Curriculum Progression Pathway

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 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 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 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, 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 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?

Students First
OUTWOOD
GRANGE ACADEMIES TRUST

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.

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 Numeracy Ninjas, 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 half termly assessment points 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 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.

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 GCSE 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

	7	8	9	

Autumn 1	**Algebra 1** Generalisation **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	**Data 3** Probability **Proportion 5** Ratio & proportion **Number 7** Rounding and estimating, including error intervals **Algebra 5** Linear graphs		
Autumn 2	**Proportion 2** Measurement Decimals **Data 1** Displaying data, including scatter graphs The mean	**Data 4** Two way tables Venn diagrams Frequency trees **Shape 4** Congruency Similarity Transformations		

Spring 1	**Number 2** Addition and subtraction of fractions **Shape 1** Lines Angles 2D shapes **Number 3** Multiplication and division of fractions and decimals **Shape 3** Area	**Shape 4** Congruency Similarity Transformations **Proportion 6** Compound measures **Algebra 6** Real life graphs **Number 8** Four operations with fractions, including mixed number		
Spring 2	**Proportion 3** Equivalence, conversion and ordering of fractions, decimals and percentages **Number 4** Addition and subtraction of negative numbers **Data 2** Averages Range	**Algebra 7** Solving equations Changing the subject Substitution Expanding double brackets **Shape 5** Parts of circles Circumference of circles and arc length Perimeter of semi circles, quarter circles and compound shapes **Number 9** Indices Surds		

Summer 1	**Number 5** Types of number Product of prime factors LCM/HCF using Venn diagrams **Number 6** Multiplication and division of negative numbers **Algebra 2** Order of Operations Simplifying, including expanding brackets and factorising	**Number 9** Indices Surds **Shape 6** Angles on parallel lines Angles in polygons **Algebra 6** Real life graphs **Data 5** Pie charts		
Summer 2	**Proportion 4** Percentage of amounts Percentage increase and decrease **Algebra 3** Substitution Solving equations **Data 3** Probability	**Proportion 7** Fractional and percentage change **Shape 7** Area of circles and semi circles Compound shapes **Number 10** Standard form		
	In Years 10 and 11, Students will cover Units 14 to 27 as detailed below. Due to our Covid recovery plans and the need to cover lost learning and re-visit prior learning there will be some flexibility with the timings of when these units are delivered.			

	UNIT 14 **Algebraic Expressions** 1. Basic laws of indices and introduction to surds and four operations 2. Sequences including arithmetic & geometric 3. Expansion incl. double brackets 4. Factorisation incl. double brackets and solving simple quadratic equations 5. Algebraic manipulation (rearranging and advance rearranging)	**UNIT 15** **Graphs and Proportion** 1. Cartesian coordinates and an introduction to functions 2. Linear graphs 3. Direct and inverse proportion 4. Relationships and Proportionality 5. Variation and variation with powers (direct and inverse proportion with algebra)	**UNIT 16** **2-D Geometry** 1. Bearings 2. Further construction and loci 3. Congruence and similarity 4. Triangles and quadrilaterals (angles on diagonals) 5. Angles in polygons	
	UNIT 17 **Equations and Inequalities** 1. Construct and solve equations and inequalities 2. Graphical solutions to simultaneous linear equations 3. Linear simultaneous equations 4. Quadratic and non-linear graphs and links with quadratic equations	**UNIT 18** **Sampling and Probability** 1. Populations and samples; capture/recapture 2. Theoretical and experimental probability 3. Listing and the product rule for counting 4. Set notation & Venn diagrams 5. Combined events, including tree diagrams and conditional probability	**UNIT 19** **Geometry** 1. Transformations (translation, rotation, reflection) and combined transformations 2. Use known angle and shape facts to obtain simple proofs 3. Enlargement and negative scale factors of enlargement. 4. Combine transformations	

	UNIT 20 **Geometry** 1. Similar shapes 2. Exploring trigonometric ratios with 30-60-90 and 45-45-90 triangles of varying dimensions (*not sin,cos,tan) 3. Trigonometry and Pythagoras in right angled triangles, 3-D trigonometry and Pythagoras	**UNIT 21** **Number** 1. Calculations with and rules of indices and fractional indices 2. Indices and Surds 3. Calculations with standard form 4. Repeated change and percentage/fraction problems 5. Standard non-linear sequences and recurrence relations and iteration	**UNIT 22** **Statistics** 1. Represent and describe distributions and histograms, cumulative frequency and box plots 2. Identify misleading graphs 3. Time series 4. Correlation, using lines of best fit and interpolation/ extrapolation	
	UNIT 23 **Reasoning** 1. Algebraic arguments – algebraic proof and recurring decimal proof 2. Using angle and shape facts to derive results and circle theorems 3. Coordinates (including midpoints, coordinate problems) 4. Equations of parallel and equations of perpendicular lines 5. Vectors and vector proofs	**UNIT 24** **Geometry and Number** 1. Further surface area and volume (including exact answers) and similar areas and volumes 2. Solve problems involving compound units 3. Trigonometry in all triangles 4. Limits of accuracy and upper and lower bounds	**UNIT 25** **Applications of Algebra** 1. Expand/factorise binomials and triple brackets 2. Algebraic fractions 3. Quadratic equations; roots of functions, solving by factorising, complete the square, quadratic formula, quadratic inequalities 4. Quadratic Simultaneous eqns 5. Cubic/reciprocal graphs, exponential graphs, trig graphs, transformations of graphs 6. Graphical solutions of equations	

	UNIT 26 **Algebra and Geometry** 1. Arcs and sectors of circles 2. Proof in algebra and geometry and equation of a circle and the tangent to a circle 3. Rates of change and gradients of chords and tangents 4. Area under a graph and interpreting in context	**UNIT 27** **Revision & extension** 1. Functions – will be taught at every appropriate opportunity (e.g. algebraic notation, rearranging formulae, linear graphs, mappings etc.) and then brought together as a topic here		