Mathematics Mastery

Year 7 Module Overviews

Key principles

We are guided by four underlying principles:

- high expectations for every child – one curriculum
- depth before breadth
- number sense and place value come first
- problem solving at the heart

High expectations – and a growth mindset

Success in mathematics often seems to be used as an indicator of 'innate' intelligence, rather than something that everyone can achieve with effort. We believe that every child can learn mathematics, given the appropriate learning experiences within and beyond the classroom. We therefore have a responsibility to map our curriculum to enable every child to succeed. Our curriculum map reflects our **high expectations for every child.** Every student is entitled to master the key mathematical content for their age. Every student must receive the support and challenge they need. We believe that this personalisation can be achieved with all students learning the same concepts and skills.

Deep progress

National Curriculum level descriptors have led us to equate progress with knowing new procedures and rules. Many students build a superficial knowledge of a large number of techniques, but find that at GCSE, A level or beyond they lack the depth of understanding to be able to use these skills. We focus on fewer key concepts in each term, putting **depth before breadth,** and students demonstrate progress by making connections between representations, and applying them within and beyond the curriculum. This structure liberates. Teachers find that spending longer on each topic enables them to really think and talk about the mathematics they are teaching. The curriculum is cumulative. We sequence the concepts and methods so that previously learnt ideas can be connected to new learning, supporting students in understanding the coherent and connected nature of the subject, and ensuring they consolidate learning by continually using and applying it in a variety of contexts.

Number sense and place value first.

Mathematics is a rich and varied subject, and throughout primary and secondary education students experience a wealth of concepts and skills, including algebra, geometry and statistics. We believe that all of mathematics can be appreciated more fully once a student has a deep appreciation of the number system, and therefore we put number sense and place value first.

Problem solving is at the heart of mathematics.

We structure our curriculum so that all students in a year group learn the same content at the same time, have longer to focus on this content, and spend a significant amount of time securing essential number skills. In this way we aim to create the optimal conditions for students to both learn through problem solving and to learn to solve problems.

Mathematics Mastery

How to use these unit overviews

These unit overviews are designed to be used by teachers in schools that are members of the Mathematics Mastery partnership. They should be interpreted by experienced teachers and leaders within the context of the philosophy, aims, curricula and pedagogical principles of the mastery approach. A very few pertinent features are re-emphasised in the weekly overviews below, but this alone is not sufficient for the approach to be effectively interpreted.

Mastery objectives are cumulative

At the end of the year, students should know, understand and be able to do *every* objective included here. Objectives specified for a unit should not only be considered to be the learning for an individual lesson or discrete series of lessons, but rather be explicitly taught during the specified unit, and then applied in future lessons as well as in other areas of the curriculum and beyond. This applies both within and across half terms. When a concept or skill is first introduced for the key stage, it is highlighted in grey.

Timing

The expectation is that all Mathematics Mastery member schools dedicate at least 3 hours each week to maths lessons at key stage three. As the length of half terms varies, and individual school calendars vary, the curriculum framework is based on 5 weeks of lessons per half term.

In a given half term a further four lessons should be reserved for formative assessment. In the first half of a term, this is two lessons to complete and review the pre-learning assessment, and two lessons to complete and review the post-learning assessment. In the second half of a term, time is not allocated for review of pre- and post-learning assessments; one hour is used for each of these assessments, then one hour for the end-of-term assessment and the fourth hour for reviewing this paper. Further lessons are reserved for teaching informed by the post-learning assessment, which may involve deepening understanding demonstrated, or revisiting ideas that are yet to be mastered.

Where a department has the luxury of more time they may spend longer on the lessons, create further lessons, or allocate more time to reviewing assessment and intervention.

Mathematics Mastery

Year 7 Half Term 1 (Autumn 1)
Place value, addition and subtraction

Subject content

Number

- understand and use place value for decimals, measures and integers of any size
- order positive integers and decimals; use the number line as a model for ordering integers and decimals; use the symbols =, ≠, <, >, ≤, ≥
- use addition and subtraction, applied to positive integers and decimals
- recognise and use the inverse relationship between the addition and subtraction operations
- use standard units of mass, length, time, money and other measures, including with decimal quantities
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places]
- use approximation through rounding to estimate answers

Geometry and measure

- calculate and solve problems involving perimeters of 2-D shapes (triangles and rectangles)

Working mathematically

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals
- select and use appropriate calculation strategies to solve increasingly complex problems
- move freely between different numerical and diagrammatic representations
- use language and properties precisely to analyse numbers

Reason mathematically

- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in number
- interpret when the structure of a numerical problem requires additive reasoning

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Mathematics Mastery

Unit 1 **Place value of whole numbers up to 10 million** (1 week)	This unit covers the key concepts of the base ten system, ensuring students develop a strong understanding through the use of manipulatives and a variety of investigative tasks. The need for precise mathematical language is introduced by challenging students to e.g. explain how they know given statements are true or false and how they make their decisions when rounding.	Within this week's unit, students will learn to: • recognise concrete representations and place value models of whole numbers • read and write whole numbers in figures and words • mark the approximate position of a number on a number line • multiply, and divide, any whole number by 10, 100, 1000, or 10 000 • round whole numbers to the nearest 1000, 100 or 10 • put a set of numbers in ascending or descending order
Unit 2 **Mental addition and subtraction of integers** (1 week)	This unit focuses initially on addition and subtraction of integers, in particular looking at mental methods and choosing appropriate strategies. The relationship between addition and subtraction will be emphasied and bar modelling, a highly useful tool to support problem solving, is introduced to help students to visualise this. The formal algorithms for addition and subtraction are introduced towards the end of the unit, with the emphasis on developing conceptual understanding. Students are expected to understand the bond between the two operations and use this to solve problems. Negative integers are not formally dealt with in Year 7 as the focus is on structure and number sense.	Within this week's unit, students will learn to: • add and subtract with and without concrete representation and place value tables • choose and use a variety of strategies to mentally add and subtract sets of numbers • understand and use the commutativity and associativity of addition • solve addition and subtraction problems in a variety of contexts
Unit 3 **Written addition and subtraction of integers** (1 week)	This unit builds on the previous week's learning, developing their understanding and experience of the formal written algorithms whilst still encouraging students to choose suitable mental strategies when appropriate. Rounding will be revisited in the context of estimation to help spot/prevent errors in the use of the formal methods. Perimeter is introduced as a context for further problems, and bar modelling is taught in greater depth as a means to represent worded problems, prior to gaining a solution.	Within this week's unit, students will learn to: • choose from and use a variety of strategies to add and subtract sets of numbers • understand and use the formal written algorithms for addition and subtraction • use estimation to find approximate answers • understand, calculate and work with perimeters • develop their understanding of bar modelling to represent problems • use approximation to estimate the answers to calculations

Unit 4 **Addition and subtraction of decimals** (2 weeks)	This unit covers decimal place value as well as the addition and subtraction of decimals. Students' understanding of place value from earlier units is extended into decimal values. Decimal grids and number lines are used regularly throughout the unit.	Within this fortnight's unit, students will learn to: • understand decimal notation and place values (tenths, hundredths, thousandths) and identify the values of the digits in a decimal • read and write decimals with up to 6 digits in figures and words • convert between decimal and fraction where the denominator is a factor of 10 or 100 • use the number line to display decimals and round decimals to the nearest whole number, to 1 or 2 decimal places • use correctly the symbols <, > etc. and the associated language to order a set of positive integers and decimals, or measurements • multiply and divide any integer or decimal by 10, 100, 1000, or 10 000 • solve word problems involving the addition and subtraction of money in decimal notation • relate decimal arithmetic to integer arithmetic • use standard written methods in column format for addition and subtraction of integers and decimals • extend existing mental calculation to include decimals • calculate the perimeter of rectangles, squares and rectilinear figures

Mathematics Mastery

Year 7 Half Term 2 (Autumn 2)
Place value, multiplication and division

Subject content

Number

- understand and use place value for decimals, measures and integers of any size
- order positive integers and decimals; use the number line as a model for ordering integers and decimals; use the symbols =, ≠, <, >, ≤, ≥
- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor and lowest common multiple
- use the four operations, applied to positive integers and decimals
- recognise and use the relationships between operations including inverse operations
- use standard units of mass, length, time, money and other measures, including with decimal quantities
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places]
- use approximation through rounding to estimate answers

Geometry and measure

- derive and apply formulae to calculate and solve problems involving: perimeter and area of rectangles and triangles
- calculate and solve problems involving perimeters of 2-D shapes (triangles and rectangles)

Statistics

- calculate and use the mean to describe, interpret and compare observed distributions of a single variable

Working mathematically

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals
- select and used appropriate calculation strategies to solve increasingly complex problems
- move freely between different numerical and diagrammatic representations
- use language and properties precisely to analyse numbers

Reason mathematically

- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in number
- interpret when the structure of a numerical problem requires additive or multiplicative reasoning

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Mathematics Mastery

Unit 5 **Multiplication and division of integers** (2 weeks)	This unit covers the multiplication and division of integers. Emphasis will be placed on the relationship between the two operations and the use of correct mathematical vocabulary. As well as developing mental strategies and number sense, students will learn to use the formal written methods for both operations, based on conceptual understanding. Place value work will be built on to support estimation to verify the order of magnitude of answers. Bar model representations, introduced in work on addition and subtraction, are extended to multiplication. Solution of multi-step calculations will be supported through the development of number sense. Area will be explicitly taught in this unit.	Within this fortnight's unit, students will learn to: • use multiplication and division facts to solve mental calculations • use knowledge of place value and the relationship between multiplication and division to derive facts from known facts • use the terms 'product', 'multiple' and 'LCM' • divide whole numbers and decimals by whole numbers • use the terms 'quotient', 'remainder', 'factor', 'HCF' • understand and use the column method to multiply integers • understand and use the formal algorithm for division • represent multiplication and division word problems using bar models, and solve • estimate answers in calculations and check that results are reasonable • calculate the areas of rectangles and triangles • explore commutativity and associativity
Unit 6 **Area** (1 week)	This unit develops representations of multiplication to formally introduce the formulae for the area of rectangles, triangles and parallelograms. Students will have met arrays as representations of multiplication in Unit 5, and will develop that here to formally use multiplication and division when working with area models and compound shapes.	Within this week's unit, students will learn to: • calculate the areas of rectangles, triangles and compound shapes • multiply and divide whole numbers in the context of area • estimate answers in calculations and check that results are reasonable • solve problems involving length, perimeter and area, including compound shapes and calculating the lengths of unknown sides
Unit 7 **Multiplication and division of decimals** (1 week)	This unit builds on Units 5 and 6 by extending multiplication and division to decimals, largely through developing their understanding of area. Students are encouraged to explore shape area and perimeter in a number of tasks, including "working backwards" problems. Decimal place value and the links between columns are revisited as students' estimation skills are developed. This is particularly important in the division of decimals by decimals.	Within this week's unit, students will learn to: • multiply and divide whole numbers and decimals • estimate answers in calculations and check that results are reasonable • solve problems involving length, perimeter and area, including compound shapes and calculating the lengths of unknown sides • estimate answers in calculations and check that results are reasonable • calculate the areas of rectangles, triangles and compound shapes with decimals

Mathematics Mastery

Unit 8 **Further applications of multiplication and division** (1 week)	In this unit division is put into context through detailed work on the mean. Multiplication by 24 and 60 are included in the solving of time problems, including giving some sense of large numbers through questions like "which is closest to 1 000 000 seconds?" Problem solving work will be consolidated with specific support in choosing the correct operation (or operations) to solve worded problems.	Within this week's unit, students will learn to: • choose the appropriate operation(s) when problem solving • find the mean average, interpreting average as "total amount ÷ number of items" and solve word problems involving this • measure time, calculate with time and solve time word problems

Mathematics Mastery

Year 7 Half Term 3 (Spring 1)
Geometry: 2D shape in a 3D world

Subject content

Number

- use the four operations, including formal written methods, applied to positive integers and decimals
- recognise and use the relationships between operations including inverse operations
- use standard units of mass, length, time, money and other measures, including with decimal quantities
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places]
- use approximation through rounding to estimate answers

Algebra

- work with coordinates in all four quadrants

Geometry and measure

- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles
- draw and measure line segments and angles in geometric figures
- describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, triangles and quadrilaterals (given angles and lengths)
- use the standard conventions for labelling the sides and angles of triangle ABC
- derive and illustrate properties of triangles, quadrilaterals [for example, equal length and angles] using appropriate language and technologies
- apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles
- use the sum of angles in a triangle

Working mathematically

Develop fluency

- select and use appropriate calculation strategies to solve increasingly complex problems
- use language and properties precisely to analyse 2-D shapes

Reason mathematically

- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in geometry
- interpret when the structure of a numerical problem requires additive or multiplicative reasoning

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Mathematics Mastery

Unit 9 **Working with units** (1 week)	This unit covers scales and measures. Students will learn to read scales and interpret measures. They will also look at converting between some metric units using their knowledge of powers of ten. The main focus should be on understanding measure and scale. The nature of the topic allows for good use of concrete manipulatives – measuring devices, containers and everyday objects in the classroom. Bar models are used to pictorially show the metric conversions.	Within this week's unit, students will learn to: • record and order measurements using decimal notation • estimate, measure where appropriate, and convert between: o length in kilometres (km) /metres (m)/ centimetres (cm)/ millimetres (mm) o mass in kilograms (kg) /grams (g) o volume of liquid in litres (l) / millilitres (ml)
Unit 10 **Angles and angle properties of straight lines** (1 week)	This unit covers estimating, measuring, drawing and calculating angles. Types of angles will be discussed before students learn to measure and draw angles accurately. The following three units for this half term will ensure students get further time to practise these skills. Students will also be introduced to facts involving angles around a point, angles on a straight line and vertically opposite angles, and use these to find missing angles.	Within this week's unit, students will learn to: • draw and measure acute and obtuse angles reliably to the nearest degree • estimate the size of any given angle • recognise acute, right, obtuse and reflex angles • know and use the fact that the angles around a point total 360^{o}, that angles on a straight line total 180^{o}, and that vertically opposite angles are equal
Unit 11 **Properties of triangles** (1 week)	This unit involves students making and drawing triangles accurately as well as analysing their geometrical properties. Students will spend time drawing and measuring angles within the context of triangles, to practise the skills learned in Unit 9. Students will be expected to use the previously covered facts involving angles around a point, angles on a straight line and vertically opposite angles in problem solving tasks on missing angles.	Within this week's unit, students will learn to: • classify triangles according to their properties including symmetries • use a ruler and protractor to construct triangles from given data • know and use the fact that the sum of interior angles of a triangle is 180^{o} • solve problems involving coordinates in the first quadrant

Unit 12 **Properties of quadrilaterals** (1 week)	This unit looks at the properties of quadrilaterals. Students start the unit by looking more closely at parallel and perpendicular lines - key properties of quadrilaterals - before moving onto naming and defining the shapes.	Within this week's unit, students will learn to: • classify quadrilaterals according to their properties including symmetries • use a ruler and protractor to construct quadrilaterals from given data • know and use the fact that the interior angles of a quadrilateral sum to 360^{o} • solve problems involving coordinates in the first quadrant
Unit 13 **Symmetry and Tessellations** (1 week)	This practical unit reinforces earlier work on angles and shape and allows students to explore which combinations of reflection and rotational symmetry are and are not possible. Students will learn that all triangles and quadrilaterals tessellate and explore other tessellations.	Within this week's unit, students will learn to: • identify lines of symmetry in any shape • identify the order of rotational symmetry in any shape • create shapes given details of their symmetries • investigate and create tessellations

Mathematics Mastery

Year 7 Half Term 4 (Spring 2)
Fractions

Subject content

Number

- understand and use place value for decimals, measures and integers of any size
- order positive fractions, decimals and integers; use the number line as a model for ordering fractions, decimals and integers; use the symbols =, ≠, <, >, ≤, ≥
- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor and lowest common multiple
- multiply and divide positive integers, decimals and fractions
- recognise and use the relationships between operations including inverse operations
- work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 and 3/8)
- interpret fractions as operators
- define percentages as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%
- use standard units of mass, length, time, money and other measures, including with decimal quantities
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places]
- use approximation through rounding to estimate answers

Ratio, proportion and rates of change

- express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- understand that a multiplicative relationship between two quantities can be expressed as a fraction

Working mathematically

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals and fractions
- select and use appropriate calculation strategies to solve increasingly complex problems
- move freely between different numerical and diagrammatic representations [for example, equivalent fractions, fractions and decimals]
- use language and properties precisely to analyse numbers

Reason mathematically

- extend their understanding of the number system
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in geometry
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Unit 14 **Understand and use fractions** (2 weeks)	As the introduction to fractions in Year 7, students are encouraged to explore definitions and multiple representations of fractions in order to address any misconceptions from prior learning. Students need to know that fractions are not limited to non-integer values or numbers less than one, as well as recognising that the denominator represents equal divisions. Given the latter misuse, circles tend to be avoided as a representation of a fraction due to the difficulty in dividing these equally. By using fraction notation for division alongside the division sign, teacher consolidate understanding that fractions are divisions. When considering the equivalence of fractions and decimals in this unit, the notion of a percentage is dealt with briefly; this is revisited and developed in Units 19 later in the year.	Within this fortnight's unit, students will learn to: • represent fractions using area diagrams, bar models and number lines • recognise and name equivalent fractions • convert fractions to decimals • convert terminating decimals to fractions in their simplest form • convert between mixed numbers and improper fractions • compare and order numbers (including like and unlike fractions) • convert simple fractions and decimals to percentages • express one quantity as a fraction of another
Unit 15 **Fractions of amounts** (1 week)	This unit looks at finding fractions of amounts. Within the unit students will apply concepts and skills connected with *time* and *angles within triangles and quadrilaterals*. Bar models are used to demonstrate finding a fraction of an amount. These are a particularly good pictorial representation of splitting a number into equal parts and really useful when moving onto finding the whole given a fractional part.	Within this week's unit, students will learn to: • find a fraction of a set of objects or quantity • find the whole given a fraction
Unit 16 **Multiply and divide fractions** (2 weeks)	This unit looks at multiplying and dividing fractions emphasising throughout the relationship between the two operations. The lessons build on work on finding fractions of amounts to look at finding the whole given a fractional part before progressing onto the processes of fraction multiplication and division. Significant use is made of bar models and rectangular representations throughout to represent the fractional amounts. Alternative representations such as line models are also encouraged. Teachers encourage students to use these to help them solve and demonstrate understanding of the problems even where not stated explicitly.	Within this fortnight's unit, students will learn to: • multiply and divide a whole number or fraction by a whole number or fraction • understand and use reciprocals • find the whole given a fractional part • multiply and divide mixed numbers, whole numbers and fractions

Mathematics Mastery

Year 7 Half Term 5
(Summer 1) Algebra

Subject content

Number

- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor and lowest common multiple
- use the four operations applied to positive integers and decimals, and multiply and divide proper and improper fractions
- use conventional notation for the priority of operations, including brackets
- recognise and use relationships between operations including inverse operations

Algebra

- use and interpret algebraic notation, including:
  - ab in place of a x b
  - 3*y* in place of *y* + *y* + *y* and 3 x *y*
  - a^2 in place of a x a
  - $\frac{a}{b}$ in place of a ÷ b
  - coefficients written as fractions rather than as decimals
  - brackets
- substitute numerical values into formulae and expressions, including scientific formulae
- understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors
- simplify and manipulate algebraic expressions to maintain equivalence by
  - collecting like terms
  - multiplying a single term over a bracket
  - taking out common factors
- understand and use standard mathematical formulae
- model situations or procedures by translating them into algebraic expressions
- generate terms of a sequence from either a term-to-term or a position-to-term rule

Working mathematically

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals and fractions
- select and use appropriate calculation strategies to solve increasingly complex problems
- use algebra to generalise the structure of arithmetic, including to formalise mathematical relationships
- substitute values in expressions, rearrange and simplify expressions, and solve equations
- move freely between different numerical, algebraic and diagrammatic representations
- develop algebraic fluency
- use language and properties precisely to analyse numbers, algebraic expressions and 2-D shapes

Reason mathematically

- extend their understanding of the number system
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in algebra
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

Mathematics Mastery

Unit 17 **Order of operations** (2 weeks)	This fortnight's unit focuses on the order of operations. It is important that this is not reduced to a case of remembering BIDMAS/BODMAS. These acronyms can cause confusion amongst students who have not been taught in detail about the use of brackets and properties of all four operations. Students need to understand that division does not come before multiplication, nor does addition come before subtraction; this is simply the way they appear in these acronyms.	Within this fortnight's unit, students will learn to: • understand and use brackets • carry out combined operations involving all four operations • understand and use simple index notation • use associativity to solve numerical problems
Unit 18 **Introduction to algebra** (2 weeks)	This fortnight's unit formally introduces algebra to Year 7 students. Throughout the year students have seen and used algebraic notation to generalise their findings. For this reason, teachers can introduce algebra as a means of extending the students' work in mathematics to this point, rather than as a separate or novel topic. Sequences are included as a means of developing and using algebraic notation; finding rules for the n^{th} term is not covered at this stage. Common misconceptions with algebraic notations and meaning are addressed throughout the unit, e.g. letters not necessarily having a particular value.	Within this fortnight's unit, students will learn to: • recognise and continue sequences • represent an unknown number using a letter • form and use algebraic expressions • evaluate simple algebraic expressions by substitution • understand and use formulae • multiply out brackets, collect like terms, identify and take out common factors to simplify expressions • recognise that different-looking expressions may be identical and prove simple algebraic identities
Unit 19 **Algebraic generalisation** (1 week)	This week's unit consists of a series of investigations, designed to consolidate student learning on algebraic expressions. Students investigate number and word problems, with a view to generalising their findings algebraically.	

Mathematics Mastery

Year 7 Half Term 6 (Summer 2)
Percentages and pie charts

Subject content

Number

- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor and lowest common multiple
- use the four operations, including formal written methods, applied to positive integers, decimals, proper and improper fractions, and mixed numbers
- recognise and use relationships between operations including inverse operations
- work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)
- define percentages as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%
- interpret fractions and percentages as operators
- use standard units of mass, length, time, money and other measures, including with decimal quantities
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places]
- use approximation through rounding to estimate answers

Ratio, proportion and rates of change

- express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- understand that a multiplicative relationship between two quantities can be expressed as a fraction
- solve problems involving percentage change, including: percentage increase and percentage decrease

Geometry and measures

- measure angles in geometric figures
- apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles

Statistics

- use pie charts to describe, interpret and compare observed distributions of a single variable
- interpret pie charts for categorical data

Working mathematically

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals and fractions
- select and use appropriate calculation strategies to solve increasingly complex problems
- move freely between different numerical, algebraic, graphical and diagrammatic representations
- use language and properties precisely to analyse numbers and statistics

Reason mathematically

- extend their knowledge of proportion
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- explore what can and cannot be inferred in statistical settings, and begin to express their arguments formally

Solve problems

- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

May 2016 version

Mathematics Mastery

Unit 20 **Percentages** (2 week)	This fortnight's unit formally looks at percentages and their relationship with fractions. Students worked with percentages earlier in the year alongside work on decimals, so should be familiar with the denominator of 100. This unit will look at converting between fractions and percentages, as well as comparing representations of these. Bar models, pie charts and 100 grids will be used throughout to pictorially represent these numbers. We then build on this work to look at finding percentages of amounts and increasing/decreasing by a percentage. Students are **not** expected to be using multipliers at this stage, but rather finding percentages of amounts and using these to increase/decrease the total.	Within this fortnight's unit, students will learn to: • understand percentage as a fractional operator with denominator of 100 • express a part of a whole as a percentage • convert between fractions, decimals and percentages • find fractions and percentages of given quantities • find the whole given a percentage • increase and decrease by a percentage
Unit 21 **Working with data** (2 week)	This unit explores a variety of methods of presenting data, with an emphasis on interpretation as well as production. We have provided a data sheet with data for 36 pupils which can be used as a basis for most of the tasks in this unit. Although students are consequently not required to collect raw data, if they could collect some class information this would make the unit more meaningful. Opportunities to build on previous work on fractions and percentages are embedded throughout this unit.	Within this fortnight's unit, students will learn to: • Understand the difference between types of data • Construct and interpret o tables (including tally and two way) o bar charts (including comparative and composite) o pictograms o line graphs • Read and interpret pie charts • Draw pie charts from raw data • Explore misleading graphical representations
Unit 22 **Project work** (1 week)	The final week of Year 7 gives students the opportunity to consolidate the year's mathematics learning using project-based work.	Topics such as countries of the world, tourism, food content, fitness, sports events, etc. would be ideal for this type of project or you can use the "termly projects" provided on the toolkit.