# Curriculum Principles: Mathematics

## INTENT: A powerful, knowledge-rich curriculum

**By the end of their education, a student of mathematics at Dixons Fazakerley Academy:**

- Will have a highly-developed understanding of the 'big ideas' of Mathematics. So much of Mathematics makes sense when you understand the big ideas. When students understand the counting sequence, place value, properties of, and the ways in which numbers work, maths makes sense to them.
- Will be able to create models of maths ideas. We want our students to act out situations, use concrete objects, draw pictures and diagrams, and use abstract symbols to express maths ideas. Modelling maths ideas pushes our students to think deeply about the ideas, provides a way for them to show their understanding and justify their thinking, and allows them to simplify maths tasks and solve maths problems.
- Will have computational fluency. We want our students to be able to use their maths understanding to efficiently perform a variety of computations, including those with whole numbers, fractions and decimals.
- Will understand how maths ideas and concepts are connected. Maths is a series of skills and concepts which are interconnected, not isolated. Seeing connections between maths ideas allows our students to continually build their maths knowledge. The interconnectedness of maths ideas allows our students to build on previous knowledge and discover important insights.
- Will be able to reason mathematically and communicate their maths ideas**.** We want our students to reason through maths tasks, to analyse data, to discover insights, to test conjectures and draw conclusions and communicate this well.
- Will be able to solve a variety of mathematical problems. We want our students to know more than *how* to add, subtract, multiply, and divide. We want them to be able to apply maths skills to real situations. We want them to know *when* to add, subtract, multiply, or divide. We want them to have a strong repertoire of skills and strategies to be able to solve complex maths problems.

**Our uniting 'sentence' is:**

**"The Mathematics Department at Dixons Fazakerley Academy inspires students to question and explore the beauty of mathematics, leading to the development of resilient and analytical problem solvers who are able to numerically question the world around them."**

**In order to deliver a powerful, knowledge-rich curriculum we have selected knowledge by:**

- considering, debating and making decisions regarding the threshold concepts and powerful knowledge within the Maths curriculum. This work has involved Trust Assistant Principals for Maths and Heads of Maths across the Trust.
- considering debating and making decisions regarding declarative and procedural knowledge. This has been completed through rigorous debate between all Heads of Mathematics across Dixons Academies Trust through our Cross Cutting Teams, and through debate within the department of subject experts at the academy.
- codifying the declarative and procedural knowledge and making sure they are ideally sequenced together to reflect the reciprocal learning relationship between them. This has been done to reflect both the Dixons Curriculum model and our local context.

**The threshold concepts in our subject are:**

- Knowledge of **Number** and place value including decimals, fractions, integer powers and roots, equivalent terminating decimals, fractions, and percentages. Strong **Number** sense helps build a foundation for mathematical understanding.
- Knowledge of **Ratio and Proportion**, e.g. ratio of amounts, proportionality, volume and compound units, e.g. speed and density. **Ratio and proportion** are foundational to a student's understanding across multiple topics in mathematics, allowing them to compare quantities.
- Knowledge of Algebraic terms (**Algebra**) to include expression, equation, inequality, term, factor, variable, function, solution, substitute, gradient, intercept, root, expand, functions and sequences both arithmetic and geometric. **Algebra** gives us the foundation we need to comprehend certain problems that require more thinking and generalisation.
- Knowledge of **Shape** properties and formulae which include area and perimeter of triangles, parallelograms, trapezia, circles and volumes and surface area of cuboids and prisms. In addition, properties of transformations and congruent and similar shapes.

- Knowledge of geometric facts (**Geometry**) which include circle definitions, angles at a point, at a point on a straight line, in a triangle, vertically opposite, alternate and corresponding; in any polygon, interior and exterior angles; Pythagoras' Theorem and trigonometric ratios in right-angled triangles.
- Knowledge of **Probability:** 0-1 probability scale, independent events, equally and unequally likely outcomes, possible outcomes sum to one. Understanding **Probability** is the foundation to the is used in almost every other area to define a random event or an event with uncertainty.
- Knowledge of **Statistics**: discrete, continuous, and grouped data; mean, median, mode and range. A strong understanding of **Statistics** what they mean and how they are calculated is essential in a modern-day society.

**In order to achieve a true understanding of Mathematics, topics have been intelligently sequenced based on the following rationale:**

- the overall aim of the Mathematics curriculum is to provide students with the knowledge they need to increase their cultural capital and be successful in their lives beyond the academy. The schemes of learning sequence topics in an order closely following that set out by the 'Mathematics Mastery Programme'. Adopting a spiral curriculum, in which topic areas are revisited and extended on a yearly basis, this sequence of learning promotes a deeper understanding of the mathematical concepts being taught, both in line with the National Curriculum and in the wider domain.
- within the classroom, lessons roughly follow this format: Do Now/Review Now, New Learning (I do, We do, You do), Check for understanding, Independent Task, Exit ticket. In Key stages 3 and 4 students spend more time on practice and application to promote resilience and independence. In Key Stage 3 we synthesise knowledge learned in a lesson with an application question and there is a greater emphasis on this in Key Stage 4, to provide students with applied practice, underpinned by real life contexts.
- the concept of interrupting the 'forgetting process' permeates the Mathematics long term plan (LTP) and schemes of work (SOW). Interleaving and spaced learning are utilised in several ways. Across each year, new learning is split into units of work, each beginning with quick revision, then focusing on extension and application of similar learning to the year before. As a result, students will consistently revisit topics (spaced learning) and interleave concepts throughout their Mathematics career.
- every lesson begins with a 'Do Now', which promotes recall of integral knowledge, along with applied practice, from topics in the previous unit of work, allowing for spaced practice of up to seven weeks. The 'Do Now' also includes prerequisite knowledge of upcoming topics, to allow for a smooth transition into a new topic and a reduction of cognitive load.
- In addition, each topic taught has a mini-test and consolidation or extension re-test attached to assess understanding. Gaps in learning are then addressed through global feedback, with opportunities for targeted additional practice. These tests ensure learning is visited repeatedly. Spaced learning through retrieval practice and brain dumps in morning meetings and recall homework from knowledge organisers, are supplementary ways in which the forgetting process is interrupted, leading to true mastery of the Mathematics curriculum.

**The Mathematics curriculum will address social disadvantage and actively seeks to tell the stories of the marginalised by:**

- the spiral nature of the Mathematics curriculum, which is designed with the most vulnerable student in mind. Assuming a basic mathematical understanding from previous learning, each stage builds the students' knowledge. Key Stage 3, in particular, is used to ensure fluency in fundamental mathematics by closing any knowledge gaps evidenced in assessment, whilst also providing suitable extension.
- identifying on entry, students in Year 7 working below the nationally expected level. These students are immediately then targeted by addressing their mathematical needs and accelerating their learning. This is done by providing them with a bespoke curriculum. In Cycle 1 the focus is on the substantive knowledge taught at Key stage 2 such as times table, number facts, which is reinforced using manipulatives where necessary. In Cycle 2 the focus is on application of the substantive knowledge through problem solving. In Cycle 3 we work through the powerful knowledge taught in Year 7, in preparation for year 8. Key Stage 2 question level analysis is used to pinpoint needs of the students and drive retrieval exercises.
- oracy skills are developed through the exploration of functional questions all through. At Secondary level, using techniques such as Lemov's *Reading Reconsidered* ensures full understanding of the context of a question, including any assumed 'real life' knowledge, before tackling the mathematics behind it. Additionally, in Secondary, disadvantaged students are supported to succeed in Mathematics through prioritised invites to Sparx club. This is run weekly in our academy, and this provides focused time with a teacher after school where students can have access to a computer to master the skills set in the homework.

- identifying students with special educational needs or disabilities and providing additional support to allow them to access the universal offer. All scaffolding and differentiation is applied appropriately to meet the individual needs of the student and monitored to ensure impact.
- ensuring all students access the same curriculum, and we have the highest expectations of all. We teach to the top with scaffolding and support for those who need it to allow all students to achieve and experience the very best of what has been thought and said.

**We fully believe Mathematics can contribute to the personal development of students at Dixons Fazakerley Academy by:**

- Encouraging them to develop socially in Mathematics lessons through the celebration of 'making mistakes' and setting high expectations. This helps students to develop listening and speaking skills. Taking part in 'Maths Challenges'(MEM/UKMT) and 'Grade 9 Conference' events also encourages teamwork in problem solving. Self-awareness is developed through self-assessment, which enables students to have an accurate understanding of their strengths and weaknesses, to accept them and then understand how to learn from them. Additionally, students are encouraged to tutor other students in Sparx Clubs, developing further their social interaction skills in a professional manner.
- Developing morality, which is evident in much of the Mathematics curriculum. There are references to real-life contexts and students are encouraged to make decisions, developing an understanding that certain choices may have different consequences and outcomes. One example where this applies is in percentages, where comparing interest rates occurs and the role of 'loan sharks' can be discussed. Additionally, topics such as tracking and how the media use misleading statistical diagrams are also addressed.
- Encouraging them to question how Mathematics impacts the way the world works promoting spiritual growth. Referring to 'big issues' such as the gender pay gap, birth and death rates, gambling, through probability, and global warming within contextual questions. This allows students to have a concrete understanding of where Mathematics fits into the bigger picture. In additional to teaching a variety of strategies that allow creativity to blossom (i.e. tessellation, construction and symmetry).
- Being a universal language with concepts and theorems being developed all over the world lends Mathematics to promoting cultural capital. Discussion introducing many topics, such as place value, time, Fibonacci sequences, Pythagoras, and trigonometry, allows cultural influences to be explored.

**At KS3 and KS4, our belief is that homework should be interleaved revision of powerful knowledge that has been modelled and taught in lessons. This knowledge is recalled and applied through a range of low stakes quizzing and practice.**

**Opportunities are built in to make links to the world of work and enhance the careers advice and guidance that students are exposed to:**

- The Mathematics curriculum provides students with opportunities to consider the world of work and how Mathematics leads to successful careers. For example, when teaching constructions, reference can be made to any form of engineering or when teaching compound interest, reference can be made to any form of financial career.
- Each scheme of learning also contains a 'careers spotlight' where students are introduced to careers which utilise the learning within the unit. Information about qualifications needed, salaries and career progression are explored with the students.

**We teach beyond the requirements of the National Curriculum by:**

Introducing content into each scheme of learning that will benefit students in their understanding of the wider impact of Mathematics. For example, in Y7, students will recap telling the time and its Babylonian origins, explore where our place value systems came from and be introduced to Fibonacci and the 'Golden Ratio'. In Y8, students will discover Venn diagrams and the nuances of interest rates through percentages. Y9 and Y10 offer an insight into the history of Pythagoras' Theorem and the origins of trigonometry. Whilst not strictly appearing on the GCSE specification, providing this additional information allows students to build their cultural capital and deepen their understanding of the true beauty behind the mathematics they learn.