Planning for Learning - KS4 Mathematics

Contents

1. Sequencing Statement

The purpose of education is to teach knowledge for its intrinsic value, as this can facilitate both social justice and preparedness for the workplace. We cannot necessarily predict the knowledge students will need for their future careers and experiences, so giving them access to a broad palate of knowledge supports them for any situations they may face.

Mathematics is the bedrock of the curriculum because it can provide the foundation for successfully learning other subjects or skills needed in the workplace. However, more than this it is fascinating, beautiful and satisfying to learn in its own right. Our intent is that we enable each student to become the best mathematician they can be; confident and fluent with numbers, able to think logically, resilient in their approach to problems, and capable of dealing with abstract concepts; and that we foster an appreciation of mathematics within every student we teach.

The mathematics curriculum develops students' knowledge and skills sequentially and cumulatively so that they are able to connect new topics covered to prior knowledge and understanding. In recognition of the wide variety of prior experience students may have had prior to joining us, key elements are consolidated first, with varied practice once students are secure, and then revisited at intervals throughout the course as we build on them with new content. Regular low stakes assessments form a key part of learning in mathematics; with regular retrieval practice supporting students in ensuring learning is retained.

2. Specialism Statement

Mathematics is a facilitating subject for the specialisms of the UTC and Studio. In addition to learning specific topics that overlap with the specialisms, studying mathematics also supports the development of problem solving and analytical skills, as well as fostering logical and systematic approaches to problems.

3. Curriculum on a Page

GCSE Mathematics has two tiers; Foundation and Higher. Students taking Foundation can achieve grades 1-5, and students taking Higher can achieve grades 3-9. Both Foundation and Higher require students to sit three 90-minute question papers, each of equal weight (80 marks per paper). Paper 1 is a non-calculator paper. Papers 2 and 3 are both calculator papers. Each of the three papers contains a mix of question styles, from short single-mark questions, to multi-step problems. The mathematical demand increases as a student progresses through each paper.

GCSE Mathematics contains five broad topic areas; Number, Algebra, Ratio, Geometry, and Probability and Statistics. All content can be assessed on any of the three papers that students will sit in their GCSE examinations. As such, some questions will draw together elements of maths from different topic areas.

The table below shows the approximate weighting of the topic areas for the overall tier of assessment, not for each individual paper.

Topic Area	Foundation Tier (%)	Higher Tier (%)
Number	25	15
Algebra	20	30
Ratio	25	20
Geometry	15	20
Probability and statistics (combined)	15	15

For more information on each topic area, see AQA GCSE Maths Specification at a Glance.

4. Knowledge Acquisition

The curriculum is designed such that topics are taught in topics, generally lasting 3 to 4 weeks per topic. Each topic is split into 1 to 2 week blocks, with progression throughout the block moving from knowledge acquisition and consolidation towards increasing variation and problem solving. Building the curriculum in this way allows students to see links between smaller blocks into a whole topic, giving them a deeper understanding of how mathematics works together as a whole. Once completed, the topic is assessed with a Topic Test.

A typical KS4 Mathematics lesson will always begin with a 'Do Now' activity. These tasks will allow students to settle into the lesson in a calm manner, and give opportunity to revise previous learning. Our 'Do Now' activities are typically one of the following:

- 5 a day - Used by our Year 11 students to practice GCSE style questions. They are differentiated by tier, so students are practicing questions that can both build confidence and stretch their understanding.
- Mathsbox - Used by all year groups, the Mathsbox starters are designed to boost retrieval of fundamental skills needed in mathematics. The same skills are repeated each week of a half term. They are also differentiated by tier.
- 4 Questions - Used by all year groups, these four question starter activities are designed to allow students to recap learning from 'Last Lesson, Last Week, Last Topic and Last Term'. Allowing students to revisit previous topics to ensure learning has been embedded.

Following the 'Do Now', a KS4 Mathematics lesson will then encompass three stages of the learning journey - 'I Do', 'We Do', 'You Do'.

- I Do - Students will be shown the skill that is being taught, in a clear way. Students will often copy this into their books as a good example to look back on when practicing these skills in the future.
- We Do - Students will practice the skill as a group, generally done using mini-whiteboards for effective assessment for learning. Misconceptions can be identified and corrected before moving on.
- You Do - Students will practice the skill independently. We aim for there to be 15 minutes of independent practice per lesson, giving time for students to carefully check their own work and ask for support with any errors they have made.

5. Homework

Homework is set through Sparx Maths. Homework is assigned once per week, set on a Wednesday and due the following Wednesday. The homework consists of a variety of questions, based on students' previous learning in lessons. Not only is their weekly homework an opportunity to truly embed what they have learnt, it is also a great opportunity for students who have missed lessons (due to absence, school trips, etc.) to ensure they have fully caught up with what they have missed.

Students should aim for 100% on each homework assignment, and are encouraged to attempt the ‘Target’ and ‘XP Boost’ questions on their for further practice. Students who have not attempted their homework, with no valid reasoning, may be asked to come back to the maths classrooms after school, to use the department laptops to catch up on their work.

Instructions for logging onto Sparx Maths for the first time are as follows:

1.) Go to: https://sparxmaths.com/
2.) Click "Log in" at the top right, then "Student login"
3.) You then need to search for "The Studio School Liverpool" (all students are registered under one school) and click continue.
4.) Click on "New Sparx user?"
5.) Enter student first name, surname and date of birth
6.) It will tell them what their username is, make a note of it and then click "Set a password"
7.) Enter a password
8.) Enter the username and password on the next page to confirm them
9.) The student can then log in using those details going forwards.

6. Literacy

Throughout this course of study there are ample opportunities for pupils to develop their literacy skills. GCSE Mathematics contains an abundance of key words critical to the understanding of mathematics and science. In Mathematics, we help students to develop their literacy skills by:

- Providing full definitions of any new vocabulary introduced in lessons - encouraging students to make a note of it in their books to look back on.
- Insisting students use the correct terminology when discussing work in class, or with the teacher.
- Having many of the keywords used in Mathematics placed around each classroom.

7. Resources

Each year group has their own Google Classroom which contains a wealth of resources such as presentations used in lessons, containing the Sparx codes of the topics taught in that block, practice papers and solutions, links to recommended websites for revision.

Each Google Classroom contains resources for both Foundation Tier and Higher Tier where appropriate. Foundation Tier students who wish to make the jump to Higher Tier are free to look at and complete the resources for the Higher Tier.

For GCSE Mathematics, the following equipment is required; pen, pencil, ruler, rubber, protractor, compass and scientific calculator. This equipment cannot be provided to students in assessments. They must have their own. There are a lot of different types of calculator on the market, so it can be difficult to know which calculator is appropriate. The calculator we recommend is the Casio fx-83GT. These can be purchased from Student Services if necessary.

8. Syllabus

AQA GCSE Mathematics (8300).

https://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300

We also offer AQA Certificate Level 2 Further Mathematics (8365). This is for students achieving the highest grades in GCSE Mathematics. The course contains several topics found in A-level Mathematics and A-level Further Mathematics, and so is a very good precursor to those courses.

https://www.aqa.org.uk/subjects/mathematics/aqa-certificate/further-mathematics-8365

9. What Will I Learn?

On the following page, is the Overview for our Schemes of Work for each year group and tier. It must be stressed that this SOW is not set in stone. We try our very best to stick to this schedule as much as possible. But as the school year progresses, staff may decide to change the order of what is being taught to ensure students are making the best possible use of their time in lessons.

As students come to the UTC and Studio Schools from a variety of different backgrounds, we do not want to make it more difficult than necessary for students to change between tiers if initially placed in the wrong group for them. Therefore, all students in Year 10 are taught the same topics for the full year, until all students have had the opportunity to sit two rounds of Pre-Public Examinations. Once the students have sat these examinations, and reached the end of Year 10, we will have a firmer idea of what tier the students should sit at the end of Year 11, and they can be placed into the right group to study the topics required for that tier.

Year 11 Foundation focuses on embedding key skills that have been learnt in Year 10, and taking them further to gain the full understanding necessary to achieve a passing grade in GCSE Mathematics. Year 11 Higher focuses on learning further skills that are vital in order to get the top grades available, and progress with further learning in Mathematics past KS4.

Year 10

Week	HT1	HT2	HT3	HT4	HT5	HT6
1	Baselines	Sequences	Perimeter and Area	Quadratic Graphs	PPE Feedback	Pythagoras Theorem
2	Basic Number, Factors and Multiples	Coordinates and Linear Graphs	Circumference and Area	Expanding and Factorising Quadratics	Ratio and Proportion	Right Angled Trigonometry
3	Basic Fractions		Angles	Solving Quadratics		PPE
4	Basic Decimals and Rounding	**Simultaneous Equations**	Properties of Polygons	PPE Preparation	Calculating with Percentages	PPE
5	Basic Percentages	Statistical Measures	Indices/Surds	PPE	Speed, Density, Pressure	Constructions and Loci
6	Basic Algebra	Collecting and Representing Data	Standard Form	Vectors		PPE Feedback
7						Basic Probability
8	Solving Equations					

Year 11 Foundation

Week	HT1	HT2	HT3	HT4	HT5	HT6
1	Probability	PPE	Sketching Graphs	PPE	Personalised Plans	
2		PPE	Inequalities	PPE		
3	Surface Area and Volume	Pythagoras	Linear Equations	Personalised Plans		
4	Scale Diagrams and Bearings	Trigonometry	Simultaneous Equations			
5	Congruence and Similarity					
6	Transformations	PPE Feedback	PPE Preparation			
7		Linear Graphs				
8	PPE Preparation					

Year 11 Higher

Week	HT1	HT2	HT3	HT4	HT5	HT6
1	Scale Diagrams and Bearings	PPE	Surface Area and Volume	PPE	Personalised Plans	
2	Congruence and Similarity	PPE	Circle Theorems	PPE		
3	Transformations	Probability	Equation of a circle	Personalised Plans		
4			Algebraic Fractions			
5	Functions	Pythagoras	Iteration			
6	Tranforming Graphs and Functions	Right Angled Trigonometry	PPE Preparation			
7	Pre Calculus	Sine and Cosine Rule				
8	PPE Preparation					

10. How Will I Be Assessed?

Assessment in mathematics is split into five main parts; PPEs, Weekly Exam Papers (Y11 only), Topic Tests, Formative Assessment and Homework.

- PPEs – Pre-Public Examinations are mock exams. This is a chance to practice a full GCSE paper in full exam conditions. PPEs are conducted in March of Y10, June of Y10, November of Year 11, and February of Year 11.

  Following a PPE, students will be provided with feedback in lessons, where they will have the opportunity to look through their paper and see what they did well and where they made mistakes which can be improved upon in future. They will also be provided with a QLA Sheet (question level analysis) to take home. This sheet will break down what questions they gained and lost marks on, what topics those questions were, and the Sparx codes of the topic. This is an invaluable resource for students who wish to go away and revise key topics to improve upon for the next set of PPEs. Students will also be given a Current Working Grade, indicating what grade they might expect to get if they were to sit the GCSE exams tomorrow, and a Predicted Grade, which is the grade we think they will most likely achieve when they sit their actual GCSE examinations, if things continue as they have so far.

- Weekly Exam Papers – These are only conducted in Y11. They work on a four-week cycle. We take a full past paper and split it in half. Week 1, students sit the first half. Week 2, the first half of the papers are returned to students, marked, and verbal feedback is given. Week 3, students sit the second half. Week 4, the second half of the papers are returned to students, marked, and verbal feedback is given. This allows students to regularly practice exam papers, and exam-style questions.

- Topic Tests - after each topic, students sit a Topic Test. The topic test is a 20 minute/20 mark assessment that assesses the different elements of that topic. They are GCSE style questions that both consolidate learning and stretch student thinking. After completing a Topic Test, the teacher will mark it, provide feedback in class, and a task will be recommended for students to complete on Sparx Maths at home. The task that is recommended on Sparx is unique to each student, highlighting their area of weakness and is designed to help them improve.

- Homework – Homework is set through Sparx Maths. Homework is assigned once per week, set on a Wednesday and due the following Wednesday. The homework consists of a variety of questions, based on students' previous learning in lessons. Not only is their weekly homework an opportunity to truly embed what they have learnt, it is also a great opportunity for students who have missed lessons (due to absence, school trips, etc.) to ensure they have fully caught up with what they have missed.

- Formative assessment - This is arguably the most valuable assessment. Teachers will continuously use formative assessment in lessons, in a variety of ways, to ensure that we fully understand where the student is currently at in their learning, and how we can help them improve. Teachers do this through questioning, mini whiteboard work, and verbal and written feedback.

11. How Will This Prepare Me for My Next Steps?

GCSE Mathematics is a prerequisite for a large number of jobs and courses post-16. Students hoping to study most A-level subjects will require a minimum of a grade 4/5 in GCSE Mathematics.

In addition to this, GCSE Mathematics offers the opportunity to develop a variety of skills that are applicable to a vast multitude of different areas of study such as:

- critical reasoning and analytical skills, including the capacity for solving problems and thinking creatively
- develops numeracy skills which are applicable to all walks of life
- develops spatial awareness through the study of Geometry
- develops understanding of the use of statistics, and gives students the ability to criticise statistics

12. Contribution to UTC & Studio Aims

The Studio:

“Our purpose is to prepare you for success in a fast-moving digital world and, in particular, help create opportunities to work or launch businesses in the creative and digital industries. We’ve created an environment to inspire creativity and critical thinking, fed by the industry knowledge of our partners, that lead the sector across the region.”[1]

Life Sciences UTC:

“Our ethos is simple: we’re committed to providing the highest standards of teaching and learning, combined with real life industry experience which opens doors for our students. Our offer is unique, and we’re proud to work with some of the world-leaders in science and healthcare, giving our students the ability to build a strong and enviable portfolio of experience, so they can hit the ground running once they graduate from our UTC.”[2]

Mathematics is the fundamental language of science and technology. Scientists, and people working in technology, are able to make much greater contributions to their disciplines when their understanding of mathematics is greater. The first calculators and computers were built by mathematicians such as Ada Lovelace and Alan Turing. Sir Isaac Newton and Albert Einstein were able to describe the Laws of Motion and the Theory of General Relativity through mathematics.

As can be seen from our schools’ ethos, students will have the opportunity to work with leaders in science, healthcare and technology. Businesses in these sectors are looking for employees with good mathematical understanding. Employees in these sectors are required to be able to think critically, and solve quite complex problems. Mathematicians are often the best problem-solvers and critical thinkers.

13. Career Planning

Students completing mathematics-based degrees often go on to work in the following sectors:

- Finance – banking, accounting, investments, financial fraud
- Data analyst/scientist
- Technology – software engineer, game design, machine learning engineer
- Education

While these are the main sectors, employees with mathematics-based degrees work in every sector. A mathematics-based degree is highly regarded in the working world, as employees with these degrees tend to have exceptional problem-solving skills.

We endeavour to incorporate real life scenarios into all our teaching, so that students can understand the value of mathematics in the real world. Our Google Classrooms also provide links to a wide range of videos, explaining the point of that area of mathematics, and where it can be used in a variety of job roles.