








A summary of our principles: ALNS Maths Curriculum

<p><b>ALNS Maths Curriculum</b> 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.</p>	<p><b>Balanced</b> Our curriculum is firstly designed to ensure students are fluent and confident with key facts and methods that they most frequently need in order to be successful with more complex topics. This fluency reduces cognitive load to allow students to progress to become great problem solvers. In KS3 we prioritise making links with algebra and number skills covered in KS2 to support the development of new knowledge while embedding multiplicative reasoning to prepare students for KS4.</p> <table border="1" data-bbox="483 785 808 1008"> <thead> <tr> <th></th> <th>F</th> <th>H</th> </tr> </thead> <tbody> <tr> <td>Number</td> <td>25</td> <td>15</td> </tr> <tr> <td>Algebra</td> <td>20</td> <td>30</td> </tr> <tr> <td>Ratio/Proportion</td> <td>25</td> <td>20</td> </tr> <tr> <td>Geometry</td> <td>15</td> <td>20</td> </tr> <tr> <td>Probability and Statistics</td> <td>15</td> <td>15</td> </tr> </tbody> </table>		F	H	Number	25	15	Algebra	20	30	Ratio/Proportion	25	20	Geometry	15	20	Probability and Statistics	15	15	<p><b>Rigorous</b> The curriculum has been designed to ensure students are well prepared to meet the increased rigour and challenge of the new maths G.C.S.E specification. Teachers continually gather information about their students through questioning, written classwork, Independent Learning(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 students’ key misconceptions about topics.</p>	<p><b>Coherent</b> The fundamental idea behind our curriculum design is to build carefully from the previous key stage, previous topic and previous lesson. Ensuring students become fluent with key facts and methods through careful sequencing. For example, we cannot expect pupils to factorise before they are secure in finding factors of numbers. While some sequencing is vital (FDP close to probability) we try to organise standalone topics to give as varied a curriculum as possible. We also try to avoid one topic always being at the end of Summer term, or similar, to minimise the chance of students missing them in both key stages.</p>
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<p><b>A Spiral or Mastery Approach</b> We are constantly looking at ways to combine the best of both ‘mastery’ and ‘spiral’ approaches in our curriculum. We want to help students gain a deeper understanding as opposed to accelerating through topics. We believe in keeping the class working together on the same topic and that all students are capable of learning the maths appropriate for their level that has the maximum area. We also understand the forgetting curve and that students need to see topics again and again. In different contexts and in different years - so we’ve built in the revisiting and reinforcing features of spiral curriculum.</p>	<p><b>Appropriate</b> Lessons are appropriately designed to build students confidence and model success for all. Challenging topics are introduced in small steps with clear success criteria. Reasoning and problem solving are integrated into classroom practice as much as possible in the order that is appropriate for the topic, e.g. sharing in a ratio may be introduced by a problem about sharing or grouping for which we need to become fluent at the procedure. Problem solving with trigonometry might be introduced early – how would you measure the height of the spinnaker tower with no rope? Then revisited with a clinometer when students have the required skills.</p>	<p><b>Focused</b> We have a clear focus on students making links between different topics and being able to select the mathematics they need to use. A permanent drive on developing “cognitive reasoning” type problems as much as possible in our lessons, such as “show that” and “spot the mistake” style problems ensures students must show their workings and explain their answer rather than just simply answering a set of question.</p>	<p><b>Relevant</b> The curriculum incorporates many useful topics where it is easy to make links to genuine applications, other subjects and potential careers. Teachers make these links explicit during lessons. Teachers also celebrate and encourage a love of learning maths when topics are less easily applied to real life contexts. Ensuring that students value the skills that mathematics affords them. Thinking logically and being able to follow a process or method. Finally, teachers are encouraged to have a passion for mathematics and take pride in being a mathematician. Modelling maths as enjoyable and explaining to students why it is useful and relevant or giving historic contexts and allowing time to explore off-curriculum ideas.</p>																		

## How does our Maths Department incorporate ALNS Teaching Principles?

<p><b>Fostering a love of learning</b> </p> <p>Our curriculum is designed to give students a broad, purposeful, and meaningful experience of a wide range of topics</p> <p>We use a range of teaching strategies, resources and styles of tasks to ensure that all students are engaged and successful within lessons. We are constantly reviewing schemes of learning to ensure lessons are engaging and promote a love of learning.</p>	<p><b>Challenge for All</b> </p> <p>High-Quality Teaching ensures that planning meets the needs of all pupils, and builds in high expectations for all pupils. We set in maths to allow those at the very top to excel but we then have mixed ability classes at both KS3 &amp; KS4 so that all students are challenged and supported in equal measure, This move away from “bottom set” has had a positive impact on how students view themselves as mathematicians.</p>	<p><b>Feedback for Learning</b> </p> <p>Our students receive regular verbal and written feedback which focuses clearly on the knowledge and skills required to ensure progress and success.</p> <p>Mr Carter starters, marked reviews, IT based quizzes and formal assessments allow pupils to develop an understanding of how they are progressing.</p> <p>Students are learning to become more independent and respond to the feedback by using Hegarty as a tool to fill gaps in their knowledge.</p>	<p><b>Literacy for Life</b> </p> <p>Teachers use correct mathematical terms and encourage students to follow suit. Staff carefully introduce new terminology but also consolidate previously used terms wherever possible. When new vocabulary is introduced it is used in context so students begin to understand when to use it.</p> <p>This year Oracy will be developed further, and SOLs amended to provide ample opportunity. This will be through the use of visual prompts and the question “where’s the maths”. Teachers will also make more use of always true, sometimes true or never true. Students will learn to justify their answers with examples and non-examples to the class.</p>
	<p><b>Modelling</b> </p> <p>We ensure that tasks build students’ confidence by achieving high success rates at the modelling stage.</p> <p>We take an ‘I do – we do – you do’ approach to the modelling and learning process to build confidence &amp; resilience. The use of mini white boards allows teachers to catch and discuss misconceptions before they become learned during self-practice.</p>	<p><b>Responsive teaching</b> </p> <p>We take a responsive approach to teaching, incorporating reteach lessons which respond to common misconceptions identified through the marked review cycle.</p> <p>In lesson strategies which include questioning of prior learning allow staff to know when to be responsive and deviate from the planned learning.</p>	<p><b>Stickability</b> </p> <p>Our Schemes of Learning incorporate a range of strategies to help students overlearn key material. This can be through starters, marked reviews, Hegarty tasks, sequencing of the curriculum, end of unit tests or cumulative assessments. It is this overlearning that will ensure content moves into long term memory and becomes easy to retrieve – hence reducing cognitive load.</p>

## **Curriculum Intent**

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.

The Maths curriculum has been designed to give students a broad and detailed knowledge of mathematics. It is the intent of our curriculum that students will:

- become fluent with key skills in mathematics, through varied and frequent practice with increasingly complex content over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and preserving in seeking solutions.
- communicate, justify, argue and prove using mathematical vocabulary.

### **Our principles behind our approach to Maths lessons:**

#### **All students are entitled to:**

- a positive, safe learning environment that enables them to flourish and succeed within a culture of mutual respect and shared responsibility.
- a chance to feel successful, this will allow pupils to associate the subject with enjoyment and increase their motivation to improve. Teaching should put pupils on the path to success, a proficiency first approach above learning from their mistakes is likely to prevent pupils developing anxiety around maths.
- understand that we all make mistakes and the difference between infrequent mistakes which we can learn from and consistent mistakes which are due to weak foundational knowledge.
- be actively engaged in their own learning whilst being challenged and motivated to take responsibility for their own learning.
- question each other and the world around them to enable each student to develop an enquiring mind.
- have the opportunities to apply and develop their skills and knowledge of science to a variety of new situations.
- experience well planned lessons which challenge them, provide clear assessment and development opportunities.
- reflect upon their own learning regularly and be given opportunities to improve.

#### **Teaching within Mathematics lessons should have:**

- a positive ethos which promotes an atmosphere for learning in which all students feel safe and confident to put forward ideas without reservations.
- clearly modelled learning episodes using direct instruction to engineer success in learning in alignment with the detail and sequence of the planned curriculum.
- a chance to practice mathematics free from distraction and in near silence while balancing the need for opportunities for discussion.
- lessons that allow time for overlearning and rehearsal of core facts, methods, and fluency of procedures.
- differentiated and choices of tasks which support and challenge all.
- students explore their own ideas and use them creatively in problem solving and making informed decisions.
- well planned lessons in which learning aims are clear and shared with all students enabling them to understand the purpose of their learning and how to make progress.

- clear explanations of where new content makes links with content students have previously acquired and connections between problems are identified by the teacher.
- clear methods of assessment that are shared with all students. Pupils are to be well prepared for assessments and marked reviews ensure key facts are learned to automaticity.

### **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?**

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.

### **Key Pedagogies**

The Maths Curriculum draws upon pedagogical approaches which support the development of students' learning, comprehension, application and recall of key ideas within the curriculum that they are studying. These include the pedagogical approaches below as well as more detailed in the Maths Handbook

#### **Over learning of key facts**

Some pupils are quick to grasp new content, while others might need more time to think, practise, recall and apply. Given that proficiency in mathematics requires pupils to attain a level of procedural fluency teachers should ensure the give pupils adequate opportunities to practise. This is vitally important with the learning of key multiplication facts.

#### **Success Criteria**

After modelling examples, many students benefit from having success criteria to follow. If this can be constructed with students it will allow you to question and assess students while also developing their oracy skills.

#### **Simultaneous Equations**

1. Label the equations
2. Do I need to scale up the equations?
3. Do I need to add or subtract to eliminate?
4. Solve to find x
5. Substitute x value into one of the original equations (Equation 1)
6. Solve equation to find y value

7. Substitute  $x$  and  $y$  value into unused equation (Equation 2) to ensure you have the correct answer

### **I go We go You go Modelling**

Teacher modelling is vital to secure students' knowledge and understanding of mathematical processes. Emphasis on certain steps and justifications of how or why things work or do not work can be the difference between learning by rote and understanding maths. Eggen and Kauchak (2001) defined modelling as "an instructional strategy in which the teacher demonstrates a new concept or approach to learning and students learn by observing". Using the I go We go You go strategy encourages students to participate rather than just observe. Through questioning and use of mini whiteboards modelling should engage students and encourages learning and not just allow students to be passive.

It is important for students to see the thought process we, as teachers, go through in answering a question and we do not simply click through a PPT.

### **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 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.

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 don't 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.

## Use of Chromebooks

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