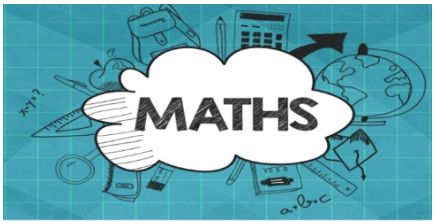
Mathematics



The aim of the Mathematics Department at ALNS is to enable our students to become independent problem solvers and lifelong mathematicians as a product of engaging and research driven teaching and learning. Our team of enthusiastic mathematics specialists strive to promote interest, curiosity and enjoyment in the learning of mathematics by providing a supportive yet challenging environment, where pupils believe they can achieve.

How is the curriculum planned?

The curriculum is more than a list of mathematical statements to be ticked off as pupils pass through school. The curriculum embodies everything that contributes to pupils learning mathematics. Mathematics is a highly interconnected and cumulative subject and is taught as such. The aim of our mathematics curriculum is for teachers to deliver content in a way that ensures that pupils' knowledge is developed through the layering of interconnected topics, allowing pupils to develop an understanding of the relationship between mathematics and problem solving. As students develop fluency they also begin to build connections and develop their reasoning skills, their understanding deepens and their knowledge grows. Ensuring students leave ready for the next steps in their education or employment.

Students have opportunities to learn increasingly sophisticated mathematical ideas relative to their mathematical ability and prior attainment. We provide opportunities within the curriculum to review mathematical content regularly during starters and assessments. Pupils are exposed to a standard of mathematics in KS3 which builds upon concepts already studied at KS2 and ensures no wasted time in year 7. Students who join us in year 7 with a greater depth of understanding are put into a higher class, the rest of the students are taught in mixed ability throughout KS3. At KS3 we have a strong focus on developing students reasoning skills and go into great depth to ensure their algebra and number skills are ready for increasing challenge of mathematical problem solving they will face in KS4.

Teachers continually gather information about their students through questioning, written classwork, homework and assessments. They use their expert knowledge to ensure students have the expected prior knowledge required to access more challenging learning. Teachers use direct instruction to explain key mathematical concepts and processes, ensuring they have planned to uncover and address pupils' key misconceptions about topics.

Lesson structure across the department ensures that pupils are challenged to demonstrate proficiency in these three core strands of the mathematics curriculum: Fluency, Cognitive Reasoning and Problem Solving.

Through marked reviews students are regularly challenged with carefully selected mathematical problems that force students to recall previously covered key content from multiple topics. As a result, students become more confident in their ability to select the mathematics required to solve problems, more independent and willing to persevere when faced with challenging mathematics.

It is this clear focus on connecting mathematical concepts through problem solving that allows our pupils to become enthusiastic and successful mathematicians.

Students are encouraged to ask questions and make links between topics learned in mathematics and other subjects. Teachers work hard to make explicit the links between topics being taught and their usefulness in other subjects and explain why topics are useful for potential future employment. The key skills of numeracy and graphicacy are often modelled using a variety of approaches and we encourage students to use the methods they are most successful with. This allows students to build upon prior knowledge which ensures they are more likely to be successful in transferring their mathematical skills when in other subjects.

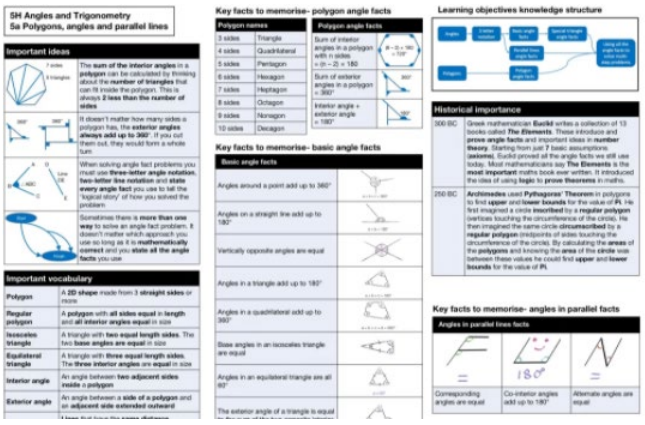
In Mathematics we actively seek opportunities to ensure all students have the chance to acquire the cultural capital they need to help them become successful in the future. Prime examples of this include the stock market challenge, where students experience a live trading floor. The chance to buy and sell stocks and shares and make a nice profit gives students the opportunity to gain a greater understanding of the stock market and the economy in general. This is just one of the ways we highlight potential career paths that mathematics can open up. Teachers also seek opportunities to make links to famous mathematicians and historical mathematical discoveries and when appropriate make links to real life applications of mathematics.

How is the curriculum delivered/taught?

Teachers ensure students receive quality first teaching by ensuring examples are well modelled (using the I go, we go, you go approach when appropriate) making explicit the skills being used. Students are given the opportunity to practice key skills in isolation before combining them to solve multistep problems. This atomisation allows teachers to scaffold learning for all students. Teachers make use of multiple representations and manipulatives when introducing topics to enable us to take students from the concrete to the abstract successfully. Students are regularly given the opportunity to develop steps to success which they can refer to in later lessons.

When learning new content students are encouraged to reflect on what skills they already have and consider how they can be used to tackle new problems. Where pupils lack a well-rehearsed and readily available method to solve a problem they need to draw on problem solving strategies to make sense of the unfamiliar situation. Research shows that by thinking hard about a problem, students are more likely to remember the new content as it will be viewed as useful. Dan Meyer refers to this method as head ache and aspirin. Problems that cause students to think causes a headache and the new learning is the aspirin. Selecting problem-solving tasks for which pupils do not have readymade solutions makes learning more memorable.

Teachers understand that memory is a highly complex process and in order to build strong neural paths students must be exposed to new content more than once. The use of spaced learning is common practice across the department, with the aim being to help students commit key concepts into long term memory. This is done in a variety of ways including the use of recall starters, low stakes quizzes, key formula tests, games, revision cards and mind maps. Students are also provided with knowledge organisers at the start of topics to help them prepare for new learning.



Teachers understand that using the language of mathematics is essential and the knowledge organisers also help students understand and use mathematical language confidently. Understanding the language of maths gives students the skills they need to think about, talk about, and understand new mathematical concepts. For example, knowing how to label lengths and angles allows students to discuss congruency. When meeting new vocabulary teachers ensure key meanings are understood and explained in a student friendly way. Students are also encouraged to read questions carefully and underline key words when tackling problems in lessons and exams.

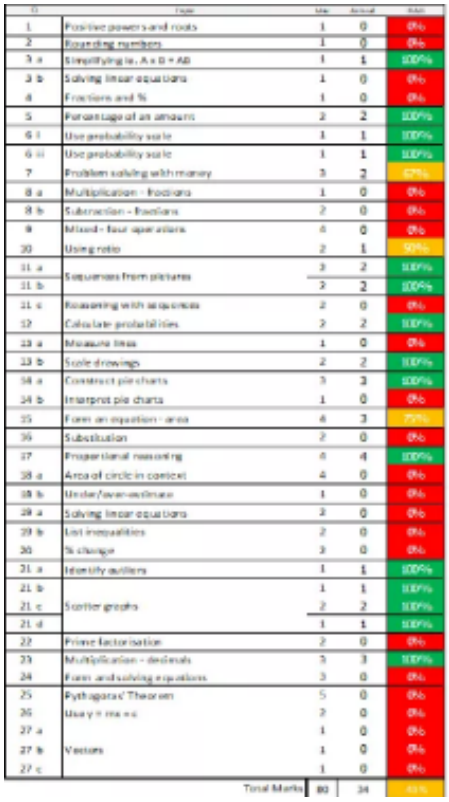
How is the curriculum assessed?

Marked reviews are used to assess the learning of current and previously learned topics. Teachers select questions that support both fluency and problem-solving skills with the aim being that students are able to confidently answer questions which require them to select methods from different branches of maths, for instance using circle theorems to find a missing angle to enable students to use trigonometry. Marked reviews allow teachers to focus on giving high quality feedback on topics they have identified as weaknesses in a way that promotes spaced learning. When the class are receiving feedback and making corrections the use of peer support for targeted students is widely used.

One of our key strengths in assessing students has been on developing "cognitive reasoning" type problems as much as possible in our lessons, such as "show that" and "spot the mistake" style problems- this ensures students have to show their workings and explain their answer rather than just simply answering a question. These questions are becoming more and more common in the GCSE examinations and examiners reports suggest students across the country regularly miss them out or gain few/no marks on them. We aim to ensure students are practising these skills regularly by including them in marked reviews.

Key skills and knowledge are also assessed more formally using half termly assessments. Students sit assessments each half term as identified on an assessment calendar. Assessments have been created to be cumulative, with 50% of questions based on the current half terms learning and 50% spaced on previous learned content. Students in sets 1 and 2 also have an extension test to reflect the challenge KPIs they complete that other classes don't.

At KS4 both foundation and higher tier papers have been created. At both key stages students alternate between a calculator and non-calculator paper each half term.



In year 11 Question Level Analysis is then used to inform data meeting with maths leadership which in turn then inform topics to focus on during re-teach weeks. Students are encouraged to use Hegarty Maths as a tool to respond to feedback from QLA.

Teachers understand that assessment should be used not only to track pupils' learning but also to provide teachers with information about what pupils do and do not know. Targeted questioning using no hands up in lessons is a common approach used in the department. Assessment for learning is used to give regular verbal feedback that is specific and clear.

Use of diagnostic questions and MWBs are common across the department in most lessons as a way for teachers to assess the whole class quickly. When students give wrong answers, teachers encourage and support further effort and do not allow students to give up. Teachers not only address misconceptions but also understand why pupils may persist with errors and plan for these accordingly. Use of whole class feedback using MWBs addresses common misconceptions and with best practice teachers are planning lessons which address errors before they arise.

How do we use IT to support learning in the classroom and Online?

The use of IT and Chromebooks in lessons ensure we can offer powerful opportunities for pupils to explore mathematical ideas, to generalise, explain results and analyse situations. Teachers understand the opportunities that IT offers, and are constantly trying to find ways to enhance the teaching and learning of mathematics.

Decisions about how and when Chromebooks should be used to help teach mathematical facts, skills or concepts are based on whether the Chromebooks support effective teaching of the lesson objectives. The use of Chromebooks should allow pupils to do something that would be more difficult without it, or to learn something more effectively or efficiently.

Teachers work hard to identify topics that can be enhanced with the use of Chromebook and while they can be used advantageously in most areas of mathematics, the following topics particularly benefit from the opportunities they offer:

- Sequences, functions and graphs
- Geometrical reasoning: lines, angle facts and circle theorems
- Transformations
- Coordinates
- Construction and loci
- Handling data

Teachers are confident in using Desmos as a graphing tool and use it well to make clear links to algebraic concepts. Examples of teachers using Desmos well include pupils investigating the effect on a that changing the value of m in the function y = mx + c has on the graph. Desmos is also used to engage students and the mini-golf game developing problem-solving skills and consolidating students' understanding of coordinates demonstrates a great use of the Chromebooks in lessons.

Much of geometry, particularly transformational geometry, is concerned with movement. Manipulating diagrams dynamically generates many examples that can help pupils to make conjectures and explore what changes and what stays the same. The use of Chromebooks can help pupils to develop their skills of geometrical reasoning. We are working with the AMSP to turn this into a strength of students and teachers.

The department use Hegarty Maths well in lessons and as part of independent learning, students value the fast and reliable feedback that Hegarty provides and teachers make good use of the individual data Hegarty provides us with.

Teachers have excelled in developing their ability to deliver our curriculum online. We are equally capable of being able to record high quality lessons for students to access independently or teach live lessons on zoom. We have also delivered hybrid lessons, simultaneously delivering lessons via zoom to students self-isolating while also teaching students in the classroom. Students have enjoyed the opportunity to keep up with what is going on live in lessons while at home.