

Mathematics

Curriculum Principles

By the end of their education, a student of mathematics at Dixons Kings will:

- know and be able to apply the fundamental skills of the subject in order to become confident and keen mathematicians. Students will develop fluency in procedures, be able to reason mathematically and demonstrate resilience when solving problems.
- understand how the skills developed in mathematics are important for their future learning, employment and in everyday life.

In order to truly appreciate the subject and create deep schema, topics within mathematics have been intelligently sequenced with the following rationale:

- The overall aim is to provide all students with the knowledge and skills they need to achieve excellence in mathematics, ultimately providing them with the tools to increase their cultural capital and lead happy and successful lives beyond the academy.
- A spiral curriculum has been adopted in which topic areas are revisited and extended on a yearly basis (i.e. Geometry 4 in Year 8 builds upon Geometry 1-3 which is spaced out through the Key Stage 3 scheme of work). Algebra, Number, Statistics, Ratio and Proportion, Probability and Statistics appear several points in the curriculum, each time ensuring that prior learning is retrieved before more difficult concepts are delivered to students. Year 9 provides an opportunity for students to consolidate foundational concepts in order to access more complex ideas and procedures in Key Stage 4. 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 mathematical domain. This spiral curriculum supports the idea that each year should not be viewed in isolation; students are on a mathematical journey to ensure they are fully prepared for their GCSEs and wider world.
- The Year 7 mathematics curriculum begins by building on Key Stage 2 number skills through applying the four operations within multiple contexts e.g. calculating with averages, converting metric units, area and perimeter. Starting with number skills from the primary curriculum allows prior learning to be consolidated by all students before extending their knowledge. The Year 8 curriculum begins with extending the fraction and percentages topics from Year 7 to include fractional increase and decrease, simple and compound interest, compound depreciation and repeated percentage change. High prior attaining students will always be stretched and challenged by completing extension topics identified on the long-term plans e.g. in Year 7, forming and solving algebraic expressions is extended to problems with area and perimeter and students are challenged beyond basic averages to calculating the reverse mean. In Year 8, a recap of the four operations extends to including standard form for high prior attaining students and during the unit on straight line graphs, students are encouraged to investigate perpendicular lines which usually appears in the Year 10 scheme of work.
- The Year 9 mathematics curriculum is the first year of a two-year Key Stage 4 curriculum mapped from the Edexcel scheme of work. This first year of the focuses on teaching the Grade 4-5 topics from the Higher tier and Grade 1-2 topics from the Foundation tier to ensure students are secure with the skills required to access the more challenging topics in Year 10. For Higher students, it is important to teach rounding and estimation at the start of Cycle 1 because these skills are required repeatedly in subsequent units of learning such as area and volume. The sequencing of all the topics on the Higher tier scheme of work has been imperative in designing this scheme of work e.g. forming and solving equations is taught before finding missing angles on in polygons using algebra, factorising quadratics is taught before working with algebraic fractions and surds are taught before Pythagoras' theorem and trigonometry. Similarly for the Foundation Tier, sequencing has also been carefully considered e.g. prime numbers are taught before prime factorisation and finding the HCF and LCM from Venn diagrams and solving equations is taught before solving inequalities to maximise students' chances of success with grasping new concepts.
- The Year 10 mathematics curriculum builds upon the skills and content introduced in Year 9 and focuses on teaching the Grade 6-8 topics at the Higher tier and Grade 3-4 topics at the Foundation tier. Careful sequencing continues into Year 10 with simultaneous equations being taught at the start of the year; students have historically found this skill difficult to master so it is important to teach them this at a point where they are confident with substitution and also leave enough time for them to regularly revisit this during Year 10 and Year 11.



- In the final year of the GCSE mathematics course in Year 11, teaching is focused on the Grade 7-9 topics at the Higher tier and Grade 4-5 topics at the Foundation tier as Year 9 and Year 10 have ensured students are secure with the skills required to access the more challenging topics. For the Higher Tier, it is essential to teach factorising quadratics at the start of Cycle 1 because this skill is required for various topics to follow e.g. simplifying algebraic fractions, solving quadratic simultaneous equations, completing the square and algebraic proof. The topic order for the Foundation tier has also been carefully designed e.g. solving equations is taught before solving inequalities, solving simultaneous equations, sequences, angles, area and perimeter. Solving equations is a key skill that can be revisited through several topics so this is essential that this is taught during cycle 1. Fractions is also a fundamental topic that must be taught during cycle 1 as this skill will be applied through topics which follow e.g. probability trees with fractions and ratios.
- The idea that the memory of new information is lost without spaced learning and retrieval practice is addressed in several ways. Across each year, students will consistently revisit topics (spaced learning) through regular 'retention do nows' and fortnightly mini-assessments that students complete which include a review section. Retention homework tasks are also spaced effectively to support students in revisiting prior learning and a weekly 'Memri' task is used to support the department's retention strategy. Extended morning line-ups and lectures (for Year 11) provide another opportunity to retrieve prior learning. Retrieval practice is also encouraged by the use of 'Knowledge Navigator Do Nows' on a weekly basis to ensure students are regularly retrieving key formulae and facts to reduce cognitive load when problem-solving.
- Topics will be interleaved through Years 7 to 11 to allow students the opportunity to gain a deeper understanding e.g. when teaching the angles unit this will be interleaved with forming and solving equations and percentages will be interleaved with converting units and area application problems. As exam questions often require the use of multiple mathematical concepts, exam question plenaries are used every lesson to provide an opportunity to apply several skills which may not have been explicitly taught that day.
- Every mathematics lesson follows an 'I Do, We Do, You Do' sequence where the teacher explicitly models and explains a concept, providing the opportunity to address errors and misconceptions e.g. when rounding to significant figures the examples are carefully planned to contain leading zeros as this is a common misconception that students make when rounding to significant figures. In both key stages, students will always complete a set of example questions as part of an assessment for learning activity on mini-whiteboards which will then determine their starting points on the collaboratively planned differentiated activities.
- Consistency in teaching and sequencing within topics is supported by the department's vision to work collaboratively and actively engage with up-to-date research in education to improve our pedagogy so that no child is left behind in mathematics. Approaches are shared and discussed before agreeing on best practice which is used so that students do not become confused when taught by different teachers. This shared calculation policy is shared with Science, PE and Geography departments to improve cross-curricular delivery of topics such as graphs and compound measures.

The mathematics curriculum at Kings has been influenced by:

- Mark McCourt's work on mastery in his 2019 book 'Teaching for Mastery'. The teaching for mastery approach is a framework for education that has existed for over 100 years and is now supported by cognitive science.
- D. Rohrer (2015) in Journal of Educational Psychology 107 'Interleaved practice improved mathematics learning'
- Craig Barton's books: 'How I Wish I'd Taught Maths' and 'Reflect, Expect, Check, Explain'
- National Curriculum for Key Stages 3 and 4
- White Rose Maths Hub which is a Key Stage 3 two-year scheme of work designed to support a mastery approach to teaching and learning in mathematics. When students are introduced to a new concept in mathematics they should have an opportunity to build competency with each topic by taking an approach which involves concrete objects and manipulatives to help them explain and understand what they are doing. Students will also be given the opportunity to use pictorial representations to reason and solve problems e.g. bar modelling, box method for sharing ratios.
- Edexcel (GCSE 9-1) two-year scheme of work which is completed during Year 9 and Year 10. This two-year scheme of work is designed to take an innovative mastery approach to teaching and learning in mathematics and focuses on nurturing confidence, building fluency and embedding problem-solving and reasoning. By the end of Year 10 students should be confident problem solvers which should support them to access the most challenging topics during Year 11 and prepare them for their final summer examinations.
- The Year 11 Higher scheme of work is differentiated to allow students who wish to study mathematics after GCSE (at A-Level and/or University) to extend their knowledge of key concepts beyond what is required for their examination e.g. graph transformations other than translation and reflection.
- Departmental CPD - shared calculation policy and 'Teach Maths Right' initiative



Our mathematics curriculum ensures that social disadvantage is addressed through:

- Becoming a confident mathematician is essential to unlocking the potential of our most disadvantaged pupils and ensure they can be successful in their journey beyond the academy, whether that be in higher education, apprenticeships or the workplace. Students who have mastered the fundamental skills in mathematics will benefit from the utility of this knowledge in future learning and employment. These include money management, reading timetables, discovering and understanding patterns in data. The mathematics curriculum will develop students to become analytical thinkers, confident in problem solving and have a thirst for mathematical reasoning which are great skills for future success.
- To take into account different starting points, all mathematics lessons are differentiated to ensure students are stretched and challenged in every lesson. In Key Stage 3, there are nine activities which are appropriately scaffolded to support the weakest pupils and sufficiently challenge the most able. In Key Stage 4, all Higher and Foundation lessons contain two levels of differentiation activities. For the Higher Tier, the first level of differentiated activities are aimed at Grades 5-7 and the second level of differentiated activities are aimed at Grades 7-9. Similarly for Foundation, the first level of differentiated activities are aimed at Grades 1-3 and then second level of differentiated activities at Grade 3-5 which all foundation students will be aiming to complete every lesson. Foundation lessons also contain scaffolded resources to support the lower ability students. Disadvantaged students and SEN students will also have their mathematics book marked more frequently to ensure timely and effective feedback is given to support students' progress.
- As well as ongoing formative assessments, after every data input, teachers analyse the progress of all of their students. Weekly interventions take place for students who are not making good progress to ensure that gaps are closed and followed up as quickly as possible. Furthermore, all students receive a weekly morning maths session to target and address misconceptions identified from the most recent cohort analysis as areas to develop.
- Oracy skills have been proven to be instrumental to a child's future success. Regrettably, students from disadvantaged backgrounds, a significantly high percentage of the cohort we serve, do not always receive the same opportunities to develop this skill. The mathematics curriculum aims to challenge this through the exploration of functional questions. Using techniques such as Lemov's Reading Reconsidered ensures full understanding of the context of a question, including any expected 'real life' knowledge, before tackling the mathematics behind it.
- The mathematics department runs a weekly homework club to support disadvantaged students in completing homework. Students may not have access to IT facilities so we ensure all students can access their homework. In addition, we also provide disadvantaged students with a mathematics revision guide and ensure that revision resources are easily accessible on the padlet resource.
- Students who are below expected progress in mathematics will received two additional mathematics lessons and will complete 'McGraw Hill' intervention program to ensure students close the learning gaps during Year 7 and Year 8.
- In Year 11, disadvantaged students are targeted to receive daily tutor-time intervention for mathematics. The tutor-time mathematics intervention is informed by question-level-analysis data from the most recent assessments to identify the topics which need to be addressed in these sessions including a weekly exam paper to complete. All Year 11 students will complete an Edexcel exam paper each week during lesson so students are exposed to regular exam questions and this also supports interleaving and retention strategies.
- In Year 11, disadvantaged students are also given the opportunity to attend 'Aiming for grade 5' or 'Aiming for grade 9' masterclasses held at the academy and also across the Dixons MAT.

We fully believe mathematics can contribute to the personal development of students at Dixons Kings through:

- Students will be encouraged to develop socially in mathematics lessons through strategies such as 'track the speaker', 'no opt out' and 'right is right'. Promoting a culture in which students are confident to contribute to class and peer discussions whilst being unafraid of making mistakes is of upmost importance in Maths classrooms. Maintaining high expectations for these interactions supports students to develop listening and speaking skills and celebrating mistakes encourages resilience. Self-awareness is developed through self-assessment every lesson, which enables students to have an accurate understanding of their strengths and weaknesses; directed independent reflection time following formative and summative assessments provide further opportunities to develop this skill in order to identify next steps to improve.
- Problem-solving is a regular feature of all mathematics lessons, a skill which is transferable to all subject disciplines and in the wider world. Participation in 'The Maths Challenge' and 'Dixons Group Cup' events also allows students to develop teamwork and communication skills. These events also provide an opportunity to interact and learn from adults and students beyond their friendship group and academy environment. Additionally, students are encouraged to tutor others in Hegarty Maths club, further developing their social interaction skills in a professional manner.



- The curriculum allows teachers to develop an understanding of ethics and morality in many ways through exploring the real-life applications of mathematics. The positive and negative consequences of making decisions is explored through topics such as comparing interest rates in the percentages unit. The study of statistics provides countless opportunities to explore themes of morality. For example, the manipulation of data and averages to serve a particular purpose in the media and the effects of the use of poor or misleading graphs and diagrams. It is important that students understand different types of data, sampling and how data presented can be affected by bias.
- Encouraging students to think about how mathematics impacts the way the world is important to their development. Teachers regularly encourage students to apply their knowledge to contextual problems in order to help them understand how mathematics fits into not only everyday life but 'big issues' such as poverty, the gender pay gap and gambling through questions on comparing wages and probability.

Our belief is that homework is used for deliberate practice of what has been taught in lessons. We also use retrieval practice and spaced revision to support all students with committing knowledge to long term memory.

- Students receive weekly online mathematics homework on 'Hegarty Maths' which is a combination of tasks that students have learnt that week during lessons and also retention tasks. The retention tasks have been planned to retrieve knowledge taught at appropriate intervals.
- Students are also set regular 'MemRi' tasks on Hegarty Maths which are a series of questions based upon individual data about misconceptions collected by the online program. The 'MemRi' tasks interleave topics which supports the department's spaced retrieval practice aims to improve the long term memory of students.
- After the majority of content has been taught in Year 11, students are provided with a weekly GCSE exam paper for homework to ensure regular exposure and practice of exam-style questions to improve retention. Whilst Hegarty Maths provides opportunities to review topics, online quizzes are used to supplement fact recall and test understanding of more complex procedures.

Opportunities to build an understanding of social, moral and ethical issues are developed alongside links to the wider world, including careers:

- The mathematics curriculum provides students with opportunities to consider the world of work and how mathematics leads to successful careers. Each topic or strand in mathematics has a purpose attached for all students to see and, where relevant, staff refer to how the skill in question relates to specific careers. For example, when teaching constructions, links can be made to any form of design work or navigational career. Weekly enrichment is run for year 7 students, where they explore mathematics further through puzzles and real-life problems.
- Students have the opportunity to discover exciting career options available to them through the study of mathematics at the yearly Careers Fair. Other opportunities include the BAE Systems Schools Roadshow which is designed to inspire students to choose a career in STEM subjects. This Roadshow provides students with an interactive experience to understand how STEM underpins everything that we do.
- Students are able to participate in trips and workshops provided by the Advanced Mathematics Support Program e.g. the Celebrating Women in Mathematics event at Nottingham University which encourages girls to continue studying Maths in further education. Furthermore, 20-30 disadvantaged students will have the opportunity to attend a Further Maths Workshop with the University of Bradford with the aim of encouraging them to study mathematics at A-Level and beyond.

Remote working in our subject supports students to access the full curriculum in the following ways:

- Five lessons uploaded per week on Sharepoint for students in all year groups which correspond to the long-term plan to provide a continuation of learning. In Years 7 and 8 this is differentiated by different work issued for Set 1, Set 2 & 3 and the Nurture group. For Years 9 and 10, work is differentiated by the Higher and Foundation tier and for Year 11 there are three pathways (Set 1 Higher, Set 2 & 3 and Foundation) to ensure that work is appropriately challenging for all students.
- Resources include lesson slides (with examples and solutions) and corresponding tasks along with a differentiated set of instructions. The instructions clearly link each lesson to a Hegarty Maths video which ensures that clear modelling is provided to allow students to complete work independently. Students can leave comments on Hegarty tasks or email their class teacher for further support.
- Students are then able to self-assess their work from the answers provided in order to receive instant feedback. Work is then submitted to teachers via email to track this work, check for the quality of work produced and plan accordingly for the student's return to school in order to address any gaps and misconceptions.



- Students have received training on how to access Home Learning via their class teachers and they are familiar with the Hegarty Maths platform as this has been embedded as a homework routine since the start of Year 7.
- Students should complete their homework as normal via Hegarty Maths as homework is always issued and checked on the same day each week.
- Any student who does not have access to IT is able to check out a textbook from the library at the start of their isolation period. Instructions have been created to ensure that students complete work from these books that is appropriately challenging and also follows the long-term plan. These textbooks provide worked examples to support students to access the work and answers are available for them to self-assess for instant feedback.

Further Information can be found in:

- Long term plans
- Schemes of work
- Knowledge Navigators