

Curriculum Intent - Mathematics

Curriculum Priorities

At NGA, it is our duty to provide pupils with a curriculum which meets the demands of our learners. We want to pupils to access a coherent course of study that develops mathematical understanding, encouraging pupils to **think, act and communicate** mathematically. Our curriculum is planned to build on the skills and knowledge acquired by pupils in key stage 1 and 2 with core themes revisited and explored to deepen understanding. By having teaching for mastery principals at its heart, pupils are given opportunities to revisit previous ideas through interleaving, focus on fluency, develop their reasoning and problem-solving skills and appreciating the connectedness of mathematical ideas. At the same time, we want to foster a love of knowledge for its own sake; building resilient, curious and confident mathematicians that recognise the value of mathematics and problem solving in their own lives and in society. Our core curriculum for all key stages is enhanced by variety of opportunities for pupils to further spark their enthusiasm for maths, teamwork and mathematical curiosity by entry into the UKMT maths challenges. In key stage 4 learners are given opportunities to study additional qualifications in Statistics and Level 2 Further Maths preparing them for future studies at post-16. By providing a broad curriculum with links to other subjects and a range of different study options, we want to expose pupils to all the doors a good foundation in maths can open for them. We want our pupils to value and view maths not only as a life skill but as a potential career with pathways into STEM subjects.

Knowledge

By the end of Key Stage 4 we want pupils to have developed knowledge across the 4 main strands of mathematics; Number, Algebra, Ratio and Proportion, Geometry, Probability and statistics. This includes, but is not exhaustive, of the following end points for year 11. For further detail please see the curriculum plan.

Number:

Knowledge of rational and irrational numbers and their representations, including fluency in arithmetic with all types of rational and irrational numbers

Understand and apply the laws of indices in complex calculations

Use mathematical techniques including estimation

Use upper and lower bounds to calculate error intervals

Algebra:

Knowledge of how to use algebra to represent generalisations of numerical principles.

Form and solve both linear and non-linear equations and inequalities.

Solve simultaneous equations both linear and non-linear.

Using graphing techniques to plot linear and non linear graphs and use them to solve problems

Generate sequences from a rule and find the term to term rule for linear and non linear sequences

Ratio and Proportion:

Knowledge of how to represent ratios, simplify them and share a quantity into a given ratio
Can identify items that are proportional to each other and can calculate proportional change using multiplicative methods

Use rates for conversion and conversion graphs

Understand indirect proportion and solve problems

Geometry:

Knowledge of 2D and 3D shapes including properties, area and volume

Solve problems with congruency and similarity

Use mathematical instruments to construct Loci, bisectors, and shapes

Knowledge of angles rules for polygons, parallel lines, and circle theorems

Use and apply Pythagoras and Trigonometry to solve problems with triangles

Probability and Statistics:

Knowledge of how data is collected, analysed and presented

Compare distributions of ungrouped and grouped discrete and continuous data by constructing appropriate graphs and charts

Compare distributions using mean, median, range, quartiles and inter-quartile range.

Calculate probabilities of independent combined events using sample space diagrams or tree diagrams

For those that study **GCSE Statistics:**

The collection of data, including planning data collection, the types of data, sampling methods.

Processing and representing data including tables and diagrams including justification for the appropriate method.

Probability and comparing the likely hood of different events, compare experimental and theoretical outcomes, compare conditional and unconditional events.

For those studying **Level 2 Further Maths:**

Coordinate geometry.

Differentiation.

Equations of Tangents and Norms.

Factor theorem and factorising cubics.

Solving simultaneous equations with 3 variables.

For those who study this subject at **Key Stage 5** we want students to have:

Overarching themes within the A level curriculum are:

Mathematical argument, language and proof

Mathematical problem solving

Mathematical modelling.

Pure mathematics

Proof
Algebra and functions
Sequences and series
Differentiation
Integration
Coordinate geometry in the x-y plane
Trigonometry
Exponentials and logarithms
Vectors

Statistics

Statistical sampling
Data presentation and interpretation
Probability
Statistical distributions
Statistical hypothesis testing

Mechanics

Quantities and units in mechanics
Kinematics
Forces and Newton's laws

Skills

The skills we aim to develop are:



Literacy & Numeracy



Communication



Problem Solving



Metacognition



Leadership



Collaboration



Physical,
Practical &
Technical



Digital Literacy

For example:

- Be able to use and apply numeracy skills fluently.
- Reason clearly and logically.
- Build up a resilience to approach problems systematically and choose appropriate strategies to begin to find the solution.
- Solve problems in a diverse range of situations and contexts.
- Understand the use and importance of mathematics in daily life.
- Identify maths skills in other areas of the curriculum and make links/find similarities.
- Have a secure understanding of mathematics needed for entry to further education or the workplace

- **Literacy and numeracy:** Pupils make notes for all units of work and are encouraged to explain their findings through both written and verbal methods. Key mathematical language is used through-out lessons with pupils encouraged to always use key terminology. Key words and definitions are given to pupils at the start of each topic and discussed in lessons where they appear. Half termly reading tasks are provided as part of the homework policy to promote fiction and non-fiction reading. Numeracy is at the heart of all Maths lessons. Weekly form time activities are completed with KS3 pupils to build their numeracy skills. Additional intervention programmes are in place to help pupil develop their numeracy skills.
- **Communication:** Pupils regularly discuss and explain their ideas both to each other and to the class. Pupils are expected to communicate their mathematical findings through written explanations and diagrams. As part of lessons pupils are asked to justify their answers, knowing the answer alone is not always enough but communicating how they got there is more important. 'Discuss' tasks are built into lessons to give pupils opportunities to communicate their ideas. Pupils are given opportunities to 'be the teacher' and model answers.
- **Problem solving:** Problem solving elements are embedded into lessons to give pupils opportunities to work on problems that deepen their understanding. Question design encourages pupils to apply new skills and retrieve previous content as a method of increasing challenge.
- **Metacognition:** The maths curriculum contains regular interleaving activities. Manipulatives and multiple representations are used to develop understanding of a concept in both its pictorial, numerical and abstract form.
- **Leadership:** Group work is built into lessons. Pupils work as a group taking on different roles, often one member will work as the leader.
- **Collaboration:** Pupils work in both pairs and groups regularly in maths to develop a collaborative attitude to learning.
- **Physical, practical and technical:** In the geometry topics pupils are given opportunity to work with mathematical equipment in hands on practical ways to perform constructions and loci. Pupils are introduced to graphing programmes including Desmos to aid them in the understanding of different graphical representations. Throughout the course pupils are required to become proficient in the use of a scientific calculator.
- **Digital literacy:** Homework is set online using Hegarty maths and half termly non-fiction reading.

Qualities

The qualities we aim to develop are:



For example:

- **Respect:** Equipment when given to pupils is to be respected, looked after and returned. Pupils are given the opportunity to show respect when listening to the ideas of others when they are being shared during a discussion task.
- **Kindness:** The maths classroom is a space where pupils can share their ideas even if they differ from other pupils. Pupils listen to each other to see how they have solved the problem and to share their learning.
- **Resilience:** Pupils are encouraged to work on problems that they find difficult to enable them to build resilience and the desire to not give up. Pupils are encouraged to break problems down so that they seem easier to tackle. Mark schemes are shared with pupils to showcase what good maths work looks like. This highlights to pupils that they can receive marks for the wrong answer if they persevere. Misconceptions and mistakes are highlighted and shared as a way to further the learning of the class.
- **Creativity:** Pupils are encouraged to be creative in how they tackle a problem. Often pupils are not given a set of instructions to follow but encouraged to find their own way with a given starting point. Different approaches are celebrated and discussed as a class.
- **Positivity:** Pupils are immersed into a positive environment modelled by staff. Positive attitudes towards learning are encouraged and pupils are expected to be positive towards their maths lessons.
- **Aspiration:** By accessing a challenging curriculum, pupils are encouraged to push themselves further in their studies. By being given opportunities to participate in UKMT challenges pupils are competing with math pupils from across the UK at a range of different settings, allowing them to compete as one of the best of the best. Offering additional qualifications for pupils at key stage 4 also raises aspirations for what pupils can study at a higher level
- **Empathy:** Pupils are encouraged to show empathy through working with others.

Curriculum Principles

Sequencing, Learning and Assessment

Our curriculum has been structured to take into account the cognitive science of how we learn. Key knowledge is covered sequentially and deliberately revisited and built upon. Spaced practice and retrieval are a feature of the curriculum structure.

This is further reinforced by:

- Learning Challenge: a purely formative assessment to help evaluate, and then reshape learning and address misconceptions at the end of each unit.
- Learning Consolidation: a summative assessment, taken at a planned interval from the end of the unit, to help evaluate retention of learning in the long-term memory.

Cultural Capital

Cultural capital is developed throughout the curriculum with deliberate opportunities for all pupils (but especially disadvantaged pupils) to experience aspects of the taught curriculum through trips, events and activities and broaden their horizons.

For example:

- Mathematicians of note are celebrated and shared with pupils by being displayed on noticed boards and represented on the front of knowledge organisers. Half termly readings are used to promote the work of these individuals and the impact they have had on society.
- Equipping pupils with the skills they will need in their lives outside of school. We do this by covering the following
 - Year 7 – solving problems with money, reading scales, telling the time
 - Year 8 – understanding proportional changes, scale drawings, currency conversion
 - Year 9 – financial maths, best buys
 - Year 10/11 – Calculating simple and compound interest, calculating Gross and Net Pay and understanding a wage slip
- As part of year 10 work experience, we support pupils through a pupil programme of investing job, income and budgeting for their future lives.
- We support the delivery of PHSE days through provision of lessons on budgeting, opening bank accounts
- Trips are arranged throughout the year to support pupils love for maths including The Festival of Maths at Sheffield University for all year groups.

Equality

We want our curriculum to reflect what it means to be a young, British woman today; for our pupils to know about the struggle and sacrifice that has led to the freedom and opportunity they have. We want them to know about their heritage and culture, and that of others in our community, enabling them to celebrate it and contribute to the progress of democracy as global citizens. We therefore regularly review and consult on the equality of our curriculum.

For example:

- All pupils follow the same curriculum in key stage 3. Shared lessons are delivered to all pupils with support and differentiation built in to where it is needed with time given to some areas for pupils to develop their understanding.
- The work of black mathematicians is promoted during Black History Month with pupils being given the opportunity to watch and discuss the film 'Hidden Figures'.

Careers and Employability

To support our pupils growing understanding of how our subject might support them with employment, we plan in explicit links between their subject area and possible career pathways. Examples of the careers and sectors we highlight are:

We emphasise throughout how a good foundation in Maths can be the gateway to many opportunities in the future. We make links within topics to careers that they may subsequently be used for:

- Financial maths – links to accountancy, banking,
- Geometry – links to construction and architecture
- Data collection – links to marketing, retail
- Statistics – links to data mining, psychology,
- Formulas – healthcare, nursing, vet