TCEAT Curriculum & Assessment Overview: Mathematics

Course description and overarching aims (Intent)

Mathematics is a subject with wide-ranging applications that provides us with a powerful language to describe and understand the world around us. Basic numeracy skills are essential and are found in all areas of life, including shopping, cooking, sports, travel, personal finances, and DIY. More advanced Mathematics enables us to make progress in fields such as engineering, finance, technology, medicine, architecture and much more. Mathematics also helps us to develop essential personal skills such as critical thinking, problem solving, resilience, communication and independence. It enables us to analyse data and make informed decisions.

We believe that every student can succeed in Mathematics, and have designed a curriculum that enables them to realise their full potential in the subject. We aim to break difficult Mathematical concepts down into manageable chunks that promote a love of learning. We revisit topics frequently to ensure students become fluent and confident with these and steadily build on prior learning, whilst making clear links across the curriculum. We have also built in regular opportunities for students to reason, communicate mathematically, solve problems and spot patterns; all of which help them develop those all-important personal skills mentioned above.

Curriculum model overview (Implementation)

Our Mathematics curriculum has been backward planned based on the outcomes we hope students to achieve at GCSE. It is broken down into 6 different strands of content, which are

Algebra	Geometry	Number	Probability	Ratio and Proportion	Statistics

When students arrive in year 7 we focus on number, ratio and proportion, building on KS2 foundations, as this is the knowledge that all future content relies heavily upon. Students get an introduction to each of the other strands in year 7 or year 8. Content is then built upon in a spiral fashion throughout the rest of the curriculum, with each of the strands revisited on a regular basis and covered in more depth.

The skills that we are simultaneously aiming to develop with students in Mathematics are to

- use and apply standard techniques, **(AO1)**
- reason, interpret and communicate mathematically, and **(AO2)**
- solve problems within Mathematics and other contexts **(AO3)**

We enable students to develop these skills by having regular, built in opportunities for them to recall prior learning, practice routine procedures, tackle unfamiliar problems, assess the validity of an argument, spot patterns, discuss mathematical concepts and check the validity of their own solutions.

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Three tiers and three outcomes

Our curriculum is structured so that all students can access the appropriate level of support and challenge. There are three tiers (Core, Higher, Advanced) which cover the same material at increasing levels of challenge. All lessons have three differentiated outcomes (labelled Gold/Silver/Bronze) at KS3 and KS4. These allow the students to have a high ownership of their learning and a sense of purposeful progression. This means not only is it possible for all students to learn the same key content at a level appropriate to their current understanding, but it also allows students to move between tiers at any point with ease. The spiral nature of the curriculum results in students having the opportunity for further developments in these topics the next time the topic is revisited.

Example:

Factorising Single Brackets 1	**Bronze**	**Silver**	**Gold**
Advanced	Factorise two terms with one common factor	Finding highest common factor	Factorising higher powers
Higher	Recap expanding brackets	Factorise two terms with one common factor	Finding highest common factor
Core	Recap expanding brackets	Factorise where an integer is HCF	Factorise where a variable is HCF

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Assessment Objectives

We have overarching objectives which summarise the skills covered, or the handling of content involved. The internal school assessment system has integrated assessment objectives so that students can be aware of and consciously work on the different strands of content and skills within the subject /course. The internal school system uses the same objectives from Year 7 to Year 13 so that students can build the habit of subject specific self-review as a continuous process from KS3 to KS5

AO1: Use and apply standard techniques

- 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

- 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

- 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

The proportion of each assessment objective that appears in our quarterly assessments depends on the year group and tier as laid out below. The aim here is to provide appropriate support/challenge according to the needs of each student, whilst working towards the level of rigour required in the GCSE exam at the end of year 11.

	Year 7	Year 8	Year 9	Year 10	Year 11
Advanced	AO1: 50% AO2/AO3: 50%	AO1: 50% AO2/AO3: 50%	AO1: 40% AO2/AO3: 60%	AO1: 40% AO2/AO3: 60%	AO1: 40% AO2/AO3: 60%
Higher	AO1: 60% AO2/AO3: 40%	AO1: 60% AO2/AO3: 40%	AO1: 50% AO2/AO3: 50%	AO1: 40% AO2/AO3: 60%	AO1: 40% AO2/AO3: 60%
Core	AO1: 70% AO2/AO3: 30%	AO1: 70% AO2/AO3: 30%	AO1: 60% AO2/AO3: 40%	AO1: 50% AO2/AO3: 50%	AO1: 50% AO2/AO3: 50%

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Knowledge:

- Substantive knowledge - The main categories that account for the accepted conventions and facts of our subject. In Mathematics we break this down into two further categories
  - Declarative knowledge: Mathematical facts, terminology, definitions and notation **(AO1)**
  - Procedural knowledge: routine procedures or set tasks requiring multi-step solutions **(AO1)**

	Declarative Knowledge	Procedural Knowledge
Examples	✓ "I know that" the prime numbers are 2, 3, 5, 7, 11, … ✓ "I know that" angles in a triangle sum to 180° ✓ "I know that" the formula for the area of a triangle is $\frac{base \times height}{2}$ ✓ "I know that" a parallelogram has two pairs of parallel sides with opposite angles equal in length "I know that" the definition of a term, expression, equation, formula, identity is…	✓ "I know how" to solve an equation ✓ "I know how" to substitute into a formula ✓ "I know how" to multiply a two-digit integer by another two-digit integer ✓ "I know how" to factorise an expression ✓ "I know how" to calculate the median of a set of numbers ✓ "I know how" to add two fractions together

- Disciplinary knowledge - The main subject skills, procedures, thinking structures and behaviours of our subject. In Mathematics we also refer to this as "Conditional Knowledge", and it can usually be prefixed with "I know when…":
  - Making deductions, inferences and drawing conclusions **(AO2)**
  - Interpreting and communicating information accurately **(AO2)**
  - Presenting arguments and proofs **(AO2)**
  - Assessing the validity of an answer/argument and evaluating a given way of presenting information **(AO2)**
  - Making connections between different areas of Mathematics **(AO3)**
  - Solving problems **(AO3)**
  - Evaluating solutions to identify how they may have been affected by assumptions made **(AO3)**

  It is important to be aware that students are not able to access this knowledge unless they have a firm grasp of the prerequisite substantive knowledge. This should be prioritised in the first instance.

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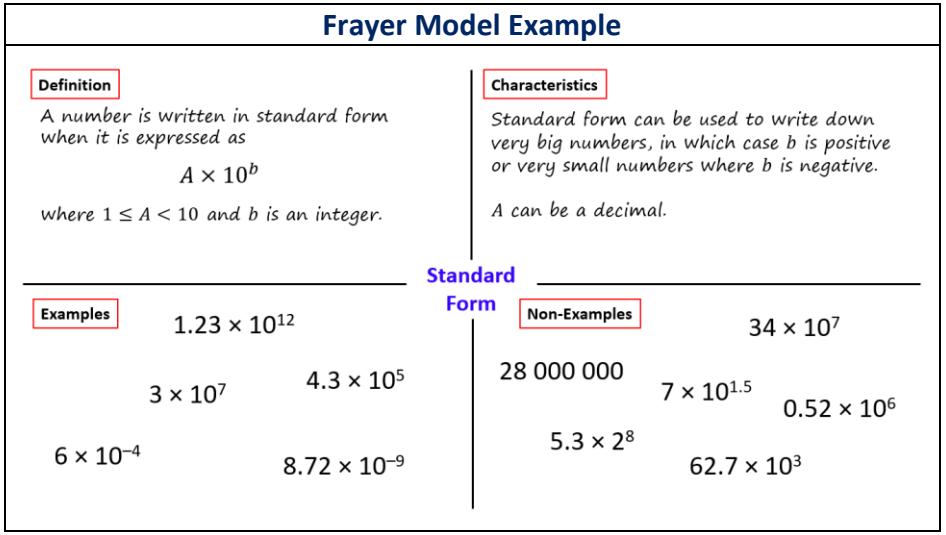
- Disciplinary Literacy

  In Mathematics we support student literacy through the explicit teaching and assessment of tier 2 and tier 3 vocabulary. We define tier 2 vocabulary as the specific mathematical command words that students need to understand in order to access a question. Some examples are “solve”, “evaluate”, “expand”, “multiply out”, “factorise”, “fully factorise”, “simplify”. Tier 3 vocabulary is then defined as subject specific. In Mathematics, these might be words such as “isosceles”, “hexagon”, “prime”, “pictogram”, “median”, “expression”, “proportion”.

  Tier 2 command words are taught explicitly as they first appear in the curriculum, supported by modelling of situations where these words apply. They are also regularly assessed through questioning as they appear later in the curriculum, in standardised assessments, in prep tasks, and in quarterly assessments.

  Tier 3 words are also taught explicitly as they first appear in the curriculum and are assessed regularly as they appear again later in the curriculum. We make use of Frayer models when having both examples and non-examples really helps to clarify the definition of a word being taught. These might be appropriate in the case of words like “adjacent”, “polygon”, “expression”, “geometric sequence”, “standard form”, but not necessarily in the case of words like “mean”, “median” and “mode”, “area”, “perimeter”, “volume”, where explicit definitions, followed by modelling of the concepts could be more powerful.



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In addition to this, we record our tier 3 vocabulary in our knowledge organisers, which students can refer to during lessons as necessary. During class discussion we expect students to use accurate Mathematical vocabulary, and in written work we expect them to use accurate mathematical notation in order to support their mathematical literacy. On occasion, when students are asked to provide written answers, we provide them with concise sentence structures to work within in order to communicate themselves clearly and efficiently.

Curriculum seven-year plan:

The Mathematics curriculum is designed to converge at key points throughout the academic year. Mathematics students will follow a curriculum map specific to their school. You can find individual course overviews for each school here:

[Ada Lovelace] [Ealing Fields] [Twyford] [William Perkin] – TO BE UPDATED/LINKED

Approaches to learning

Mathematics lessons within any given unit have been designed with some core principles in mind. These are

- A starter that either promotes retrieval practice of previous content or assesses prior learning required to further a concept.
- A development phase that introduces new concepts and vocabulary gradually, makes links to prior learning, and defines key facts/formulae, principles and rules.
- Opportunities for teacher modelling of methods, algorithms, and procedures in a systematic way.
- Independent tasks to allow time for consolidation of understanding.
- Mathematical questioning and discussion that enables students to develop their reasoning skills.
- Assessment for learning points that allow the teacher to gauge the understanding of the class and adapt their teaching accordingly.
- Students expected to use accurate mathematical vocabulary during class discussion and accurate mathematical notation in written work.
- Opportunities for students to practice problem solving and make links across the curriculum.
- A lesson prep task that further consolidates understanding of the content taught and/or allows retrieval practice of previous content.

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Assessment

The Trust assessment policy is central to support the 10:10 ethic which informs the ethos of all of the Trust's schools. Effective assessment allows students to know when and how they have done well, it identifies areas of weakness and supports students to know where they have got to improve. The school assessment system is entirely formative as all assessments are designed to be diagnostic for both the students and the teacher, designed to provide information on progress and provide feedback on areas for improvement as part of a feedback loop. The delivery of the curriculum in all subjects allows for a range of assessment activities including:

AfL – Assessment for Learning

Afl is critical to learning. Throughout each lesson students will be given opportunities to test their understanding and give their teacher opportunities to identify issues and correct misunderstandings on the spot. All teachers utilise strategies to ensure they can assess whole class progress rapidly & target support within lessons. These strategies include the use of mini whiteboards, green pens (used to distinguish student self-marking /correction from that of the teacher), self-assessment, peer-assessment, circulation, live marking, using a visualiser and various types of questioning. In Mathematics, teachers would routinely expect students to use accurate mathematical vocabulary/notation and would provide students with the opportunity to correct these where necessary.

Prep

Prep is designed to support learners to retain and retrieve information therefore strengthening long-term memory. Preps are short tasks, no longer than 15 minutes in length, set each lesson with a due date of the next timetabled lesson. This work is to be completed outside of the classroom (at home or in study club) and is designed to consolidate learning and prepare students for their next lesson. In Mathematics prep is set via a combination of the online platform Sparx and short written tasks. Sparx sets automatic online tasks for students that are targeted at the level they are currently working at. As time goes by, the question selection becomes more and more personalised to each student, as the software learns about which topics they need more support with. We also set short recall and retention/problem solving tasks that students complete on paper and self-assess at the start of the next lesson.

Standardised assessments

These are longer tasks designed to provide students with a chance to applying work from several lessons. These may be done as homework or in-class tasks. In Mathematics we set these in class at key points throughout the year. They cover one or two units worth of work and provide students with timely feedback on their understanding of recent content. These are marked by teachers and the results are recorded on Go4School for parents and students to see. We emphasise that these are low stakes tests and simply used to provide feedback on how well students have understood recent units of work.

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Quarterly assessments

At fixed points throughout the year students sit exams in a formal setting.

Twice per academic year (December Q2, June Q4) students will sit assessments that take the form of formal exams and examine cumulative skills and content acquisition. These milestones are opportunities for students, staff, parents & carers to take stock of progress and performance at this point. We then have the information and feedback needed to take the next steps in their learning. In Mathematics we assess cumulatively at each quarter, but provide topic lists so that students are able to focus their revision on the particular topics assessed at that quarter. Full details of our assessment structure and topics assessed can be found in our assessment planning document - *TO BE UPDATED/LINKED.*

	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Quarter 1	Formal assessment for Q1 focussing on specific topics as detailed in the assessment overview document linked above. Marks and grades recorded on Go4Schools. Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.						
Quarter 2	Formal assessment for Q2 focussing on specific topics as detailed in the assessment overview document linked above. Marks and grades recorded on Go4Schools. Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.						
Quarter 3	Formal assessment for Q3 focussing on specific topics as detailed in the assessment overview document linked above. Marks and grades recorded on Go4Schools. Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.						
Quarter 4	Formal assessment for Q4 focussing on specific topics as detailed in the assessment overview document linked above. Marks and grades recorded on Go4Schools. Learning habit grades, current grades, on track shown on Go4Schools and grade sheets.						

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Feedback routines.

Students are given feedback throughout the school year so they can improve.

In lessons students will regularly use their mini whiteboards to show their answers and give teachers the opportunity to correct misconceptions. Teachers use a variety of questioning techniques such as no hands up questions, the use of thinking time (e.g. Pose-Pause-Pounce-Bounce), pair talk (e.g. Think-Pair-Share), No opt-out (e.g. reframing the question to the same pupil) and follow up questions (e.g. asking pupil to elaborate, or avoiding paraphrasing pupils- instead pushing for the 'best version' answer). This allows teachers to adapt teaching as necessary.

Formal assessments and Quarterly assessments will be followed by feedback and opportunities to re-check understanding. This will include time for the student to respond to their feedback, time for the teacher to immediately address any significant misconceptions/errors in student understanding, a follow up task or prep that allows students to build on the feedback given and time for students to update their progress tracker at the front of their books.

In Mathematics we have a dedicated lesson following each standardised/quarterly assessment to provide students with feedback on their work. We address the common errors and misconceptions highlighted from marking these assessments and expect students to make corrections/add further annotations to their own work in green pen. Students complete a question level analysis sheet that enables them to quickly see which topics were an issue when planning future revision. They are then provided with a set of similar questions to work through in class/at home to check that their understanding has improved.

External examinations.

KS4 exam board:	AQA GCSE Mathematics specification (8300)
KS5 exam board:	AQA A Level Mathematics specification (7357) [Twyford and William Perkin only], AQA A Level Further Mathematics specification (7367) [Twyford and William Perkin only]
Additional qualifications:	AQA Level 2 Certificate in Further Mathematics specification (8365) AQA Level 1/2 Functional Skills specification (8361/8362) [Ealing Fields and William Perkin only]