Algebra 15 Solving quadratic equations and using quadratic graphs		Data 10 Data Handling Scatter graphs Time series	Revise, Assess and Respond	Shape 15 Volume	Proportion 10 Compound measures Real-life graphs		
Summer	Proportion 11 Contextual calculations and multi-step problems	Algebra 16 Algebraic fractions	Revise, Assess and Respond	Shape 16 Pythagoras' Theorem and trigonometry incl. 3D			Proportion 12 Direct and inverse proportion and graphs	Shape 17 Bearings & scale diagrams	Revise, Assess and Respond		Proportion 13 Percentages incl. finance		

Year 11	1	2	3	4	5	6	7	8	9	10	11	12	13
Autumn	Data 11 Probability Sampling, capture/recapture and relative frequency Venn diagrams & set notation Tree diagrams and frequency trees		Algebra 17 Non-linear graphs	Shape 18 Transformations	Algebra 18 Sequences	Number 13 Error bounds	Algebra 19 Completing the Square	Revise, Assess and Respond		Shape 19 Proof of congruence Similarity	Algebra 20 Functions Transformations of graphs Iteration		
Spring	Bespoke Learning Plan to prepare for GCSEs							Mock Exam Fortnight		Bespoke Learning Plan to prepare for GCSEs			
Summer	Bespoke Learning Plan to prepare for GCSEs				GCSE Exams - Bespoke Learning Plan to prepare for GCSEs								