Mathematics Mastery

Year 8 Module Overviews

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

First, we agree that mathematical intelligence is expandable. In a sense, if we didn't believe this, we wouldn't be teaching. But 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.

The second thing we agree on is the importance of 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.

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.

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 community. 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 here, 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 5 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 25 lessons per half term.

In a given half term a further four lessons should be reserved for 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.

On this basis, a half term is 29 lessons (just under six weeks). Where there is less time, due to an uneven calendar, it may be desirable to move a unit between half terms. 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 8 Module 1 (Autumn 1) Number

This half term, students will:

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, fractions, powers and roots
- select and use appropriate calculation strategies to solve increasingly complex problems
- move freely between different numerical 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 connections between number relationships
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in number and 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.

Subject content

Number

- order positive integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥
- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property
- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
- use conventional notation for the priority of operations, including brackets, powers and roots
- recognise and use relationships between operations including inverse operations
- use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations
- work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)
- interpret fractions and percentages as operators
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately

Unit 1 ***Primes numbers and factorisation*** (2 weeks)	Within this fortnight's unit, students will learn to: • Find the factors and multiples of a number • Find prime numbers • Find the prime factors of a number • Determine HCF by prime factorisation • Determine LCM by prime factorisation • Find squares, square roots, cubes and cube roots using prime factorisation • Use indices to record repeated multiplication

	• Calculate with the use of a calculator, including squares, cubes, square roots and cube roots Tasks and questions in this unit focus predominantly on prime numbers and prime factorisation, given students' prior learning on factors and multiples (Year 7 Units 5 and 7). The use of a calculator is not built into the tasks. However, any additional lessons during this period and/or homework time should be used to enable students to familiarise themselves with the use of calculators. Further development and practice can be found in the Year 9 Autumn Term project "Roots and Indices".
Unit 2 ***Add and subtract fractions and mixed numbers*** (3 weeks)	Within this three week unit, students will learn to: • Use equivalent fractions • Add and subtract fractions with like denominators • Add and subtract fractions with unlike denominators • Add and subtract fractions mixed numbers and improper fractions • Convert between improper fractions and mixed numbers • Add and subtract fractions mixed numbers and improper fractions • Calculate with decimals Tasks listed here introduce the addition and subtraction of fractions using musical notes. Bar models should be used throughout this unit to demonstrate equivalence and addition. Bars representing a whole will need to be comparable to aid student understanding. Teachers may choose to recap on fraction equivalence prior to starting these tasks. Additional time with the students should be spent on the latter two topics listed above, revising multiplying and dividing fractions (Year 7 Unit 15) and linking fraction calculations to those with decimals.

Mathematics Mastery

Year 8 Module 2 (Autumn 2) Algebra

This half term, students will:

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, fractions, powers and roots
- select and use appropriate calculation strategies to solve increasingly complex problems
- use algebra to generalise the structure of arithmetic, including to formulate 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 and algebraic expressions

Reason mathematically

- extend their understanding of the number system; make connections between number relationships, and their algebraic representations
- identify variables and express relations between variables algebraically
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in number and algebra

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
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems.

Subject content

Number

- understand and use place value for decimals, measures and integers of any size
- order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥
- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
- use conventional notation for the priority of operations, including brackets, powers and roots
- recognise and use relationships between operations including inverse operations
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- appreciate the infinite nature of the sets of integers, real and rational numbers.

Algebra

- use and interpret algebraic notation, including:
  - ab in place of a x b
  - $3y$ 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

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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
• use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)
• generate terms of a sequence from either a term-to-term or a position-to-term rule
• recognise arithmetic sequences and find the nth term
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<tr><td>Unit 3

Positive and negative numbers

(2 weeks)</td><td>Within this fortnight's unit, students will learn to:
• Represent and order positive and negative integers on a number line (using the symbols >, ≥, <, and ≤)
• Show addition and subtraction on a number line
• Apply the four basic operations on positive and negative integers
• Calculate with rational and decimal numbers (including negative numbers)
Students should have met negative numbers in primary education and know that the number line extends beyond zero. These tasks will focus on misconceptions students may have when comparing the size of numbers and the four basic operations using negatives. Confusion can arise around the meaning of the minus sign as to whether it represents a negative number or a subtraction. Teachers should be aware of the language used in relation to this, using phrases such as 'subtract negative three' rather than 'minus minus three'. Number lines are used throughout this unit. Laminated sheets with a selection of number lines (labelled and unlabelled) could prove a useful resource. In particular, they are extremely useful for demonstrating multiplication and division with negative numbers.</td></tr>
<tr><td>Unit 4

Sequences, expressions and equations

(3 weeks)</td><td>Within this three week unit, students will learn to:
• Recognise and represent number patterns (including finding an algebraic expression for the nth term)
• Translate simple real-world situations into algebraic expressions
• Use letters to represent numbers
• Distinguish between terms and coefficients in algebraic expressions
• Distinguish between like and unlike terms in algebraic expressions
• Add and subtract linear algebraic expressions
• Expand simple linear expressions
• Solve linear equations in one unknown
• Solve simple fractional equations that can be reduced to linear equations
• Formulate a linear equation in one unknown to solve problems
This unit on solving linear equations is introduced using sequences and expressing a sequence algebraically. Students will be familiar with algebraic notation from formal introduction in Year 7 Units 17 and 18, as well as informal use throughout the year. It is important to remember that the letters used in algebraic notation represent numbers and are not shorthand for words. Language should be used carefully to ensure that this understanding is communicated to the students. Teachers might choose to use unrelated letters in order to avoid confusion. Solution of equations will be limited to unknowns on one side only at this stage.</td></tr>
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Mathematics Mastery

Year 8 Module 3 (Spring 1) 2D Geometry

This half term, students will:

Working mathematically

Develop fluency

- select and use appropriate calculation strategies to solve increasingly complex problems
- use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships
- use language and properties precisely to analyse 2-D shapes

Reason mathematically

- extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically
- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in geometry, including using geometrical constructions

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.

Subject content

Number

- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers
- recognise and use 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 a calculator and other technologies to calculate results accurately and then interpret them appropriately

Algebra

- substitute numerical values into formulae and expressions
- understand and use standard mathematical formulae
- use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)

Geometry and measures

- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms and trapezia
- calculate and solve problems involving: perimeters of 2-D shapes
- describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles
- use the standard conventions for labelling the sides and angles of triangle ABC
- derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths 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
- understand and use the relationship between parallel lines and alternate and corresponding angles
- derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons
- interpret mathematical relationships geometrically

Unit 5 **Draw accurate triangles and quadrilaterals and find unknown angles (including parallel lines)** (3 weeks)	Within this three week unit, students will learn to: • Measure and draw angles • Identify and name angles (e.g. POQ, x) • Define an equilateral, isosceles, and scalene triangle • Draw a triangle, given two angles and the side adjacent to the given angles • Draw a triangle, given two sides and the included angle, Construct a triangle given the length of two sides and the angle between them (accurate to 1mm and 1°) • Classify special quadrilaterals on the basis of their properties: define a parallelogram, rhombus and trapezium • Draw a square, given one side • Draw a rectangle, given its length and breadth • Draw a rhombus, given one side and one angle • Draw a parallelogram, given two adjacent sides and the included angle • Draw a trapezium with the parallel sides indicated, given two adjacent sides, the included angle and the angle adjacent to the included angle • Understand and use right, acute, obtuse and reflex angles, complementary and supplementary angles, vertically opposite angles, adjacent angles on a straight line, adjacent angles at a point, interior and exterior angles • Identify the different types of angles formed by parallel lines and a transversal such as corresponding angles, alternate angles and interior angles • Use the various properties of angles to find unknown angles • Find unknown angles in geometrical figures involving square, rectangle, parallelogram, rhombus, trapezium and triangle Having covered types of angle, triangle and quadrilateral in Year 7 Units 9 to 12, these topics will be consolidated within the tasks involving construction of triangles and quadrilaterals. Teachers may choose to spend additional time with students ensuring competency at measure (angles and length), practising the constructions and using angle properties to find missing angles in various shapes.
Unit 6 **Length and area – units, parallelograms and trapeziums** (2 weeks)	Within this fortnight's unit, students will learn to: • Convert between cm^2 and m^2 • Find the area and perimeter of a figure made up of some of the following shapes: square, rectangle, triangle • Find the areas of parallelograms and trapeziums • Find the areas and perimeters of composite plane figures • Solve word problems involving area and perimeter Students will be familiar with the concept of area from primary school and their work in Year 7 Unit 6. Tasks for this unit focus predominantly on exploring unit conversions and formulae for the area of parallelograms and trapeziums. Additional time may be used for consolidation of these findings. In particular, teachers may choose to spend this time practising conversions between metric units and solving word problems involving area and perimeter. There are also opportunities to practise division of one decimal number by another.

Mathematics Mastery

Year 8 Module 4 (Spring 2) Proportional Reasoning

This half term, students will:

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, fractions, powers and roots
- select and use appropriate calculation strategies to solve increasingly complex problems
- use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships

Reason mathematically

- extend their understanding of the number system; make connections between number relationships, and their algebraic representations
- extend and formalise their knowledge of ratio and proportion in working with measures
- identify variables and express relations between variables algebraically
- 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, including in financial mathematics
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems.

Subject content

Number

- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
- 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 percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, 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 a calculator and other technologies to calculate results accurately and then interpret them appropriately

Algebra

- substitute numerical values into formulae and expressions, including scientific formulae

Ratio, proportion and rates of change

- use ratio notation, including reduction to simplest form
- divide a given quantity into two parts in a given part : part or part : whole ratio; express the division of a quantity into two parts as a ratio
- understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- relate the language of ratios and the associated calculations to the arithmetic of fractions

• solve problems involving percentage change, including: percentage increase, decrease and original value problems • use compound units such as speed to solve problems.	
Unit 7 **Percentage change** (2 weeks)	Within this fortnight's unit, students will learn to: • Use percentages greater than 100% • Express one quantity as a percentage of another • Compare two quantities by percentage • Increase or decrease a quantity by a given percentage • Understand how to compare quantities using percentages • Reverse percentages: find the original quantity given a part of it and its percentage • Reverse percentages: find the original quantity when we know its final value after the percentage increase or decrease • Solve problems involving percentages and reverse percentages Students worked on converting between fractions, decimals and percentages in Units 13, 20 and 21 of Year 7. It is important that they recognise not only that fractions, decimals and percentages are not distinct types of number, but rather different representations of number. They should know the difference between the use of fractions, decimals and percentages as operators (such as finding a fraction of an amount) or simply as a number. Students can use this prior knowledge to progress onto solving problems involving percentage change and reverse percentages. Bar models provide an excellent representation of percentage change and equivalence between amounts, hence should be used throughout the unit to deepen student understanding.
Unit 8 **Ratio (equivalent, of a quantity) and rate** (3 weeks)	Within this three week unit, students will learn to: • Interpret a : b and a : b : c, where a, b and c are whole numbers • Compare two or more quantities by ratio • Understand the relationship between ratios and fractions • Write equivalent ratios, and find the missing term in a pair of equivalent ratios • Express ratios involving rational numbers in their simplest form • Divide a quantity in a given ratio • Find the ratio of two or three given quantities • Find one quantity given the other quantity and their ratio • Find the whole/ one part when a whole is divided into parts in a given ratio • Calculate average rate • Solve word problems involving ratio • Understand and differentiate between the concepts of speed, average speed and uniform speed • Use the relationship between distance, time and speed • ∗ Distance = Speed × Time, • ∗ Speed = Distance ÷ Time, • ∗ Time = Distance ÷ Speed • Calculate speed, distance or time given the other two quantities • Write speed in different units such as km/h, m/min, m/s and cm/s • Convert from one unit of speed to another (e.g. km/h to m/s) • Solve word problems involving speed, uniform speed and average speed

	Students' understanding of multiplication is often based on the repeated addition of integers, which is limiting when looking at topics such as ratio and proportion. The challenge is therefore to provide students with an understanding of multiplicative reasoning that is not repeated addition. Using activities that draw on measure and similarity where the scale is continuous can encourage a shift away from the use of repeated addition and build a deeper understanding of proportional reasoning. Examples with ratios involving doubling and halving should be used sparingly, since this relationship is often conceptually different for students than multiplication by other numbers. Cuisenaire rods should be used to not only demonstrate the idea of ratio – connecting to multiples and factors, but also to link ratio to previous work on fractions. Ideally these would be the rods with no markings on them so that the students did not assign particular values to them.

Mathematics Mastery

Year 8 Module 5 (Summer 1) 3D Geometry

This half term, students will:

Working mathematically

Develop fluency

- select and use appropriate calculation strategies to solve increasingly complex problems
- substitute values in expressions, rearrange and simplify expressions, and solve equations
- use language and properties precisely to analyse 3-D shapes

Reason mathematically

- make and test conjectures about patterns and relationships; look for proofs or counter-examples
- begin to reason deductively in geometry

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.

Subject content

Number

- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
- recognise and use relationships between operations including inverse operations
- use integer powers and associated real roots (square, cube and higher)
- 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 or significant figures]
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation $a<x\leq b$

Algebra

- substitute numerical values into formulae and expressions, including scientific formulae
- model situations or procedures by translating them into algebraic expressions

Ratio, proportion and rates of change

- understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction

Geometry and measures

- calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes
- use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D
- interpret mathematical relationships both algebraically.

Unit 9 **Rounding, significant figures and estimation** (1 week)	Within this week's unit, students will learn to: • Round off a number to a required number of decimal places • Round off a number to a required number of significant figures • Estimate the answer to a given problem • Identify rounding and truncation errors

	With the focus on rounding and estimation, students should be encouraged to see why these might be useful tools for giving answers and for checking answers worked out using written methods or on a calculator are reasonable. Calculators can be used within the rounding tasks to check the accuracy of the approximation, but should not be used in place of written or mental methods where these might be more appropriate. There are plenty of opportunities for reinforcing this in the following three units.
Unit 10 **Circumference and area of a circle** (2 weeks)	Within this fortnight's unit, students will learn to: • Use formulae to calculate the area and circumference of a circle • Find the area and perimeter of • ∗ semicircle (half circle) • ∗ quarter circle • Solve word problems involving area and perimeter Introducing pi by discovering the connection between the circumference of a circle and its diameter links well with the previous unit on ratio. Investigating how this ratio holds true for all circles no matter what their size could prove an interesting discussion point, particularly when thinking about lengths of other shapes compared to their perimeters. Time in this unit should focus on discovering and proving the formulae for the circumference and area of a circle, whilst linking to work on formulae, measure, ratio and approximation from earlier in the year.
Unit 11 **3D shapes and their nets** (1 week)	Within this week's unit, students will learn to: • Recognise nets of 3D shapes • Build and name 3D shapes Students may need to revisit the names and properties of 2D shapes before working on their 3D counterparts. Time should be spent building and breaking down 3D shapes, both with blocks and as nets, to fully understand the properties of these shapes and aid students as they progress onto finding volume and surface area.
Unit 12 **Surface area and volume of cuboid, prism, cylinder, composite solids** (2 weeks)	Within this fortnight's unit, students will learn to: • Find the volumes of cubes and cuboids • Find the volumes of prisms and cylinders • Find the volumes of composite solids • Explore the surface area of cubes, cuboids, cylinders other prisms and composite solids • Convert between cm^3 and m^3 The primary focus for this unit is on developing an understanding of volume and use of formulae within this context. Although surface area is not covered in depth in this unit, students are expected to understand the concept of surface area; they will have work with this idea in the Y9 Autumn Term project. For instance, when creating shapes with the same volume, they need to be able to explain how the shapes differ - this may be through different numbers of faces, vertices and edges or differing surface areas. At this stage, they are not expected to abstractly determine the surface area of a prism given its dimensions.

Mathematics Mastery

Year 8 Module 6 (Summer 2) Statistics

This half term, students will:

Working mathematically

Develop fluency

- consolidate their numerical and mathematical capability from key stage 2
- 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

- make and test conjectures about patterns and relationships
- 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
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems.

Subject content

Number

- define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%
- round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures]
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately

Ratio, proportion and rates of change

- express one quantity as a fraction of another, where the fraction is less than 1

Statistics

- describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)
- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data

Ideally this half term should be taught through project work, whether through an extended project or a series of shorter projects, giving students the opportunity to collect different types of data, record and analyse results and then perhaps time to develop it further by reconsidering questions and/or adding more data. As well as being taught exemplar ways to collect and represent data, students should be made aware of biased data, looking at charts, graphs or surveys in the news and advertising to further develop their understanding of use of representations. Students are expected at this stage to be able to recognise the differences between bar charts and histograms, and make links between area and the frequency. However, they are not expected to draw histograms given a data set.

Unit 13	Within this week's unit, students will learn to: • Collect, classify and tabulate data using data collection methods such as

Statistics (5 weeks)	○ Taking measurements ○ Conducting surveys ○ Using questionnaires ○ Collating and classifying data • Informally appreciate the role of bias when selecting a sample • Read, construct and interpret ○ Tally charts ○ Two way tables ○ Bar graphs ○ Pie charts • Compare different forms of statistical representation • Solve problems using information presented in tables and graphs • Explore the mean, median and mode • Use the range for comparing data sets