Mathematics at Casterton

Purpose of Study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems 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.
- can 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 persevering in seeking solutions.

Hours of Study (1 lesson = 1 hour)

Year (total in year group)	Hours per two week cycle	Hours per year (40 weeks)	Number of students
7 (180)	9	180	180
8 (180)	9	180	180
9 (200)	9	180	200
10 (200)	9.5	190	200
11 (210)	9.5	150 approx.	210

Timetabling and Setting Notes

Mathematics classes are grouped by ability.

For year 7 students, metrics used include internal baseline testing and assessment data from GL testing at the beginning of each academic year. For other Key Stage 3 classes, we also use departmental assessment data from previous years.
Groups are re-assessed at the end of terms 2 and 4.
On entry into Key Stage 4, these metrics are used to determine which GCSE tier each student will follow.

KS3 and KS4 students have ten lessons of mathematics per fortnight.

In year 7, there are 6 mathematics classes.
In year 8, 9 & 10, there are 7 mathematics classes.
In year 11, there are 8 mathematics classes.

Year 9 Options Notes

Mathematics is a core subject and as such is not part of the year 9 options process.

YEAR 7 (CORE)			
Terms 1 & 2			
Number Skills	**Analysing and displaying data**	**Expressions, functions and formulae**	**Decimals and measures**
Mental maths Addition and subtraction Multiplication Division Time and money Negative numbers Factors, multiples and primes Square and triangle numbers	Mode, median and range Displaying data Grouping data Averages and comparing data Line graphs and more bar charts	Functions Simplifying expressions Writing expressions Substituting into formulae Writing formulae	Decimals and rounding Length, mass and capacity Scales and coordinates Working with decimals Perimeter Area More units
Terms 3 & 4			
Fractions	**Probability**	**Ratio and proportion**	
Comparing fractions Simplifying fractions Working with fractions Fractions and decimals Understanding percentages Percentages of amounts	The language of probability Calculating probability Experimental probability Expected outcomes	Direct proportion Writing ratios Using ratios Scales and measures Proportions and fractions Proportions and percentages	
Terms 5 & 6			
Lines and angles	**Sequences and graphs**	**Transformations**	
Lines, angles and triangles Estimating, measuring and drawing angles Drawing triangles accurately Calculating angles Angles in a triangle Quadrilaterals	Sequences Pattern sequences Coordinates Extending sequences Straight-line graphs Position-to-term rules	Congruency and enlargements Symmetry Reflection Rotation Translations and combined transformations	

YEAR 7 (DEPTH)			
Terms 1 & 2			
Number Skills	**Analysing and displaying data**	**Expressions, functions and formulae**	**Fractions**
Factors, primes and multiples Using negative numbers Multiplying and dividing Squares and square roots More powers and roots Calculations	Two-way tables and bar charts Averages and range Grouped data More graphs Pie charts Scatter graphs and correlation	Simplifying algebraic expressions Writing algebraic expressions Using formulae Writing formulae Brackets and powers Factorising expressions	Working with fractions Adding and subtracting fractions Fractions, decimals and percentages Multiplying and dividing fractions Working with mixed numbers
Terms 3 & 4			
Angles and shapes	**Decimals**	**Equations**	
Angles and parallel lines Triangles Quadrilaterals Polygons	Ordering decimals Rounding decimals Adding and subtracting decimals Multiplying decimals Dividing decimals Fractions, decimals and percentages Working with percentages	Solving one-step equations Solving two-step equations More complex equations Trial and improvement	
Terms 5 & 6			
Multiplicative reasoning	**Perimeter, area and volume**	**Sequences and graphs**	
Metric and imperial units Writing ratios Sharing in a given ratio Proportion Proportional reasoning Using the unitary method	Triangles, parallelograms and trapeziums Perimeter and area of compound shapes Properties of 3D solids Surface area Volume Measures of area and volume	Sequences The nth term Pattern sequences Coordinates and line segments Graphs	

YEAR 8 (CORE)			
Terms 1 & 2			
Number	**Area and volume**	**Expressions and equations**	**Real-life graphs**
Calculations Calculating with negative integers Powers and roots Powers, roots and brackets Substituting into expressions Multiples and factors	Area of a triangle Area of a parallelogram and trapezium Volume of cubes and cuboids 3D shapes Surface area of cubes and cuboids Problems and measures	Algebraic powers Expressions and brackets Writing expressions and formulae Factorising expressions One-step equations Two-step equations The balancing method	Conversion graphs Distance-time graphs Line graphs Complex line graphs
Terms 3 & 4			
Decimals and ratio	**Lines and angles**	**Calculating with fractions**	
Ordering decimals and rounding Place-value calculations Calculations with decimals Ratio and proportion with decimals Using ratios	Quadrilaterals Alternate angles and proof Geometrical problems Exterior and interior angles Solving geometric problems	Adding and subtracting fractions Multiplying fractions Fractions, decimals and reciprocals Dividing fractions Calculating with mixed numbers	
Terms 5 & 6			
Straight-line graphs	**Percentages, decimals and fractions**	**Statistics, graphs and charts**	
Direct proportion on graphs Gradients Equations of straight lines Direct proportion problems	Fractions and decimals Equivalent proportions Writing percentages Percentages of amounts Solving problems	Planning a survey Collecting data Pie charts Using tables Stem and leaf diagrams Comparing data Scatter graphs	

YEAR 8 (DEPTH)			
Terms 1 & 2			
Factors and powers	**Working with powers**	**2D shapes and 3D solids**	**Real life graphs**
Prime factor decomposition Laws of indices Powers of 10 Calculating and estimating	Simplifying expressions More simplifying Expanding and simplifying Substituting and solving	Plans and elevations Surface area of prisms Volume of prisms Circumference of a circle Area of a circle Cylinders Pythagoras' theorem	Direct proportion Interpreting financial graphs Distance-time graphs Rates of change Misleading graphs
Terms 3 & 4			
Transformations	**Fractions, decimals and percentages**	**Constructions and loci**	
Reflection and translation Rotation Enlargement Combining transformations 2D shapes and 3D solids	Recurring decimals Using percentages Percentage change Repeated percentage change	Accurate drawings Constructing shapes Constructions Loci	
Terms 5 & 6			
Probability	**Scale drawings and measures**	**Graphs**	
Comparing probabilities Mutually exclusive events Estimating probability Experimental probability Probability diagrams Tree diagrams	Maps and scales Bearings Scales and ratio Congruent and similar shapes Solving geometry problems	Plotting linear graphs The gradient $y = mx + c$ Parallel and perpendicular lines Inverse functions Non-linear graphs	

YEAR 9 (CORE)		
Terms 1 & 2		
Number	**Algebra**	
Calculations Decimal numbers Place value Factors and multiples Squares, cubes and roots Index notation Prime factors	Algebraic expressions Simplifying expressions Substitution Formulae Expanding brackets Factorising Using expressions and formulae	
Terms 3 – 6		
Graphs, tables and charts	**Fractions and percentages**	**Equations, inequalities and sequences**
Frequency tables Two-way tables Representing data Time series Stem and leaf diagrams Pie charts Scatter graphs Line of best fit	Working with fractions Operations with fractions Multiplying fractions Dividing fractions Fractions and decimals Fractions and percentages Calculating percentages	Solving equations Solving equations with brackets Introducing inequalities More inequalities Using formulae Generating sequences Using the nth term of a sequence

YEAR 9 (DEPTH)		
Terms 1 & 2		
Unit 1 - Number	**Unit 2 - Algebra**	
Number problems and reasoning Place value and estimating HCF and LCM Calculating with powers (indices) Zero, negative and fractional indices Powers of 10 and standard form Surds	Algebraic indices Expanding and factorising Equations Formulae Linear sequences Non-linear sequences More expanding and factorising	
Terms 3 – 6		
Interpreting and representing data	**Fractions, ratio and percentages**	**Angles and trigonometry**
Statistical diagrams Time series Scatter graphs Line of best fit Averages and range	Fractions Ratios Ratio and proportion Percentages Fractions, decimals and percentages	Angle properties of triangles and quadrilaterals Interior angles of a polygon Exterior angles of a polygon Pythagoras' theorem Trigonometry

YEAR 10 (FOUNDATION)		
Terms 1 & 2		
Angles	**Averages and range**	**Perimeter, area and volume**
Properties of shapes Angles in parallel lines Angles in triangles Exterior and interior angles Geometrical problems	Mean and range Mode, median and range Types of average Estimating the mean Sampling	Rectangles, parallelograms and triangles Trapezia and changing units Area of compound shapes Surface area of 3D solids Volume of prisms More volume and surface area
Terms 3 & 4		
Graphs	**Transformations**	**Ratio and proportion**
Coordinates Linear graphs Gradient $y = mx + c$ Real-life graphs Distance-time graphs More real-life graphs	Translation Reflection Rotation Enlargement Describing enlargements Combining transformations	Writing ratios Using ratios Ratios and measures Comparing using ratios Using proportion Proportion and graphs Proportion problems
Terms 5 & 6		
Right-angled triangles	**Probability**	
Pythagoras' theorem Trigonometry: the sine ratio Trigonometry: the cosine ratio Trigonometry: the tangent ratio Finding lengths and angles using trigonometry	Calculating probability Two events Experimental probability Venn diagrams Tree diagrams More tree diagrams	

YEAR 10 (HIGHER)		
Terms 1 & 2		
Graphs	**Area and volume**	
Linear graphs Graphing rates of change Real-life graphs Line segments Quadratic graphs Cubic and reciprocal graphs	Perimeter and area Units and accuracy Prisms Circles Sectors of circles Cylinders and spheres Pyramids and cones	
Terms 3 & 4		
Transformations and constructions	**Equations and inequalities**	**Probability**
3D solids Reflection and rotation Enlargement Transformations and combinations of different transformations Scale drawings and bearings Constructions Loci	Solving linear inequalities Solving quadratic equations Completing the square Solving simultaneous equations Solving linear and quadratic simultaneous equations	Combined events Mutually exclusive events Experimental probability Independent events and tree diagrams Conditional probability Venn diagrams and set notation
Terms 5 & 6		
Multiplicative reasoning	**Similarity and congruence**	**More trigonometry**
Growth and decay Compound measures Ratio and proportion	Congruence Geometric proof and congruence Similarity Similarity in 3D solids	Accuracy Graph of the sine function Graph of the cosine function Graph of the tangent function Calculating areas and the sine rule The cosine rule and 2D trigonometric problems Solving problems in 3D Transforming trigonometric graphs

YEAR 11 (FOUNDATION)		
Terms 1 & 2		
Multiplicative reasoning	**Constructions, loci and bearings**	**Quadratic equations and graphs**
Percentages Growth and decay Compound measures Distance, speed and time Direct and inverse proportion	3D solids Plans and elevations Accurate drawings Scale drawings and maps Constructions Loci and regions Bearings	Expanding double brackets Plotting quadratic graphs Using quadratic graphs Factorising quadratic expressions Solving quadratic equations algebraically
Terms 3 & 4		
Perimeter, area and volume 2	**Fractions, indices and standard form**	**Congruence, similarity and vectors**
Circumference of a circle Area of a circle Semicircles and sectors Composite 2D shapes and cylinders Pyramids and cones Spheres and composite solids	Multiplying and dividing fractions The laws of indices Writing large numbers in standard form Writing small numbers in standard form Calculating with standard form	Similarity and enlargement Using similarity Congruence Vectors
Term 5		
More algebra	**Exam Revision**	
Graphs of cubic and reciprocal functions Non-linear graphs Solving simultaneous equations graphically Solving simultaneous equations algebraically Rearranging formulae Proof	Preparation for GCSE exams	

YEAR 11 (HIGHER)		
Terms 1 & 2		
Further statistics	**Equations and graphs**	**Circle theorems**
Sampling Cumulative frequency Box plots Drawing histograms Interpreting histograms Comparing and describing distributions	Solving simultaneous equations graphically Representing inequalities graphically Quadratic equations Using quadratic graphs Cubic equations Using iteration to solve equations	Radii and chords Tangents Angles in circles Applying circle theorems
Terms 3 & 4		
More algebra	**Vectors and geometric proof**	
Rearranging formulae Algebraic fractions Simplifying algebraic fractions More algebraic fractions Proof Surds Solving algebraic fraction equations Functions	Vectors and vector notation Vector arithmetic Parallel vectors and collinear points Solving geometric problems	
Term 5		
Proportion and graphs	**Exam Revision**	
Direct proportion Inverse proportion Exponential functions Non-linear graphs Translating graphs of functions Reflecting graphs of functions	Preparation for GCSE exams	

Powerful Core Knowledge

How we identify powerful core subject knowledge

With mathematics underpinning many facets of everyday life, we place number skills at the heart of all we do. The acquisition and practise of number operations, number skills and number facts is essential for success when problem-solving and in order to become a more proficient mathematician. From there, methods and procedures are investigated and developed, and strategies evolve to be able to reason mathematically. With an initial focus on the four operations of addition, subtraction, multiplication and division, we strive to develop both mental and formal written methods and strategies in order to promote familiarity with the associative, commutative and distributive laws of mathematics. Alongside this focus, particular attention is paid to the associated mathematical vocabulary and symbols to enable the students to further access the material being delivered.

How we sequence topics to create a logical, coherent, narrative.

All years in Key Stage 3 begin with elements of the fundamental number skills and an associated algebraic topic. Over the course of the academic year, other areas of the curriculum are introduced which relate back to the topics that have previously been taught. By doing so, existing knowledge is revisited and reinforced whilst simultaneously expanding the students' knowledge and skills bases by applying said knowledge to different contexts.

In Key Stage 4, rather than a specific number-based focus at the start of each year, there is more of an emphasis in the application of the number skills that have been acquired and developed over the previous years in order to allow students to access associated topics, themes and areas of the programme of study.

As broad topics are revisited, more specific areas of each topic are explored in further depth to provide a deeper comprehension of the larger overriding topic. As such, progression through the different aspects of the programme of study can be seen and felt by the students, empowering them and encouraging them to believe that they can become proficient in all areas of the mathematics curriculum over time.

SEND

At Casterton College, our intention for Special Educational Needs and/or Disabilities (SEND) is to ensure that all children receive a High-quality and ambitious education regardless of need or disability. Every teacher at Casterton College is a teacher of SEND. We believe that all students should be equally valued in college and strive to provide an environment where all students can flourish and feel safe.

Through our high quality planning, teaching and provision we:

- Ensure that all children have access to a broad and balanced curriculum which is adapted to enable children to understand the relevance and purpose of leaming.
- Provide an accessible leaming environment which is tailored to the individual needs of all pupils.
- Use a needs-driven SEND model, which supports individuals based on their presentation of need rather than relying on labels or diagnoses.

In the classroom a child with SEND may:

- Receive a level of challenge suitable for their ability and needs.
- Have reasonable adjustments in place to help overcome their barriers to learning.
- Experience lessons which contain appropriate scaffolding and task modelling.

The timetable is designed to allow for additional interventions. In Maths a pupil with SEND may be supported by:

- Smaller groups
- Ability setting
- Scaffolded resources
- Programmes that support Numeracy e.g. Times Tables Rock Stars and Doodle Maths
- Out of class small group interventions e.g. Numeracy Catch up and KS4 Numeracy support.

Retention

How we secure mastery (long term retention) of powerful core knowledge

The school approach of learn, practise, test runs through the heart of the mathematics programmes of study at Casterton. As they progress through Key Stages 3 and 4, students are given regular opportunities to rehearse and apply the important facts, concepts, methods and strategies that they are taught. Typically, a topic would begin with an emphasis on factual accuracy, comprehension and recall. Students are then given the opportunity to demonstrate the knowledge that they are acquiring through methodical exercises and targeted questioning. Topics end with a formative assessment, taking place approximately every 4 weeks. Summative assessments take place at regular intervals throughout the year.

In addition to this, termly Core Knowledge tests in Key Stage 3 are designed to diagnose the extent to which prior knowledge on upcoming topics already exists. This knowledge is reinforced and revisited as the curriculum progresses.

Vocabulary and Spelling

How we secure mastery of specialist academic vocabulary (T3 words)

When relevant tier 3 vocabulary is encountered topic by topic, meanings are discussed and / or explained and definitions are noted down. Staff place an emphasis on the necessity of using specialist vocabulary and correct mathematical terminology consistently within lessons and encourage students to do likewise.

How we secure mastery of vocabulary comprehension (T3 words in context)

The specialist academic vocabulary for mathematics is vast and varied. Students can access a full tier-3 word list which includes etymology, associated vocabulary and examples of how this vocabulary may be used in context.
Reading for meaning tasks are set periodically throughout the year in order to maintain a level of familiarity with the vocabulary in context, with the tasks set being relevant to topics being studied at the time.

How we secure mastery of spelling (T3 words)

Vocab tables use morphology to break words down and help students to recognise patterns in their spelling. Etymology helps them to understand common roots. The spelling of specialist vocabulary is tested as an extension of core knowledge tests.

Within Key Stage 3, spelling tests on selected mathematical vocabulary relevant to the topics being studied are conducted termly with key terms being repeated in subsequent tests. When assessing a student's ability to read for meaning, this vocabulary is the focus of our attention.

Academic Writing

How we define writing like a mathematician

The key to writing like a mathematician lies in the clarity, organisation and presence of methods and procedures. This is a trait that is essential rather than desirable and is reinforced from day 1. Just as questions can be scaffolded to provide students with necessary support when accessing a mathematical topic, a student's written responses should be clearly laid out and structured to show their thought processes. Intrinsically, this enables the teacher to engage more fluently with the student's ideas and helps both teacher and student to identify their misconceptions.

On the occasions where a student is obliged to provide a written answer, there is an emphasis on using the correct vocabulary and terminology throughout. Although such instances are infrequent at best, it is imperative that students are aware of the necessity to precise, accurate and relevant responses.

Independent Learning (Prep)

Regularity

Year	Frequency	Hours per week or term	Main form or types
7	Typically, online prep is usually set every 2-3 weeks for all classes. In addition to this, relevant prep for specific year groups will be set when necessary. Students can also access Times Tables Rock Stars at any time to improve their recall of multiplication tables.	Approximately 2-3 hours per 6-week term.	The majority of maths prep is set on an online learning platform called 'Active Learn'. Tasks are set on here to complement and consolidate learning that takes place in the classroom. This platform is used for all classes in all year groups. Revision for spelling tests is also set at appropriate points throughout the year, as well as revision for formative and summative assessments.
8		Approximately 2-3 hours per 6-week term.	
9		Approximately 3-4 hours per 6-week term.	
10		Approximately 4-6 hours per 6-week term.	
11		Approximately 4-6 hours per 6-week term.	In addition to the above, past GCSE papers and practice papers are set with increasing regularity in year 11 to prepare students for their terminal examinations.

Assessment

How we assess progress at KS3

Progress is assessed by interrogating a range of metrics including GL Progress in Maths, internal baseline assessments, end of unit checkpoint assessments, end of term key assessments and end of year key assessements. In addition to this, students will also sit Core Knowledge tests and spelling tests throughout the year. In terms of reporting progress, Key Stage 3 students receive a SAGE grade and an Attitude to Learning grade for mathematics at each Progress Point. This serves as an indicator as to how their current ability and approach to their studies is, in our professional opinion, likely to extrapolate towards GCSE performance. The SAGE scale ranges from E (Emerging), through G (Good) and A (Advanced) through to S (Scholastic Excellence). This information is reported to parents three times a year at the relevant Progress Points and further explained at parents' evenings.

How we assess progress at KS4

The means of assessing progress in Key Stage 4 is similar to the process in Key Stage 3. However, more emphasis is placed on the formative end-of-unit checkpoint assessments and the summative end-of term and end-of-year key assessments which are more akin to GCSE style examination questions in Key Stage 4, providing students with regular opportunities to demonstrate their reasoning and problem-solving abilities in conjunction with their knowledge of the mathematical skills and concepts that they have been taught. In year 11, students will sit two separate PPE series where they are exposed to a full set of GCSE papers. These are marked by the mathematics department using official marking schemes and grade boundaries. We move away from the SAGE scale to GCSE grading which is reported at Progress Points in the form of a current working grade (CWG) and further explained at parents' evenings.

Teaching and Learning

How we teach to the top

As previously mentioned, students are set on ability from early in year 7 in order to place them on a pathway which will ensure access, engagement, enjoyment and ambition. Scaffolded resources ensure that students of all current abilities are able to access the topics while those with a deeper understanding are engaged by questions of a more applied nature. Correct mathematical terminology is insisted upon and modelled by staff throughout. Knowledge is checked informally throughout the lessons by the means of targeted questioning and students are given the opportunity to explain the methods and procedures used to solve problems, sharing their thoughts with staff and peers alike.

How we ensure topics are introduced with direct instruction

Our front-of-class resources are bespoke, designed specifically to promote progress for all and regularly amended in order to meet the specific needs of their audience. Each resource contains a diverse variety of question types, structured and ordered to go beyond the initial factual recall and retrieval necessary to access the topic, moving through conceptual understanding and culminating in questions requiring a more strategic approach in order to solve a problem or reason mathematically.

Cultural Capital

How we develop cultural capital

Mathematics is a subject with a rich cultural heritage, the knowledge of which is shared with the students. From the origins of algebraic thought and the impact of ancient Greek mathematicians to modern-day STEM and financially oriented topics, all maths students at CCR are exposed to many examples of cultural capital at relevant points in the schemes of work. By providing this background instruction, the enjoyment and engagement with topics increases and foster a more positive attitude towards mathematics as a whole. This is supported in Key Stage 3 by homework tasks centred on the lives of important mathematical figures.

This work is supplemented by invitations to participate in national Maths Challenges, both on an individual and team level, cryptography in the guise of the National Cipher Challenge and additional maths-related trips and visits.

Additional Notes

The head of mathematics plays a prominent role in assemblies delivered to students who are sitting pre-public and terminal examinations, and the whole department regularly devote their time after school to extra-curricular maths lessons. Workshops are held during school holidays and on Saturdays in the exam season as well.

The influence of the mathematics department extends throughout the different aspects of life at Casterton College. Students are aware that mathematics pervades all other subjects and that making progress in mathematics and ultimately celebrating success in the subject is desirable and in many cases essential for later life. They understand that a level of proficiency in the subject is beneficial to their comprehension of the wider world.

At the end of terms 2, 4 and 6 a mathematician of the term is chosen from every teaching group and presented with a certificate of praise. Students may be chosen for regularly participating during lessons, consistently working hard or for contributions during school maths events.

Staffing

Head of Department	M. Monteforte
Deputy Head (where appropriate)	G. Pitselis
Teaching Staff (specialism where appropriate)	P. Kettle A. Reilly C. Wood R. Henriet (Head of Year 10) L. Nichols (Head of Year 7) J. Crisp K. Bryjova N. Rawes F. Bulpit (Teaching assistant working uniquely within mathematics)
Senior Link	N. Rawes