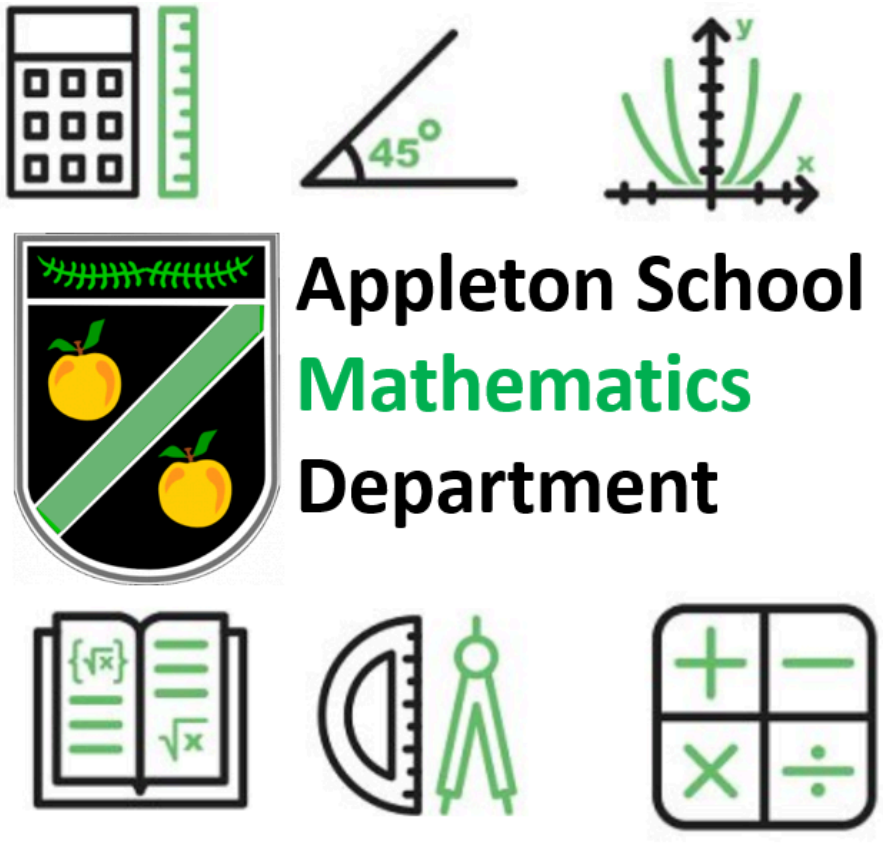
2023/ 2024

Mathematics Subject Overview

The Appleton School



Contents

Subject: Mathematics

Overall Curriculum **Intent** – Our Vision and Aims (linked to the National Curriculum and Specifications)

Our mathematics curriculum aims to provide students with the knowledge, skills and confidence to identify patterns, creatively apply logic and solve problems by constructing solutions based on rational arguments.

At the Appleton School, we promote a mathematics curriculum based on our beliefs that:

- Mathematics is a language that empowers us to explain the world around us.
- Mathematics develops skills to solve both real and abstract problems
- All students should be given a varied and balanced experience of mathematics to build confidence for the future and maximise their potential.

Our curriculum has been designed to support students in becoming fluent in the fundamentals of mathematics, 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. We strongly believe that our curriculum also supports our school ethos developing student's character, including resilience, confidence and independence, so that they contribute positively to the life of the school, their local community and the wider environment

Students, by the end of their mathematical education at Appleton School, will be expected to:

- Perform basic numeracy skills fluently
- Perform basic mathematical skills needed in their chosen career or for entry to higher or further mathematical education
- Understand the mathematics likely to be encountered in daily life
- Reason clearly and logically, and set out rational arguments
- Identify patterns encountered in diverse situations and make inferences from these
- Approach problems systematically and choose appropriate techniques for their solution
- Experience satisfaction in and enjoyment of mathematical experiences and achievements
- Develop fluency in performing key mathematical skills so they become second nature.
- Reason mathematically, think logically and flexibly to develop sound mathematical arguments.
- Solve problems in a diverse range of situations.

Department Mission Statement

We aim to teach our lessons so that our pupils:

- Develop thinking and problem-solving skills that will prepare pupils for the future.
- Take ownership of their learning
- Take measured risks and attempt challenging questions so that pupils can perform confidently in their exams
- Make links between topics and across subjects, strengthening their understanding of the critical role mathematics plays in paving the future.

How is the **curriculum** delivered?

The Mathematics curriculum that we deliver adopts the Bruner spiral curriculum model which aims for all students to form a concrete grasp of the foundational aspects of mathematics at Key Stage 3 building on the skills developed at KS2. Our Curriculum takes the broad and varied skills necessary and breaks them down by monitoring so that each strand of mathematics, including Algebra, Ratio and Proportion and Shape are revisited often throughout a student survey. This ensures that fundamental skills are consistently being developed and reinforced as we embed them across topics.

At Key Stage 4, using these concepts our knowledge-based curriculum explores the applications of these skills further as well as deepening the theoretical and pure mathematical content. For example, a student will learn to identify and collect like terms in year 7 to be able to simplify quadratic expressions in Year 9. Manipulating quadratic expressions in year 9 will lead students to be able to simplify an algebraic fraction in year 11.

Importantly, our schemes of work at Key Stage Three build on the skills that students have already acquired in Key Stage Two; this continues as Key Stage Four extends Key Stage Three learning, with Key Stage Five then developing Key Stage Four learning. Moreover, our curriculum is designed strategically to allow for a seamless transition between Key Stages. When designing the delivery of our curriculum, like in other subjects across the school, we have also been led by academic research: for instance, as a result of the 2019 research into the significance of interweaving, memory work and recall practice[4], it is now department policy that all lessons begin with memory recall. Moreover, in both Key Stage Three and Key Stage Four we use setting determined to ensure that every child is challenged at the right level.

How is the **curriculum** assessed?

As a department, we regularly assess students against the assessment criteria relevant to their ability and schemes of learning are planned to ensure progression for all individuals. We use an application and mastery model which follows a process of unit testing to focus feedback on areas of weaker understanding before students experience the final assessments in a module. This ensures that students have the opportunity to revisit skills and topics to further cement understanding.

We employ research-based assessment strategies to build upon pupils' existing knowledge and understanding. We believe that effective feedback should be specific and clear and encourage further effort.

Across all year groups, formal, summative assessments take place three times, testing students on the knowledge and skills they have developed recently, but importantly also in previous units. We use GCSE grades, level descriptors and grade boundaries to assess student work, meaning that students become familiar and confident with these terms as they progress through school. In Years 10, 11, 12 and 13, students will sit formal mock examinations in exam conditions in the school hall at least twice each academic year to allow them to familiarise themselves with formal exam protocol.

Furthermore, moderation takes place frequently during department time to ensure consistency in terms of assessed work, in addition to supporting the CPD needs of staff. Where assessments show gaps in learning, students will be invited to attend catch-up or intervention sessions which can then be measured for impact. At KS5 we have developed a practice of independent study which prompts students to use their private study time to work on areas of improvement identified from summative assessments in addition to the work being completed as part of the course.

How is the curriculum enriched through speakers, visits or clubs to generate a love of learning?

The Mathematics curriculum has been designed and structured to offer a broad and balanced experience for all students for as long as possible. We are continuing to develop opportunities for students to learn, explore and engage with Mathematics outside of the classroom. Students who do engage with the subject outside of lesson time are rewarded with letters and postcards home, merits and can also work towards achieving their Mathematics Ambassador badges.

Extra-Curricular

As a department, we regularly engage with several national mathematics competitions and have clubs run by experienced members of staff which focus on the further development of abstract thinking and problem solving necessary for these events. This allows students to explore mathematics in a challenging and interesting way of viewing concepts from different perspectives. These competitions run from KS3 to KS5 which ensures that all students at different stages can get involved. We also provide support for students taking entrance exams to the top universities such as the STEP programme, something we are looking to develop and promote further.

In addition to this, we also offer after-school clubs for GCSE Further Maths and Statistics for students who are interested in taking these extra qualifications. GCSE Further Maths, in particular, has been excellent in stretching our more able students and serves as a great transition between the year 11 and year 12 content of study. Similarly, revision and intervention sessions also take place after school; students may be invited to attend these if their work demonstrates a particular area of weakness, however, many students also choose to attend voluntarily to support their learning or to increase their confidence.

Visits

This is an area of the curriculum that we are looking to expand upon further over the next academic year. We have already identified several exciting opportunities to offer our students in this area. For example, trips to theme parks for A-Level students to study the mathematics of how the attractions are modelled and executed, from an applied mathematics perspective.
We would also like to explore financial mathematics opportunities by visiting the capital's financial district.

Speakers

This is again, an area of the curriculum that we are looking to expand upon further over the next academic year

What skills and **knowledge** do students bring with them from **Key Stage Two to Year 7?**

Our aim to produce a broad and balanced curriculum is based on recognising the importance of the transition between Key Stage 2 and Key Stage 3. We have worked hard to ensure that our schemes of work reflect the knowledge and skills students will enter our curriculum with. We strengthen our knowledge of students'abilities with the use of assessments at the start of Year 7 to further understand what students should be able to do. This information is supported further by visiting local primary schools to share information, examples of work and share resources.

With regards to Number, students should be able to:

- Read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- Round any whole number to a required degree of accuracy
- Use negative numbers in context, and calculate intervals across zero
- Solve a number and practical problems that involve all of the above.
- Multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- Divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- Divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpret remainders according to the context perform mental calculations, including with mixed operations and large numbers
- Identify common factors, common multiples and prime numbers
- Use their knowledge of the order of operations to carry out calculations involving the four operations
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- Use common factors to simplify fractions; use common multiples to express fractions in the same denomination
- Compare and order fractions, including fractions > 1
- Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, 4 1 × 2 1 = 8 1]
- Divide proper fractions by whole numbers [for example, 3 1 ÷ 2 = 6 1]
- Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 8 3]
- Identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places

- Multiply one-digit numbers with up to two decimal places by whole numbers
- Use written division methods in cases where the answer has up to two decimal places
- Solve problems which require answers to be rounded to specified degrees of accuracy
- Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.

With regards to Ratio and Proportion, students should be able to:

- Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts
- Solve problems involving the calculation of percentages [for example, of measures, such as 15% of 360] and the use of percentages for comparison
- Solve problems involving similar shapes where the scale factor is known or can be found
- Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

With regards to Algebra, students should be able to:

- Use simple formulae
- Generate and describe linear number sequences
- Express missing number problems algebraically
- Find pairs of numbers that satisfy an equation with two unknowns
- Enumerate possibilities of combinations of two variables.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum_-_Mathematics_220714.pdf

With regards to Geometry and Measure, students should be able to:

- Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate
- Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places
- Convert between miles and kilometres
- Recognise that shapes with the same areas can have different perimeters and vice versa
- Recognise when it is possible to use formulae for area and volume of shapes
- Calculate the area of parallelograms and triangles
- Calculate, estimate and compare the volume of cubes and cuboids using standard units, including cubic centimetres (cm3) and cubic metres (m3), and extending to other units [for example, mm3 and km3].
- Draw 2-d shapes using given dimensions and angles
- Recognise, describe and build simple 3-d shapes, including making nets
- Compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons
- Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.
- Describe positions on the full coordinate grid (all four quadrants)
- Draw and translate simple shapes on the coordinate plane, and reflect them in the axes.

With regards to Statistics, students should be able to:

- Interpret And Construct Pie Charts And Line Graphs And Use These To Solve Problems
- Calculate And Interpret The Mean As An Average.

Where students join us in Key Stage Three below these expected levels (sub-100 students), additional catch-up is provided for students to focus on the development of core fundamental skills.

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What **skills and knowledge** do students bring with them from **Year 7 into Year 8**?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Number, at all Steps pupils should be able to:

- Understand and use place values for decimals, measures and integers of any size
- Order positive and negative integers, decimals and fractions; use the number line as a model for the 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, square, cube, square root and cube root
- Appreciate the infinite nature of the sets of integers, real and rational numbers
- Use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals
- Recognise and use relationships between any operations including inverse operations

At the Core/Support Step, pupils can round any whole number

- Use negative numbers in practical contexts such as temperature and calculate Intervals across zero [n5]
- Count forwards or backwards in steps of any whole number with one significant figure, e.g. 9, 20, 3000 [n1]
- Add and subtract whole numbers with more than four digits, using formal written methods where appropriate [c2]
- Use their understanding of place value to multiply and divide whole numbers and decimals with up to two decimal places by 10 or 100 (e.g. 1532 ÷ 100 =, ÷ 100 = 6.3) [c6]
- Multiply and divide whole numbers mentally drawing upon multiplication facts up to 12 × 12 and place value (e.g. 60 × 70) and begin to use these facts to work with larger numbers [C6]
- Solve problems which require knowing fractions, percentages and decimal equivalents of halves, quarters, fifths and those fractions with a denominator of a multiple of 10 Or 25.
- Use common factors to simplify fractions; use common multiples to express fractions In the same denomination
- Use the time to cover calculations (FEMA) and fdp
- Multiplication method and becoming more confident with multiplication with larger
- Numbers; multiply and divide numbers with up to four digits by a single-digit number using the formal short division method and become more confident with division using larger numbers including the long division method. [c7]
- Round decimals with two decimal places to the nearest whole number and one decimal place
- Solve problems involving numbers up to three decimal places
- Add and subtract decimal numbers that have the same number of decimal places (e.g. 157.31 – 29.16) [f10]
- Multiply a one-digit decimal number by a single-digit number (e.g. 0.6 × 8) [f9]
- Express one quantity as a fraction of another in simple cases.
- Compare and order fractions whose denominators are all multiples of the same number
- Identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths
- Recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number [for example, add and subtract fractions with the same denominator and denominators that are multiples of the same number
- Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams
- Read and write decimal numbers as fractions
- Recognise and use fractional thousandths and relate them to tenths, hundredths and decimal equivalents
- Recognise the per cent symbol (%) and understand that per cent relates to ‘number Of parts per hundred’, and write percentages as a fraction with denominator 100, And as a decimal

At the Core, Step pupils can

- Identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places
- Multiply one-digit numbers with up to two decimal places by whole numbers
- Use written division methods in cases where the answer has up to two decimal places
- Solve problems which require answers to be rounded to specified degrees of accuracy
- Compare and order fractions, including fractions > 1
- Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- Multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, divide proper fractions by whole numbers [for example,
- Associate a fraction with division and calculate decimal fraction equivalents [forexample, 0.375] for a simple fraction [for example, recall and use equivalences between simple fractions, decimals and percentages, including in different contexts.
- Recognise the relationship between fractions, decimals and percentages and can express them as equivalent quantities (e.g. One piece of cake that has been cut into 5 equal slices can be expressed as a fifth or 0.2 or 20% of the whole cake).
- Can calculate using fractions, decimals or percentages both as numbers and operators
- Use ratio notation, including a reduction to the simplest form
- Relate the language of ratios and the associated calculations to the arithmetic of fractions
- Divide a given quantity into two parts in a given part: part ratio; express the division of a quantity into two parts as a ratio

At the Depth Step, pupils can

- Round numbers and measures to different degrees of accuracy, for example to the nearest whole number or one decimal place
- Use the four operations, including formal written methods, applied to integers and decimals, all both positive and negative
- Understanding numbers in contextual calculations
- Round numbers and measures to an appropriate degree of accuracy, for example to the nearest whole number or one decimal place
- Use approximation, through rounding to the nearest whole number or to one decimal place, to estimate answers
- Define percentage as ‘number of parts per hundred, and know their decimal and fraction equivalents
- Multiply proper and improper fractions and mixed numbers
- Work interchangeably with terminating decimals and their corresponding fractions(such as 3.5 and 7/2 or 0.375 and 3/8)
- Understand that a multiplicative relationship between two quantities can be
- Expressed as a ratio or a fraction
- Solve problems involving direct proportion
- Use compound units such as unit pricing to solve problems steps
- Understand and use the concepts and vocabulary of expressions, equations,
- Inequalities, terms and factors.

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Algebra, pupils should be able to:

At the Core/Support Step, pupils can

- Make and use word formulas by modelling real-world situations or procedures.
- Generate terms of a sequence from a term-to-term or a position-to-term rule and begin to generalise their results in word

- Substitute positive whole numbers into word formulas to find the value of the
- Subject.
- Use and interpret algebraic notation including ab in place of a x b, 3y in place of 3 x y
- Substitute numerical values into simple algebraic formulas that model real world
- Situations or procedures.
- Simplify expressions by collecting like terms.
- Continue simple sequences and can explain how to find the next term.
- Find missing numbers in a number sequence
- Generate terms of a sequence from a term-to-term rule including practical examples such as matchstick patterns
- Begin to investigate linear sequences when the nth term is given

At the Core, Step pupils can

- Use simple function machines to deal with inputs and outputs, recognising basic inverse functions.
- Use interpret algebraic notation, including ab, 3y in place of y + y + y, a^2 in place of a x a, a^3 in place of a x a x a, a^2b in place of a x a x b, $\frac{x}{y}$
- Instead of x ÷ y, coefficients are written as fractions rather than decimals
- Model situations or procedures by translating them into simple algebraic formulas.
- Understand and solve problems involving the exchange rate
- Understand and solve problems involving unit costs
- Set up and solve one-step equations with integer coefficients.

At the Depth Step, pupils can

- Create and solve two-step equations that model real-world situations or procedures.
- Simplify and manipulate expressions to maintain equivalence by multiplying a single term over a bracket and taking out common factors
- Rearrange simple formulae to change the subject
- Find the position to term formula for given linear sequences and for linear sequences that arise from modelling real-world situations.
- Investigate and recognise special sequences such as triangular numbers, square
- Numbers and Fibonacci numbers.
- Use the rules of indices for positive whole number powers.
- Model and interpret real-life situations or procedures graphically.
- Plot graphs of linear functions

With regards to Geometry and Measure, students should be able to:

At all steps

- Use the standard conventions for labelling the sides and angles of triangle ABC
- Draw and measure line segments and angles in geometric figures, including
- Interpreting scale drawings
- Recognise and describe simple 3–D shapes, including using nets and other 2–D representations [G3]
- Complete simple shapes using given lengths, such as 7.5cm, (accurate to +/-2 mm) and acute angles that are multiples of 5° (accurate to +/– 2°) [G3]

- Describe, sketch and draw points, lines, parallel lines, perpendicular lines, and right angles.
- Use conventional terms and notations, such as using 'dashes' to indicate equal lengths and (multiple) arrows to indicate parallel lines
- Derive and illustrate properties of circles

At the Core/Support Step, pupils can

- Read, write and convert time between analogue (including clock faces using Roman numerals) and digital 12 and 24– hour clocks, using a.m. And p.m. Where necessary [M4]
- Calculate the duration of an event using appropriate units of time (e.g. A film starts at 6:45 p.m. And finishes at 8:05 p.m. How long did it last?) [M4]
- Convert between 'adjacent' metric units of measure for length, capacity and mass (e.g. 1.2 kg = 1200 g; how many 200 ml cups can be filled from a 2-litre bottle?; write 605 cm in metres) [M5]
- Find the perimeter of compound shapes when all side lengths are known or can be easily determined (e.g. A simple shape made from two identical rectangles joined together to make an L-shape with given dimensions of the rectangle) [M7]
- Calculate and compare the area of squares and rectangles including using standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes by counting squares [M7]
- Compare and classify 3–D and 2–D shapes based on their properties (e.g. For 2–D shapes: parallel sides, length of sides, type and size of angles [G4], reflective symmetry [G2], regular/irregular polygons [G2]; for 3–D shapes: faces, vertices and edges) [G2]

- Compare and classify geometric shapes based on their properties and sizes [g2a]
- Draw 2-D shapes using given dimensions and angles [g3a]
- Describe and build simple 3-D shapes, including making nets [g3b]
- Find unknown angles in any triangles, quadrilaterals, and regular polygons [g4a]
- know and use the facts that angles at a point sum to 360°, angles at a point on a straight-line sum to 180° and angles in a triangle sum to 180°
- Calculate the base angles of an isosceles triangle where the other angle is 110°) and identify other multiples of 90°[G4]
- Identify, describe; and represent the position of a shape following a reflection or translation, using the appropriate language and knowing that the shape has not been changed. [P2]
- Describe positions on a 2–D coordinate grid using axes with equal scales in the first quadrant (in the context of number or geometry) and use co-ordinates to complete a given rectangle; become more confident in plotting points in all four quadrants [P3]

At the Core Step, 2 pupils can

- Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places [M5]
- Convert between miles and kilometres [M6]
- Recognise that shapes with the same areas can have different perimeters and vice versa [M7]
- Recognise when it is possible to use formulae for area and volume of shapes [M7]
- Calculate the area of parallelograms and triangles [M7]
- Calculate, estimate and compare the volume of cubes and cuboids using standard units, including cubic centimetres (cm3) and cubic metres (m3), and extending to other units (for example, mm3 and km3) [M8]
- Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places [M9]

At the Depth Step, pupils can

- Draw and measure line segments and angles in geometric figures; calculate lengths
- Represented by line segments in scale drawings given scale factors as ratios in form 1: n, and understand that the lengths are approximate

- Derive and apply formulae to undertake calculations and solve problems involving perimeter and area of rectangles
- Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles [g4b]
- Apply the properties of angles at a point, angles at a point on a straight line,
- Vertically opposite angles illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius [G5]
- Draw and translate simple shapes on the coordinate plane, and reflect them in the axes [P2]
- Describe positions on the full coordinate grid (all four quadrants) [P3]

- Derive and apply formulae to undertake calculations and solve problems involving: the perimeter and area of triangles, parallelograms, trapezia, and the volume of cuboids (including cubes)
- Classify quadrilaterals by their geometric properties, and provide convincing arguments to support classification decisions
- Construct similar shapes by enlargement, with and without coordinate grids
- Use the properties of faces, surfaces, edges and vertices of cubes and cuboids to solve problems in 3-d
- Derive and use the sum of angles in a triangle
- Undertake calculations and solve problems involving: perimeters of 2-d shapes (including circles), areas of circles and composite shapes
- Draw, sketch and describe regular polygons, and other polygons that are reflectively and rotationally symmetric; derive and illustrate properties [for example, equal lengths and angles] of triangles, quadrilaterals, and other plane figures using appropriate language and technologies
  Apply translations, rotations and reflections to given figures, and identify examples of translations, rotations and reflections (for example, be able to pick out from a group of shapes those that are translations, rotations or reflections of a given shape)
-

With regards to Statistics, students should be able to:

At the Core/Support Step pupils can:

At the Depth Step pupils can:

- Complete, read and interpret information presented in tables, pictograms and bar charts (e.g. Find the difference between two bars showing temperatures, where one is 20°c and the other is 13°c, on a scale labelled in multiples of 5) [s1]
- Interpret line graphs (e.g. Begin to find the difference between two temperatures on a line graph, where one is 20°c and the other is 13°c, on a scale labelled in multiples of 5) and simple pie charts (e.g. A pie chart cut into eight pieces for favourite fruit
- Using whole numbers for each section) [s1]
- Plot and interpret scatter diagrams - describe mathematical relations between the two variables in simple words.
- Calculate the mean as an average for simple sets of discrete data (e.g. Find the mean mass of three parcels weighing 5 kg, 3 kg and 10 kg) [s3]
- Summarise data using the mean, and mode as "representative or typical" values and the range as a measure of spread.

At the Core Step pupils can:

- Interpret and construct pie charts and line graphs and use them to solve problems [S1]
- Calculate the mean and interpret the mean as an average [S3]
- Calculate the range and interpret the range as a measure of spread
- Describe, interpret and compare two simple datasets of a single variable through appropriate graphical representations, and by considering the mean or median or mode and range of the datasets.
- Plot and interpret scatter diagrams - describe mathematical relations between the two variables in less obvious cases.
- *Describe, interpret and compare* observed distributions of a single variable through:
    - Appropriate graphical representation involving discrete, ungrouped data; and
    - Appropriate measures of central tendency (mean, mode, median) and spread (range)
- Construct and interpret frequency tables, bar charts, pie charts, and stem and leaf diagrams for simple categorical data, and vertical line (or bar) charts for small sets of ungrouped numerical data and numerical data grouped into a small number of groups
- Recognise graphical misrepresentation through incorrect scales, labels etc.
- Plot and interpret scatter diagrams to recognize and use the language of correlation

With regards to Probability students should be able to:

At all stages:

- Emphasise the difference between being sure and probably sure about something happening.

At the Depth Step, pupils can

- Record and describe the frequency of outcomes of simple probability experiments; try to explain their findings using their ideas about

- Make sure everyone understands that probability is the study of the chances of something happening.
- Understand and test the idea of fairness.
- Emphasise that we study probability so that we can make predictions over the long term rather than predictions about individual events. Link this to the law of large numbers.
- Use experimental probabilities
- Emphasise 'gut reaction', experimental probability and theoretical probability.

At the Core/Support Step, pupils can

- Explain what is meant by a probability scale and position keywords on that scale to list all possible outcomes for two events such as choosing from a means nu investigate simple games

At the Core, Step Pupilscano

- Mark events and/or probabilities on a probability scale of 0 to 1
- Find and justify probabilities by considering equally likely outcomes for single events
- List all possible outcomes for three events such as from a menu
- Investigate more complicated games.

randomness and possible outcomes; make and explain their own merits about the fairness of situations; understand that the probability of an impossible event is 0, and of a certain event is 1, and begin to use the 0-1 probability scale.

- Use systematic listing strategies to list all possible outcomes for four events such as tossing four coins.
- Record outcomes of probability experiments in tables using a two-circle Venn diagram to calculate related probabilities.
- Enumerate sets systematically making use of tables and grids
- Investigate games

What **skills and knowledge** do students bring with them from **Year 8 into Year 9**?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Number, students should be able to:

- Understand and use place values 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 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, and 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, roots and reciprocals
- 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, and 5 and distinguish between exact representations of roots and their decimal approximations
- Interpret and compare numbers in standard form A x 10n 1≤A

With regards to Ratio and Proportion, students should be able to:

- Change freely between related standard units [for example time, length, area, volume/capacity, mass]
- Use scale factors, scale diagrams and maps
- Express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- Use ratio notation, including a reduction to the 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 and linear functions
- Solve problems involving percentage change, including percentage increase, decrease and original value problems and simple interest in financial mathematics
- Solve problems involving direct and inverse proportion, including graphical and algebraic representations
- Use compound units such as speed, unit pricing and density to solve problems.

With regards to Algebra, students should be able to:

- Use and interpret algebraic notation, including:
  - Ab in place of a × b
  - 3y in place of y + y + y and 3 × y
  - A^2 in place of a × a, a^3 in place of a × a × a; a^2 b in place of a × a × b
  - $\frac{a}{b}$ in place of a ÷ b

  - Coefficients are 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
  - Expanding products of two or more binomials
- Understand and use standard mathematical formulae; rearrange formulae to change the subject
- Model situations or procedures by translating them into algebraic expressions or formulae and by using graphs
- Use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)
- Work with coordinates in all four quadrants
- Recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the cartesian plane
- interpret mathematical relationships both algebraically and graphically mathematics – key stage 3 7
- Reduce a given linear equation in two variables to the standard form y = mx + c; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically
- Use Linear And Quadratic Graphs To Estimate Values Of Y For Given Values Of X And Vice Versa And To Find Approximate Solutions Of Simultaneous Linear Equations
- find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs
- 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
- recognise geometric sequences and appreciate other sequences that arise.

With regards to Geometry and Measure, students should be able to:

- Derive and apply formulae to calculate and solve problems involving: the perimeter and area of triangles, parallelograms, trapezia, the volume of cuboids (including cubes) and other prisms (including cylinders)
- Calculate and solve problems involving: perimeters of 2-d shapes (including circles), areas of circles and composite shapes
- Draw and measure line segments and angles in geometric figures, including interpreting scale drawings

- Derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line
- Describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric
- Use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles
- Derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies
- Identify properties of, and describe the results of, translations, rotations and reflections applied to given figures
- Identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids
- 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
- Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' theorem, and use known results to obtain simple proofs
- Use Pythagoras' theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles
- 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 and geometrically.

With regards to Statistics, students should be able to:

- Describe, interpret and compare observed distributions of a single variable through appropriate graphical representation involving discrete, continuous 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
- Describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs.

With regards to Probability students should be able to:

- Record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, and equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale
- Understand that the probabilities of all possible outcomes sum to 1
- Enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams
- Generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities.

What **skills and knowledge** do students bring with them from **Year 9 into Year 10**?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Number, students should be able to:

- Estimate powers and roots of any given positive number
- Calculate with roots, and with integer and fractional indices
- Calculate with numbers in standard form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer
- Change recurring decimals into their corresponding fractions and vice versa
- Identify and work with fractions in ratio problems

With regards to Ratio and Proportion, students should be able to:

- Compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)
- Convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
- Understand that x is inversely proportional to y is equivalent to x is proportional to 1 y; construct and interpret equations that describe direct and inverse proportion
- interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion

With regards to Probability students should be able to:

- Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one
- Use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with an increasing sample size

With regards to Algebra, students should be able to:

- Simplify and manipulate algebraic expressions including those involving surds and algebraic fractions by:
  - factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares
  - Simplifying expressions involving sums, products and powers, including the laws of indices
- Know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent and use algebra to support and construct arguments and proofs
- Where appropriate, interpret simple expressions as functions with inputs and outputs; interpret the reverse process as the 'inverse function';
- Use the form $y = mx + c$ to identify parallel and perpendicular lines; find the equation of the line through two given points, or through one point with a given gradient
- Solve quadratic equations including those that require rearrangement algebraically by factorising, by
- Solve two simultaneous equations in two variables (linear/linear algebraically;
- Translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution
- Deduce expressions to calculate the nth term of linear and quadratic sequences.

With regards to Geometry and Measure, students should be able to:

- Describe the changes and invariance achieved by combinations of rotations, reflections and translations
- Identify and apply circle definitions and properties, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment

- Construct and interpret plans and elevations of 3d shapes
- Interpret and use bearings
- Apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures
- Apply Pythagoras' theorem and trigonometric ratios to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three-dimensional figures

With regards to Statistics, students should be able to:

- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- Interpret and construct tables and line graphs for time series data
- Construct and interpret diagrams for grouped discrete data and continuous data, i.e. Histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use

What **skills and knowledge** do students bring with them from **Year 10 into Year 11**?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Number, students should be able to:

- Apply systematic listing strategies, including the use of the product rule for counting
- Calculate exactly with fractions, surds and multiples of π; simplify surd expressions involving squares [for example 12 4 3 4 3 2 3 = ×= × = ×] and rationalise denominators
- Change recurring decimals into their corresponding fractions and vice versa
- Identify and work with fractions in ratio problems
- Apply and interpret limits of accuracy when rounding or truncating, including upper and lower bounds.

With regards to Ratio and Proportion, students should be able to:

- Understand that x is inversely proportional to y is equivalent proportional to the $\frac{1}{Y}$; construct and interpret equations that describe direct and inverse proportion
- Interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion

With regards to Algebra, students should be able to:

- Simplify and manipulate algebraic expressions including those involving surds and algebraic fractions by:
    - factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares; factorising quadratic expressions of the form $ax^2 + bx + c$
    - Simplifying expressions involving sums, products and powers, including the laws of indices

- Use the form $y = mx + c$ to identify parallel and perpendicular lines; find the equation of the line through two given points, or through one point with a given gradient
- Identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically and turning points by completing the square
- Solve quadratic equations including those that require rearrangement algebraically by factorising, by completing the square and by using the quadratic formula; find approximate solutions using a graph
- Solve two simultaneous equations in two variables (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph
- Solve linear inequalities in one or two variables, and quadratic inequalities in one variable; represent the solution set on a number line, using set notation and on a graph
- Recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r n where n is an integer, and r is a positive rational number or a surd) and other sequences
- Deduce expressions to calculate the nth term of linear and quadratic sequences.

With regards to Geometry and Measure, students should be able to:

- Interpret and use fractional and negative scale factors for enlargements
- Identify and apply circle definitions and properties, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- Construct and interpret plans and elevations of 3d shapes
- Interpret and use bearings
- Calculate arc lengths, angles and areas of sectors of circles
- Calculate surface areas and volumes of spheres, pyramids, cones and composite solids
- Apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures
- Apply Pythagoras' theorem and trigonometric ratios to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three-dimensional figures
- Describe translations as 2d vectors
- Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; use vectors to construct geometric arguments and proofs.

With regards to Statistics, students should be able to:

- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- Interpret and construct tables and line graphs for time series data
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
    - Appropriate graphical representation involving discrete, continuous and grouped data, including box plots
- Apply statistics to describe a population
- Use and interpret scatter graphs of bivariate data; recognise the correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.

With regards to Probability students should be able to:

- Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one
- Use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with an increasing sample size
- Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions

What **skills and knowledge** do students bring with them from **Year 11 into Year 12**?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Number, students should be able to:

- Apply systematic listing strategies, including the use of the product rule for counting
- Estimate powers and roots of any given positive number
- Calculate with roots, and with integer and fractional indices
- Calculate exactly with fractions, surds and multiples of π; simplify surd expressions involving squares [for example 12 4 3 4 3 2 3 = ×= × = ×] and rationalise denominators
- Calculate with numbers in standard form $a \times 10^n$, where 1 ≤ a < 10 and n is an integer
- Change recurring decimals into their corresponding fractions and vice versa
- Identify and work with fractions in ratio problems
- Apply and interpret limits of accuracy when rounding or truncating, including upper and lower bounds.

With regards to Ratio and Proportion, students should be able to:

- Compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)
- Convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
- Understand that x is inversely proportional to y is equivalent to x is proportional to 1 y; construct and interpret equations that describe direct and inverse proportion
- interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion
- interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of an instantaneous and average rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts
- Set Up, Solve And Interpret The Answers In Growth And Decay Problems, Including Compound Interest And Work With General Iterative Processes.

With regards to Algebra, students should be able to:

- Simplify and manipulate algebraic expressions including those involving surds and algebraic fractions by:
  - factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares; factorising quadratic expressions of the form $ax^2 + bx + c$
  - Simplifying expressions involving sums, products and powers, including the laws of indices
- Know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent and use algebra to support and construct arguments and proofs

- Where appropriate, interpret simple expressions as functions with inputs and outputs; interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function'
- Use the form $y = mx + c$ to identify parallel and perpendicular lines; find the equation of the line through two given points, or through one point with a given gradient
- Identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically and turning points by completing the square
- Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, and the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$, the exponential function $y = k^x$ **f**or positive values of k, and the trigonometric functions (with arguments in degrees), $y = tanx$, $y = sinx$, $y = cosx$ for angles of any size
- sketch translations and reflections of the graph of a given function
- Plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts
- recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point
- Solve quadratic equations including those that require rearrangement algebraically by factorising, by completing the square and by using the quadratic formula; find approximate solutions using a graph
- Solve two simultaneous equations in two variables (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph
- Find approximate solutions to equations numerically using iteration
- Translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution
- Solve linear inequalities in one or two variables, and quadratic inequalities in one variable; represent the solution set on a number line, using set notation and on a graph
- Recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r n where n is an integer, and r is a positive rational number or a surd) and other sequences
- Deduce expressions to calculate the nth term of linear and quadratic sequences.

With regards to Geometry and Measure, students should be able to:

- Interpret and use fractional and negative scale factors for enlargements
- Describe the changes and invariance achieved by combinations of rotations, reflections and translations

- Identify and apply circle definitions and properties, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- Apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results
- Construct and interpret plans and elevations of 3d shapes
- Interpret and use bearings
- Calculate arc lengths, angles and areas of sectors of circles
- Calculate surface areas and volumes of spheres, pyramids, cones and composite solids
- Apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures
- Apply Pythagoras' theorem and trigonometric ratios to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three-dimensional figures
- Know the exact values of tanθ, sin θ and cos θ for θ = 0°, 30° 45°, 60° and 90°
- Know and apply the sine rule, $\frac{a}{SinA} = \frac{b}{SinB} = \frac{c}{SinC}$ **,** and cosine rule**,** $a^2 = b^2 + c^2 - 2bcCosA$, to find unknown lengths and angles
- Know and apply to calculate the area, sides or angles of any triangle
- Describe translations as 2d vectors
- Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; use vectors to construct geometric arguments and proofs.

With regards to Statistics, students should be able to:

- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- Interpret and construct tables and line graphs for time series data
- Construct and interpret diagrams for grouped discrete data and continuous data, i.e. Histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
    - Appropriate graphical representation involving discrete, continuous and grouped data, including box plots
    - Appropriate measures of central tendency (including modal class) and spread including quartiles and inter-quartile range
- Apply statistics to describe a population

- Use and interpret scatter graphs of bivariate data; recognise the correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.

With regards to Probability students should be able to:

- Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one
- Use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with an increasing sample size
- Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions
- Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams.

What **skills and knowledge** do students bring with them from **Year 12 into Year 13**?

The skills and knowledge students will bring with them will be based on the Edexcel scheme of work, where the applied modules currently followed are statistics and mechanics.
In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

With regards to Pure, students should be able to:

- Sketch the graph and find the turning point of a quadratic function
- Find and interpret the discriminant of a quadratic expression
- Use and apply models that involve quadratic functions
- Interpret inequalities graphically
- Represent linear and quadratic inequalities graphically
- Transform graphs of unfamiliar functions
- Solve length and area problems on coordinate grids
- Use straight lines to construct Mathematical models
- Solve geometric problems involving lines and circles
- Find the angle in a semi-circle involving circles and triangles
- Cancel factors in algebraic fractions
- Divide a polynomial by a linear expression
- Use the factor theorem to factorise a cubic expression
- Construct mathematical proofs using algebra
- Use proof by exhaustion and disproof by counter-example
- Use Pascal's triangle to identify binomial coefficient! to expand simple binomial expressions
- Use combinations and factorial notation
- Use the binomial expansion to expand brackets

- Find individual coefficients in a binomial expansion
- Make approximations using the binomial expansion
- Sketch simple transformations of trigonometric graphs
- Calculate the sine, cosine and tangent of any angle
- Know the exact trigonometric ratios for 30°, 45° and 60°

w and use the relationships tan θ =$\frac{sin\theta}{cos\theta}$ and $sin\theta^2 + cos\theta^2 = 1$

- Solve simple trigonometric equations o the forms $sin\theta = k$, $cos\theta = k$ and $tan\,\theta = k$
- Solve more complicated trigonometric equations of the
- Form sin $\theta = k$ and $sin\,(\theta \pm a) = k$ and equivalent equations involving cos and tan
- Solve trigonometric equations that produce quadratics
- Calculate the magnitude and direction of a vector
- Understand and use position vectors

- Find the derivative, f'(x) or $\frac{dy}{dx}$ of a simple function
- Use the derivative to solve problems involving gradients, tangents and normals
- Identify increasing and decreasing functions
- Find the second-order derivative, f''(x) or $\frac{d2y}{dx2}$ of a simple function

- Find y given $\frac{dy}{dx}$ for x^n
- Integrate polynomials
- Find f(x), given f ‘(x) and a point on the curve
- Evaluate a definite integral
- Find the area bounded by a curve and the y-axis

- Find stationary points of functions and determine their nature
- Sketch the gradient function of a given function
- Model real-life situations with differentiation

- Find areas bounded by curves and straight lines
- Sketch graphs of the form $y = a^x$, $y = e^x$ and transformations of these graphs
- Differentiate e^{Av} and understand why this result is important
- Use and interpret models that use exponential functions
- Recognise the relationship between exponents and logarithms
- Recall and apply the laws of logarithms
- Solve equations of the form $a^x = b$
- Describe and use the natural logarithm function -»
- Use logarithms to estimate the values of constants in non-linear models

With regards to Statistics, students should be able to:

- Understand 'population', 'sample' and 'census', and comment on the advantages and disadvantages of each
- Understand the advantages and disadvantages of simple random sampling, systematic sampling, stratified sampling, quota sampling and opportunity sampling
- Define qualitative, quantitative, discrete and continuous data, and understand grouped data

- Draw and interpret scatter diagrams for bivariate data
- Interpret correlation and understand that it does not imply causation
- Interpret the coefficients of a regression line equation for bivariate data
- Understand when you can use a regression line to make predictions
- Calculate probabilities for single events
- Draw and interpret Venn diagrams

- Understand the large data set and how to collect data from it, identify types of data and calculate simple statistics
- Calculate measures of central tendency such as the mean, median and mode
- Calculate measures of location such as percentiles and deciles
- Calculate measures of spread such as range, interquartile range and inter-percentile range
- Calculate the variance and standard deviation
- Understand and use coding
- Identify outliers in data sets
- Draw and interpret box plots
- Draw and interpret cumulative frequency diagrams
- Draw and interpret histograms
- Compare two data sets
- Understand mutually exclusive and independent events, and determine whether two events are independent
- Use and understand tree diagrams
- Understand and use simple discrete probability distributions including the discrete uniform distribution
- Understand the binomial distribution as a model and comment on the appropriateness
- Calculate individual probabilities for the binomial distribution
- Calculate cumulative probabilities for the binomial distribution
- Understand the language and concept of hypothesis testing
- Understand that a sample is used to make an inference about a population
- Find critical values of a binomial distribution using tables
- Carry out a one-tailed test for the proportion of the binomial distribution and interpret the results
- Carry out a two-tailed test for the proportion of the binomial distribution and interpret the results

With regards to Mechanics, students should be able to:

- Understand how the concept of a mathematical model applies to mechanics
- Understand and be able to apply some of the common assumptions used in mechanical models
- Know SI units for quantities and derived quantities used in mechanic
- Know the difference between scalar and vector quantities
- Draw force diagrams and calculate resultant forces Understand and use Newton's first law
- Calculate resultant forces by adding vectors
- Understand and use Newton's second law, F=ma
- Apply Newton's second law to vector forces and acceleration
- Understand and use Newton’s third law

- Understand and interpret displacement-time graphs
- Understand and interpret velocity-time
- Derive the constant acceleration formulae and use them to solve problems
- Use the constant acceleration formulae to solve problems involving vertical motion under gravity
- Solve problems involving connected particles
- Understand that displacement, velocity and acceleration may be given as functions of time
- Use differentiation to solve kinematics problems
- Use calculus to solve problems involving maxima and minima
- Use integration to solve kinematics problems
- Use calculus to derive constant acceleration formulae

What will students **study** and **when?**

	Half Term 1	**Half Term 2**	**Half Term 3**	**Half Term 4**	**Half Term 5**	**Half Term 6**

Year 7	**Units:** Analysing Data Number Skills **What prior learning is being revisited?** Students will revisit their work reading data from KS2. Students will also work on fractions, knowledge explored in years 4,5 and 6. Students' knowledge of recognising 2d shapes and angle classifications. **How will learning from these units be developed?** Summarising data is developed further through the use of tables in year 8. Students will also develop further skills to summarise data in KS4. Students will continue to work on transformations in year 8 and further into KS4 Where the concept of negative scale factors will be introduced. The work on fractions will lay the foundation for some algebraic manipulations in years 9 and 10. Students will continue to revisit angles throughout KS4 culminating in exploring circle theorems for those who study the higher content at GCSE.	**Units:** Expressions Functions and Formulae Decimals and Measures **What prior learning is being revisited?** Students will revisit the algebraic skills that they developed by the end of key stage 2, including using simple formulae. Students will have covered work on performing calculations in KS2. Some students may have come across work on patterns before. **How will learning from these units be developed?** Finding the nth term of a sequence, linear and quadratic will be explored in KS4. Sequences are also further developed in KS5, where we can relate growth and decay. Working with numbers will be developed further where students will also explore converting very large and small values into standard form in year 9.	**Units:** Fractions, Decimals and Percentages Probability **What prior learning is being revisited?** Students will revisit their work on the percentages, decimals and fractions from KS2. The knowledge of basic conversions will be revisited. **How will learning from these units be developed?** Percentage change will be developed further in year 8, where students will further consider whom to utilise percentage increase and decrease.	**Units:** Ratio and Proportion **What prior learning is being revisited?** Students will revisit their work on the percentages, decimals and fractions from KS2. The knowledge of basic conversions will be revisited. **How will learning from these units be developed?** **Skills developed in** Percentage change will be developed further in year 8, where students will further consider who to utilise percentage increase and decrease.	**Units:** Lines and Angles Sequences and Graphs **What prior learning is being revisited?** Students will revisit the algebraic skills that they developed by the end of key stage 2, including using simple formulae. **How will learning from these units be developed?** Work covered in this unit will lay the foundation for the algebraic manipulation skills, developed in years 8, KS4 and KS5. In year 8, students will explore solving equations involving fractions. Probability scales will also be revisited in year 8.	**Units:** Transformations **What prior learning is being revisited?** Students will revisit knowledge from KS2 where they were required to use, read, write and convert between standard units, converting measurements of length, mass, volume and time **How will learning from these units be developed?** Speed distance time graphs will be explored further in year 8. This concept of measure will also be developed when students encounter pressure and density.
	Half Term 1	**Half Term 2**	**Half Term 3**	**Half Term 4**	**Half Term 5**	**Half Term 6**

Year 8	**Units:** Number Skills Area and Volume **What prior learning is being revisited?** At the start of the term, students will be revisiting the work on calculations with a number. This will include the four operations, with integers and decimals. Students will also revisit their knowledge of the order of operations with increasingly complex problems. **How will learning from these units be developed?** Students will develop their understanding of the order of operations so that this can now be applied involving algebra and in abstract contexts.	**Units:** Statistics, graphs and charts Expression and Equations **What prior learning is being revisited?** Students will reexamine their knowledge of sequences from year 7, where the nth term will now be expounded upon. Further exploration of the shape and angles **How will learning from these units be developed?** Forming equations based on sequences and using this to determine whether a term belongs to a sequence will be explored in year 9.	**Units:** Real life graphs Decimals and Ratio **What prior learning is being revisited?** In term 2, students will revisit the use of the four averages, explored in year 7. Knowledge of data will also be built upon from KS2. **How will learning from these units be developed?** In year 9, causal relationships in statistics will start to be explored more. Students will also develop new ways of comparing and displaying data.	**Units:** Lines and Angles Calculating with fractions **What prior learning is being revisited?** Building upon the knowledge at the end of key stage 2 as well as the unit in year 7, students will revisit skills in manipulating algebraic terms and converting values between fractions, percentages and decimals. **How will learning from these units be developed?** Percentage change will be developed further in KS4, where students will explore repeated percentage change, reverse percentages and simple and compound interest.	**Units:** Straight line graphs **What prior learning is being revisited?** Students will revisit the units of transformation and measure from year 7. Students will reexamine the topics of rotation, reflection, translation and enlargement. **How will learning from these units be developed?** In year 9 students will explore negative scale factors. In years 10 and 11, students will use these skills to explore similarity and congruency.	**Units:** Percentages decimals and fractions **What prior learning is being revisited?** Probabilities scales will be revisited from year 7, where students will be able to link numbers to phrases of increased certainty. **How will learning from these units be developed?** In year 9, students will explore sharing amounts by a ratio. Students will also develop their understanding of proportion and algebra in KS4. In year 11, students will explore variation at a higher level.

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 9	**Units:** Indices Standard form Expressions and Formulae **What prior learning is being revisited?** Students will further develop their understanding of algebraic terms from completed in year 7. Index laws will also be revised. Students will be revisiting ordinary large numbers from work in year 7. **How will learning from these units be developed?** Fractional and negative indices will be explored in year 10. Forming equations from sequences to determine if a number is in the sequence will also come up in year 10 as well as quadratic	**Units:** Dealing with Data Multiplicative Reasoning **What prior learning is being revisited?** Work covered in year 7 on analysing and displaying data and will encounter qualitative and quantitative data again. **How will learning from these units be developed?** In year 10, students will be able to apply the skills to processing and representing data. Students will also revisit compound measures and direct and inverse proportion in year 10 linking this to algebraic techniques of forming and solving equations. Students will also revisit the data skills in year 10, where they will be expected to represent collected data.	**Units:** Constructions Sequences Inequalities and Equations **What prior learning is being revisited?** During the year, students ill have studied angles in triangles and on a straight line. This will include drawing triangles accurately. Sequences will have also been explored in year 7 along with equations. **How will learning from these units be developed?** Students will utilise this work again by expanding and factorising quadratics as well as simplifying algebraic fractions. For students following the higher strand, there will be opportunities to explore quadratic sequences in year 11.	**Units:** Circles Pythagoras Prisms **What prior learning is being revisited?** Students will have utilized averages in years 7 and 8. Putting numbers in order and finding the sum and quotient. Work on the percentage of amounts will also be revised from year 8. **How will learning from these units be developed?** Skills developed in compound interest will be revisited in years 10 and 11. Students will also come across more complicated linear equations in year 10. The process of rearranging formulae will also be revisited.	**Units:** Graphs Probability **What prior learning is being revisited?** In year 7 students will have completed introductory units to probability using the understanding which will be revisited here. Work on graphs from year 7 and year 8 will also be built upon in this unit. **How will learning from these units be developed?** The understanding of probability built within this unit will be further explored in year 10 when students study tree diagrams. Students will also be revisiting straight-l e and different graph types in year 11.	**Units:** Comparing Shapes **What prior learning is being revisited?** Understanding of transformations, specifically, similarity and enlargement will be explored in this unit along with the knowledge developed in the line and angles unit in year 7. **How will learning from these units be developed?** 3D Trigonometry and Pythagoras as well as exact Trig values will rely on the knowledge of these units.

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 10 Foundation	**Units:** Indices Standard Form Area Perimeter Volume **What prior learning is being revisited?** Index laws will also be revised. Students will be revisiting ordinary large numbers from work in years 8 and 9. Knowledge of area and perimeter has been explored in year 9. **How will learning from these units be developed?** Forming expressions will be revisited with the work on sequences in half term 4. Fractional and negative indices will be explored in year 11. The volume will be revisited in year 11 involving cylinders, pyramids and cones.	**Units:** Trigonometry Pythagoras Processing and Representing Data **What prior learning is being revisited?** Work on triangles will have been explored in year 9. Students will also have a grasp of different methods to process and display data. **How will learning from these units be developed?** Determining when to use Pythagoras instead of Trigonometry. 3D Trigonometry and Pythagoras as well as exact Trig values will rely on the knowledge of these units.	**Units:** Ratio and Proportion Graphing **What prior learning is being revisited?** Students will revisit the idea of proportion from KS3 as well as work covered in year 9. They will also be reexamining work on straight-line graphs. **How will learning from these units be developed?** Students will continue to develop skills to plot different functions. They will also further develop their understanding of ratio in an exam context in year 11.	**Units:** Quadratic expression and Equations Simultaneous Equations Probability **What prior learning is being revisited?** Prior knowledge of factors, expansion, factorising and solving equations will be necessary for this unit. Work on solving linear equations from year 9 will also be utilised. **How will learning from these units be developed?** The probability content will be developed in half term 5 as well as in year 11 as students develop their understanding of tree and Venn diagrams. Quadratic simultaneous equations could be explored for students who are considering taking the higher paper in year 11.	**Units:** Probability Transformations **What prior learning is being revisited?** Students will revisit the skills of rotation, reflection, translation and enlargement. **How will learning from these units be developed?** Negative scale factors for enlargement will be covered in year 11. Students will also utilise these same skills in similarity.	**Units:** Inequalities Equations Straight line graphs **What prior learning is being revisited?** Knowledge of collecting like terms, inequality symbols as well as plotting coordinates will be revisited from years 7,8 and 9. **How will learning from these units be developed?** Students will continue to develop their knowledge of inequalities and solving equations in worded questions and exam contexts in year 11.

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 10 Higher	**Units:** Ratio and Proportion Processing and Representing **What prior learning is being revisited?** Students will revisit the idea of proportion from KS3 as well as work covered in year 9. Students will also have a grasp of different methods to process and display data. **How will learning from these units be developed?** Students will also revisit the data skills in year 11, where they will be expected to represent collected data. They will also further develop their understanding of ratio in an exam context in year 11.	**Units:** Graphing Quadratic Equations Simultaneous Equations **What prior learning is being revisited?** They will also be reexamining work on straight-line graphs. Prior knowledge of factors, expansion, factorising and solving equations will be necessary for this unit. Work on solving linear equations from year 9 will also be utilised. **How will learning from these units be developed?** In year 11, students will be able to apply the skills to algebraic fractions. Students will also revisit the data skills in year 10, where they will be expected to represent collected data. At A-Level – students will be required to solve quadratic simultaneous equations.	**Units:** Probability Transformations Congruence **What prior learning is being revisited?** Students will revisit the skills of rotation, reflection, translation and enlargement. Students will utilise their knowledge of enlargement and tesselation. **How will learning from these units be developed?** The probability content will be developed in half term 5 as well as in year 11 as students develop their understanding of tree and Venn diagrams. Congruency will also be revisited with further revision of transformations in year 11.	**Units:** Congruence Similarity Constructions **What prior learning is being revisited?** The use of the compass as a skill was introduced in year 7 and built upon in years 8 and 9. Students will also revisit their understanding of proportion from years 8 and 9. **How will learning from these units be developed?** Skills developed in compound interest will be revisited in years 10 and 11. Students will also come across more complicated linear equations in year 10. The process of rearranging formulae will also be revisited.	**Units:** Changing the subject Algebraic Fractions Vectors **What prior learning is being revisited?** Students will have an understanding of what translation means from the work covered in transformations in year 9 and a half term 3. Students will also be re-examining their knowledge of fractions. **How will learning from these units be developed?** Vectors and translations will be revisited in year 11. Students will also be utilising the skill of rearranging variables across multiple topics in year 11.	**Units:** Bounds Inequalities Trigonometry Pythagoras **What prior learning is being revisited?** Knowledge of rounding, solving equations, trigonometric ratios and Pythagoras will be revisited from years 9 and 8. **How will learning from these units be developed?** 3D Trigonometry and Pythagoras as well as exact Trig values will rely on the knowledge of these units. Graphing inequalities will also be required in year 12.

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 11 Foundation	**Units:** Congruency Rearranging formulae Proof Vectors **What prior learning is being revisited?** Identifying the variable and skills used to solve one-step and two-step equations will be utilised in this unit. Knowledge of translations and column addition will also be revisited. **How will learning from these units be developed?** Vectors, proof and rearranging formulae are revisited in year 12 for students who intend to do A-Level Maths. Intervention and revision sessions will also be used to revisit these units before the exams.	**Units:** Volume Constructions Angles Expansion and Factorising **What prior learning is being revisited?** Work covered in years 9 and 10 with angle facts, factors and multiples will be utilised here. Students will also need to recall key formulae from Key stage 3 in terms of the volume of prims. **How will learning from these units be developed?** Expansion and Factorising are revisited in year 12 for students who intend to do A-Level Maths. Intervention and revision sessions will also be used to revisit these units before the exams.	**Units:** Revised Scheme of work for each class based on Mock 2. **What prior learning is being revisited?** Based on the Question Level analysis for each paper provided by the HOD a shorter scheme of work of key topics is identified and delivered. This will be different for each class. **How will learning from these units be developed?** Using a range of resources, including Pixl strive for – key areas will form the focus for half terms 4 and 5.	**Units:** Intervention is based on the weaknesses identified in the full mock examination. Mock 3 **What prior learning is being revisited?** Based on the Question Level analysis for each paper provided by the HOD a shorter scheme of work of key topics is identified and delivered. This will be different for each class. **How will learning from these units be developed?** Use of Exam papers and other revision resources.	**Units:** **Intervention and revision** **What prior learning is being revisited?** Through the use of mixed exam questions, all learning so far will be revisited as teachers prepare students for the final examinations. **How will learning from these units be developed?**	**GCSE Examinations take place in May/June.** **Students who chose to continue their study of Mathematics at A-Level at Appleton School are given transition work packs to complete during this time.** **This will focus on key algebraic skills in grade 6 and above as well as trigonometry.**

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 11 Higher	**Units:** Circle Geometry Surds and Indices Quadratic formula **What prior learning is being revisited?** Knowledge of square and cube numbers developed in Key stage 3 is revisited here. Learning on quadratic equations is also reexamined from year 10. **How will learning from these units be developed?** Each of these units is revisited in year 12 for students who intend to do A-Level Maths. Intervention and revision sessions will also be used to revisit these units before the exams.	**Units:** Functions Iteration Completing the square Advanced Trigonometry **What prior learning is being revisited?** Revision of learning that took place in years 9 and 10 in algebra and geometry. **How will learning from these units be developed?** Each of these units is revisited in year 12 for students who intend to do A-Level Maths. Intervention and revision sessions will also be used to revisit these units before the exams.	**Units:** Revised Scheme of work for each class based on Mock 2. **What prior learning is being revisited?** Based on the Question Level analysis for each paper provided by the HOD a shorter scheme of work of key topics is identified and delivered. This will be different for each class. **How will learning from these units be developed?** Using a range of resources, including Pixl strive for – key areas will form the focus for half terms 4 and 5.	**Units:** Intervention is based on the weaknesses identified in the full mock examination. Mock 3 **What prior learning is being revisited?** Based on the Question Level analysis for each paper provided by the HOD a shorter scheme of work of key topics is identified and delivered. This will be different for each class. **How will learning from these units be developed?** Use of Exam papers and other revision resources.	**Units:** **Intervention and revision** **What prior learning is being revisited?** Through the use of mixed exam questions, all learning so far will be revisited as teachers prepare students for the final examinations. **How will learning from these units be developed?**	**GCSE Examinations take place in May/June.** **Students who chose to continue their study of Mathematics at A-Level at Appleton School are given transition work packs to complete during this time.** **This will focus on key algebraic skills in grade 6 and above as well as trigonometry.**

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 12	**Units:** Algebra and Functions Further Algebra Data Collection Modelling in Mechanics Constant Acceleration **What prior learning is being revisited?** Students will revisit algebra from the GCSE Higher course in year 11. **How will learning from these units be developed?** These topics will form the foundation for concepts taught in half term 2 onwards. Students will need algebraic manipulation skills to access differentiation and integration in half term 2. The constant acceleration formulae will also be used in half term 3 with forces and motion	**Units:** Differentiation Integration Measures of Spread Representation of Data Correlation **What prior learning is being revisited?** Students will revisit statistics from the GCSE Higher course in year 11. Algebraic skills revisited in half term 1 will also be employed. **How will learning from these units be developed?** Differentiation and Integration are revisited in the A-Level material. Correlation is also explored more in year 2.	**Units:** Vectors Coordinate Geometry Forces and Motion Probability Statistical Distributions **What prior learning is being revisited?** Students will revisit statistics from the GCSE Higher course in year 11. Content GCSE Physics will also crossover. **How will learning from these units be developed?** Students will utilise this work again by expanding and factorising quadratics as well as simplifying algebraic fractions. Volume and density questions in year 10 will also develop the skills used in measuring.	**Units:** Trigonometry Algebra Functions 2 Hypothesis Testing Kinematics 2 **What prior learning is being revisited?** Students will revisit advanced trigonometry from the GCSE Higher course in year 11. The algebra content will draw from skills developed in half terms 1 and 2 as well as GCSE Maths. **How will learning from these units be developed?** Hypothesis Testing will be revisited in the normal distribution, which will be taught in year 13.	**Units:** Algebra Functions 2 Exponentials and Logarithms Variable Acceleration **What prior learning is being revisited?** GCSE Physics will also crossover. Knowledge of differentiation and integration will be recalled in this unit. **How will learning from these units be developed?** The laws of logs and exponentials will be revisited in year 13. Students will need to be able to differentiate and integrate expressions involving logarithms.	**Units:** Differentiation Projectiles Functions **What prior learning is being revisited?** Knowledge of differentiation from half term 2 will be expounded upon in this unit. **How will learning from these units be developed?** Differentiation is linked heavily to integration which will be revisited in year 13, students should be able to access the integrals based on the inverse relationship.

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 13	**Units:** Integration Normal distribution Forces at any angle **What prior learning is being revisited?** Students will revisit both their knowledge of integration and differentiation from year 12. They will also revisit the knowledge of normal distribution from hypothesis testing. **How will learning from these units be developed?** Forces around any angle will be developed so that students to engage with more challenging questions in moments which will be taught next half term. Some of the integrals will also be revisited in Trigonometry in half term 4.	**Units:** Integration Proof Functions and Modelling Probability Moments **What prior learning is being revisited?** Students will revisit their GCSE knowledge of Proof as well as their algebraic techniques from year 12. Knowledge from the probability unit studied in year 12 will also be a prerequisite. **How will learning from these units be developed?** In year 11, students will be able to apply the skills to algebraic fractions. Students will also revisit the data skills in year 10, where they will be expected to represent collected data.	**Units:** Sequences and Series Binomial Theorem Trigonometry Correlation and Regression Variable acceleration 2 **What prior learning is being revisited?** Students will revisit the work they have done in sequences in Key stage 4. Knowledge from the AS unit on variable acceleration will also be developed further. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**Units:** Trigonometry **What prior learning is being revisited?** The year 12 unit on Trigonometry as well as the algebraic techniques from further algebra 2 will be revisited here. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**Units:** Parametric Equations Numerical Methods Vectors 3D **What prior learning is being revisited?** Vectors' work from GCSE and AS level units will be revisited here. the concept of Iteration from GCSE Maths will also be revisited here. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**A-Level Examinations take place in May/June.**

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 12 Further Mathematics	**Units:** Complex Numbers Argand Diagrams Series Algorithms and graph theory **What prior learning is being revisited?** complex numbers will revisit skills from GCSE Mathematics including Pythagoras and Trigonometry **How will learning from these units be developed?** Complex numbers will be revisited in Year 13. .	**Units:** Series Roots of Polynomials Algorithms and graph theory **What prior learning is being revisited?** Students will revisit their GCSE knowledge of Proof as well as their algebraic techniques from year 11 . **How will learning from these units be developed?** In year 11, students will be able to apply the skills to algebraic fractions. Students will also revisit the data skills in year 10, where they will be expected to represent collected data.	**Units:** Matrices Linear Programming **What prior learning is being revisited?** Students will revisit the work they have done in sequences in Key stage 4. Knowledge from GCSE Further Maths could be revisited for some students. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**Units:** Proof by Induction Vectors Linear programming **What prior learning is being revisited?** Knowledge of Vectors from GCSE Mathematics and Coordinate geometry will be revisited. Proof by Induction will revisit GCSE Proof concepts. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**Units:** Vectors Volumes of Revolution Complex Numbers 2 Linear programming **What prior learning is being revisited?** Vectors' work from GCSE and AS level units will be revisited here. The concept of Iteration from GCSE Maths will also be revisited here. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**Units:** Polar Coordinates Volumes of Revolution Critical path analysis **What prior learning is being revisited?** Knowledge of differentiation and integration from half term 2 will be expounded upon in this unit. **How will learning from these units be developed?** Differentiation is linked heavily to integration which will be revisited in year 13, students should be able to access the integrals based on the inverse relationship.

Year 13 Further	**Units:** Complex Numbers Polar Coordinates Hyperbolic Functions Geometric distributions **What prior learning is being revisited?** Students will revisit both their knowledge of integration and differentiation from year 12. Complex numbers and exponential functions will also be revisited. . **How will learning from these units be developed?** iStudents will apply the knowledge and skills in their revision for the examinations. Some content will be developed further at Degree level.	**Units:** Hyperbolic Functions Series 2 Geometric and negative binomial distributions **What prior learning is being revisited?** Students will revisit their A Level knowledge of Series as well as their algebraic techniques from year 12. Knowledge from the probability unit studied in year 12 will also be a prerequisite. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations. Some content will be developed further at Degree level.	**Units:** Further Calculus Hypothesis testing The Central Limit Theorem **What prior learning is being revisited?** Students will revisit the work they have done in AS Calculus as well as their Knowledge from the AS Further Maths Volumes of Revolution unit . **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations. Some content will be developed further at Degree level.	**Units:** Further Calculus Differential Equations Chi squared tests Probability generating functions **What prior learning is being revisited?** The year 13 unit on differentiation which focuses on differential equations as well as the algebraic techniques from further algebra 2 will be revisited here. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations. Some content will be developed further at Degree level.	**Units:** Differential Equations 2 Quality of tests **What prior learning is being revisited?** This unit is a culmination of work studied in A2 Statistics and Calculus from A2 Mathematics. **How will learning from these units be developed?** Students will apply the knowledge and skills in their revision for the examinations.	**A-Level Examinations take place in May/June.**

Why has learning been **sequenced** in this way?

Year	Term 1	Term 2	Term 3
7	**Descriptive statistics, calculations, expressions, Decimal measures** KS3 Mathematics follows a spiral curriculum where topics are revisited throughout a student's journey through to Key Stage 5. As the fundamental areas of mathematics, number, geometry and data, these topics have been chosen to follow from the key stage 2 curriculum. Students will need a firm grasp of these fundamentals to access topics not only, this year but into year 8 and beyond. Students need to utilise the basics of number manipulation, including the order of operations, to access fractions, decimals and percentages in term 2. The fundamentals of rounding will pervade through to exam questions at the end of key stage 4.	**Probability, Fractions, decimals, percentages, ratios and proportion** Students will be able to build on their understanding of simplifying fractions, factors multiples and primes and comparing fractions to develop their understanding of fractions and percentages and probability. Students will need an understanding of comparing fractions to access the sub-unit of calculating probability. The work completed in factors, multiples and primes will give students a good foundation when accessing simplifying fractions in term 2. The unit of probability will follow fractions and percentages and will provide students with the opportunities to make links with the work that they completed in working with fractions.	**Lines Angles, Sequences and Graphs, Transformations** The unit of Sequences being placed in term 3 will have benefited from the work on negative numbers and simplifying expressions will take place in terms 1 and 2. The unit of transformations will build on the ratio work completed in term 2 as well as the understanding of straight-line graphs.
8	**Area And Volume, Statistics Expressions And Equations** At the beginning of year 8, students will now revisit the topics taught in year 7 in increased complexity and detail. New units such as ratio and proportion will also be introduced in term 3. Having explored rounding to a specified number of decimal places in year 7, students will continue to now develop their understanding of significant figures and estimation. Students will also be able to draw on their understanding of the order of operations to approximate values effectively. Students will now also be able to interpret algebraic notation necessary for sequences based on the work covered in this unit in year 7.	**Real-Life Graphs Decimals And Ratio Lines And Angles** The topics In term 2 have been sequenced here to build on the skills and knowledge developed in year 7 as well as the first term of year 8. For example, when covering conversion graphs, students will be revisiting their knowledge from the year 1 unit of scales and measures as well as year 1 unit 9 coordinates and midpoints. The order of these units has been chosen carefully to ensure that students are revisiting topics and developing their understanding.	**Calculating Fractions Straight Line Graphs Consensus Is Decimals And Fractions** From the work covered in fractions, decimals and percentages, students will now have the prerequisite knowledge to access straight line graphs in further depth. This will build on students' ability to make comparisons, a skill that has been developed in different contexts in terms 1 and 2 or year 8. Students will also continue to use the Number work from Terms 1 and 2 to engage with Decimals and Fractions in term 3.

9	**Indices and Standard form, Data and Multiplicative Reasoning.** Year 9 continues to follow a spiral curriculum where topics are revisited multiple times in increasing complexity as a student progresses from Key stage 3 to Key stage 5. These units continue to be sequenced to deepen students' understanding throughout the KS3 curriculum. Indices and standard form will build on year 8 topics including calculating with mixed numbers, place value calculations and powers. The units on equations will rely on the work completed in years 7 and 8 in units such as simplifying fractions, writing formulae and factorising expressions.	**Constructions, Circles and prisms** From the work covered in lines and angles in year, 7 students will be familiar with the angle facts and manipulative techniques necessary to draw accurate triangles. The work completed in numbers will also make accessing measures easier as some of this involves completing operations with fractions. Area and Volume will have also been covered in year 8 allowing for students to now approach problems of increased challenge. The area is covered in year 8 and can now be developed further to consider the area and circumference in a more accessible form. This will later be revisited in Key Stage 4 and 5.	**Graphs and Comparing Shapes** Students will be able to use their prior knowledge of straight-line graphs to access more complex graph shapes. For higher students, this will also allow them to explore quadratic and cubic graphs Students can now also refer back to the work on Pythagoras in year 8 to engage with more abstract problems. Much of the operational and algebraic manipulative skills in terms 1 and 2 will be necessary which is why these topics have been strategically placed in this order.
10 F	**Indices, StandardForm, Area, Perimeter and Volume, Trigonometry, Pythagoras, Processing and Representing Data** KS4 mathematics begins with a focus on the strands of number and geometry. Students will revisit rounding and working with a number in term 1 of year 9 and will need these skills to develop a greater understanding of standard form. Skills from Indices can also be transferred to completing operations in standard form which is why these two topics are sequenced together. Having already studied collecting data and averages in year 9, we can now introduce further ways that data can be processed and represented while referring back to these skills. This is a strategy that we continually aim to employ by interleaving skills and knowledge throughout the curriculum.	**Ratio and Proportion, Graphing, Quadratic Expressions, Equations, Simultaneous Equations, Probability.** Having already studied and revised algebraic techniques of expansion, factorising and collecting like terms, along with the work on factors in years 8 and 9, students will have a much more developed understanding of the fundamental concepts that underpin graphing and quadratic manipulation. Students will also be able to build upon their knowledge of ratio and proportion studied in Key stage 3. They will now be expected to form equations based on proportional relationships, which is why it has been placed after students revisit linear equations and rearranged formulae in year 9.	**Probability 2, Inequalities, Equations and Transformations** The units in this term will build on the content studied in year 9 and the early part of year 10. Students will revisit graphing, now spending more time considering parallel lines and the use of rearranging formulae to access more complex questions. Students will also follow on with their work on Probability from term 2, where they will now consider conditional probability problems.

10 H	**Ratio and Proportion, Processing and Representing, Graphing, Quadratic Equations and Simultaneous Equations** Having already studied and revised algebraic techniques of expansion, factorising and collecting like terms, along with the work on factors in years 8 and 9, students will have a much more developed understanding of the fundamental concepts that underpin graphing and quadratic manipulation. Students will also be able to build upon their knowledge of ratio and proportion studied in Key stage 3. They will now be expected to form equations based on proportional relationships, which is why it has been placed after students revisit linear equations and rearranged formulae in year 9.	**Probability, Transformations, Congruence, Similarity and Constructions** In term 2, students will now focus on geometry and measuring, building on the skills and knowledge from year 8 and year 9. Students were introduced to concepts of transformations in year 7. They must revisit this skill in more depth before it is covered further in revision in year 11. Students will now also be able to make links between transformations, similarity and congruency. Similarity is also a unit which requires simple algebraic manipulation, which is why it is sequenced after work has been completed in this area in term 1. Constructions have also been studied before which will now have a greater focus on perpendicular lines and loci.	**Changing the subject, Algebraic Fractions, Vectors, Bounds, Inequalities, Trigonometry and Pythagoras** In year 9, students explored algebraic manipulation techniques to find the value of an unknown variable. The unit of changing the subject develops these skills further by placing greater emphasis on inverse relationships. In term 3, students will also study the unit of Bounds, which will develop their understanding of rounding from the Number work covered in term 1 of year 9.
11 F	**Congruency, Rearranging formulae, Proof, Vectors, Volume, Constructions, Angles, Expansion and Factorising** In year 9, students explored algebraic manipulation techniques to find the value of an unknown variable. The unit of changing the subject develops these skills further by placing greater emphasis on inverse relationships. Students will now also be able to make links between transformations, similarity and congruence. Making links back to the measure work which was taught in years 9 and 10 as well as the work on algebra in Key Stage 3 will help students to understand, which is why these units have been sequenced in this manner.	**Revised Scheme of work for each class based on Mock 2.** Revision based on outcomes of mocks Having now completed the prerequisite knowledge for the final public exams, a personalised scheme of work is followed for each class based on the strengths and weaknesses of the mocks sat' earlier in the year. Utilising trackers to identify these areas of improvement, the teacher thoughtfully organise the time for revision into the exams in May/June. This revision takes the form of revisiting topics and teaching the content with different resources to help students to broaden their understanding in key areas.	**Exam Paper Practise** Revision based on outcomes of mocks Having now completed the prerequisite knowledge for the final public exams, a personalised scheme of work is followed for each class based on the strengths and weaknesses of the mocks sat earlier in the year. Utilising trackers to identify these areas of improvement, teachers continue to thoughtfully organise the time for revision up into the exams in May/June. **GCSE examinations take place in May/June**

11 H	**Circle Geometry, Surds and Indices, Quadratic formula Functions, Iteration, Completing the square and Advanced Trigonometry** Students will begin year 11 with a focus on units based on the strands of Algebra and Geometry. This makes up over 40% of the final exam. Having studied rearranging formulae in year 10, students will have the skills to access the units of functions, iteration and completing the square which all have a foundation in algebraic manipulation. As mentioned at the start of the course teachers will be using starters and homework to constantly interleave skills and knowledge to support students' long-term recall.	**Revised Scheme of work for each class based on Mock 2.** Revision based on outcomes of mocks Having now completed the prerequisite knowledge for the final public exams, a personalised scheme of work is followed for each class based on the strengths and weaknesses of the mocks sat earlier in the year. Utilising trackers to identify these areas of improvement, the teacher thoughtfully organise the time for revisions into the exams in May/June. This revision takes the form of revisiting topics and teaching the content with different resources to help students to broaden their understanding in key areas.	**Exam Paper Practise** Revision based on outcomes of mocks Having now completed the prerequisite knowledge for the final public exams, a personalised scheme of work is followed for each class based on the strengths and weaknesses of the mocks sat earlier in the year. Utilising trackers to identify these areas of improvement, teachers continue to thoughtfully organise the time for revision up into the exams in May/June. **GCSE examinations take place in May/June** Students going on to study A-Level Mathematics are given transition work packs for use over the summer break.
12	**Algebra and Functions, Further Algebra, Data Collection, Modelling in Mechanics, Constant Acceleration Differentiation, Integration, Measures of Spread, Representation of Data, Correlation** Beginning the study of A-Level Mathematics with a focus on algebra helps students to gain the foundational knowledge of more complex algebraic manipulation techniques, and concepts that will be necessary to access the rest of the course. The spiral nature of the course means that students will start with content that was studied in year 11 at first before developing these core concepts further. The first term recaps the higher content of the GCSE while also introducing new concepts such as differentiation and integration which be covered in more depth further in the course.	**Vectors, Coordinate Geometry, Forces and Motion, Probability, Statistical Distributions, Trigonometry, Algebra Functions 2, Hypothesis Testing, Kinematics 2** Some of the concepts in term 2 will continue to build upon units studied in year 11. The algebraic techniques covered in term 1 will now be employed further in the applied module of mechanics, where being able to confidently rearrange formulae is paramount. The unit of trigonometry also covers concepts taught in year 11, placing this knowledge in more abstract and thought-provoking contexts. The unit of Vectors serves to both revise the content taught in year 11 and also to introduce the new concepts of magnitude and direction in the context of motion. The content of the unit statistical distribution and hypothesis testing will	**Algebra and Functions 2, Exponentials and, Logarithms, Variable Acceleration, Differentiation 2, Projectiles, Functions** Having now studied algebraic techniques in terms 1 and 2, term 3 will look to expound on these ideas further. Variable acceleration, as a module in applied mathematics, has been sequenced in this order as differentiation and integration are prerequisites to this topic. Similarly, the unit of Projectiles relies on the knowledge developed in term 1. Differentiation 2, which is a year 2 topic has been moved towards the end of year 12 to maximise the learning time in year 13.

		be completely new to students but also rely on terminology and concepts studied in term 1.	
13	**Integration, Normal distribution, Forces at any angle Proof, Functions and Modelling, Probability Moments** Students will now move on to study the year 2 content of the course, which builds on each of the concepts taught in year 1. While we follow the resources set out by the examiner we have sequenced the units to further build off one topic, including integration, and have been moved forward to maximise the time being taught. Traditionally integration and differentiation are taught much later in the course. We have found however that moving these units earlier, provides many benefits for the students. These topics can be assessed much earlier allowing for much more accurate intervention as these topics are perceivable more difficult.	**Sequences and Series, Binomial Theorem, Trigonometry, Correlation and Regression, Variable Acceleration 2** Sequences and series, initially build from GCSE knowledge before being developed much further. The binomial Theorem is sequenced to follow sequences and series due to some of the overlapping ideas which follow through. Variable acceleration can now be accessed based on having already studied the year 2 content for differentiation and integration. Throughout the two-year course, teachers will interleave content through the use of assignments, homework and starters to ensure that all topics are constantly revisited. Teachers will use trackers to identify specific areas of weakness from the mocks to facilitate revision.	**Parametric Equations, Numerical Methods, Vectors 3D** As we now move into the exam period, where time is also allocated to the revision of key concepts from across the two years, these final units have been saved for this point due to their relative ease and depth. Teachers will again use trackers to identify specific areas of weakness from the mocks to facilitate revision. A-Level examinations take place in May/June.
Year 12 Further	**Complex Numbers Argand Diagrams, Algebra and Functions** Beginning the study of A-Level Further Mathematics with a focus on complex number theory helps students to gain the foundational knowledge of more complex algebraic manipulation techniques, and concepts that will be necessary to access the rest of the course. The spiral nature of the course means that students will start with content that was studied in year 11 at first before developing these core concepts further. The first term recaps the higher	**Series Matrices and Proof** Some of the concepts in term 2 will continue to build upon units studied in year 11. The algebraic techniques covered in term 1 will now be employed further in the applied module of mechanics, where being able to confidently rearrange formulae is paramount. The unit of Proof also covers concepts taught in year 11, placing this knowledge in more abstract and thought-provoking contexts. The unit of Matricess serves to both revise the content taught in further	**Vectors and Calculus** Having now studied algebraic techniques in terms 1 and 2, term 3 will look to expound on these ideas further. Volumes of revolution as a module has been sequenced in this order as differentiation and integration are prerequisites to this topic and has been moved towards the end of year 12 to maximise the learning time in year 13.

	content of the GCSE while also introducing new concepts such as argand diagrams and series which will be covered in more depth further in the course.	mathematics in year 11 and also to introduce the new concepts of magnitude and direction in the context of motion. The content of the unit statistical distribution and hypothesis testing will be completely new to students but also rely on terminology and concepts studied in term 1.	
Year 13 Further	**Complex Numbers 2, Polar Coordinates Hyperbolic Functions** Students will now move on to study the year 2 content of the course, which builds on each of the concepts taught in year 1. While we follow the resources set out by the examiner we have sequenced the units to further build off one topic, including integration, and have been moved forward to maximise the time being taught Complex numbers will build on year 12 content but will also necessitate knowledge of logs and exponentials from Year 12 AS mathematics.	**Series 2, Calculus 2, Differential Equations** Sequences and series, initially build from A2 Series and AS Further Mathematics knowledge before being developed much further. The Differential equations unit is sequenced to finish the course and is a culmination of knowledge from both A level and Further Mathematics. Teachers will use trackers to identify specific areas of weakness from the mocks to facilitate revision.	**Exams** As we now move into the exam period, where time is also allocated to the revision of key concepts from across the two years, these final units have been saved for this point due to their relative ease and depth. Teachers will again use trackers to identify specific areas of weakness from the mocks to facilitate revision. A-Level examinations take place in May/June

What **cross-curricular themes** have been identified?

Year	Term 1	Term 2	Term 3
7	**History** – Babylonian Maths **Geography and History** - The roots of algebra in the Arabic world. Scales and timelines. **ICT –** Logic and Algorithms -0 the basis of early computing PE – interpreting data that tracks athletic performance.	**Music -** Equivalent fractions can be shown using a musical notation where a different type of note is worth a different fraction of a whole beat. **Geography –** the data handling cycle.	**Music** – linking work on measures to speed, time and rhythm patterns. Rhythms patterns to mathematical sequences.
8	**Geography –** using charts and graphs. **History –** The development of different number systems from ancient Greece to modern mathematics. **Music –** symbolic representation and the links to algebra	**Art and Design -**patterns, shapes and transformations. **Design and Technology –** Scale and scale factors. Using data to compare products **ICT-** using data programs to interpret and display data	**Design and Technology –** measurement and estimation of measures Ratio and proportion–scale maps
9	**CAPE -** Numbers come up in conversations in everyday life all the time. For example, about 1/10 of the population is left-handed or about 6% of Britain's population is gay or lesbian. Children need to understand these mathematical concepts to go on to comprehend what is being said. **Computing** - Angles and direction can be drawn and measured using floor robots and apps too. **Geography-** Collecting and representing data from field trips or weather investigations. Grid references and coordinates	**English -** clearly interpret and discuss results students get from collecting data **PE** - Time, distance and speed of races can be incorporated into Maths sessions to enable children to work out averages and convert between different measures. Data can be collected and analysed to assess performances. **CAPE –** Investing money, banking and personal finance. Opportunities to talk about Mortgages and personal debt.	**Art and Design** - Lots of different tesselations can be found in Escher drawings. Works of art from the Cubism era of the 20th century link to nets and 3D shapes. Architecture and the use of trigonometry and Pythagoras when designing and building. **Geography –** planning permission for building. Bearings are used to ascertain the location of countries and landmarks. Longitude and latitude can also be explored.
10	**CAPE** -Interpreting charts and data from charities. Identifying misleading data. **Geography –** The area of different landmasses can be discussed which ties into the study of Standard form. **History –** the origins of Pythagoras' theorem can be explored	**CAPE**- Probability, risk and chance can be incorporated into CAPE **Design and Technology -** Reading Scales, Measuring ingredients and working out proportions, Using ratios in recipes.	**Art and Design** - Ratio is used to mix paints. For example, to make purple, you mix 3 parts red to 7 parts blue. Many artists and architects have proportioned their works to approximate the

			Golden Ratio believing this proportion to be aesthetically pleasing.
11	**Computing** - Information can be represented in Excel and calculations using formulas can be done on the data here too. Logic is used in programming as is problem-solving. **Science** – rearranging of key formulae needed for chemistry, biology and physics **History** – The history of numbers can be explored in terms of rational and irrational numbers and where these ideas were developed from.	**GCSE Revision and Intervention**	**GCSE Examinations take place in May/ June**
12	**In years 12 and 13, mechanics is studied as one of the applied modules which heavily crosses over with GCSE And A-Level Physics.** **Science** – rearranging of key formulae needed for chemistry, biology and physics. The equations of motion **CAPE** – The study of big data forms one of the initial units in statistics. We can look at the implications and misuse of data in shaping consumer habits. **Business Studies** – we explore the importance of modelling in mechanics and how businesses use models to predict outcomes and behaviour	**Physics** – the study of pulleys and forces Correlation and causation with scatter graphs. **Geography** – use of vectors and bearing to navigate masses of water. **CAPE** – Probability and risk are further explored in this term – we can make links to gambling and investment.	**Physical Education** – we study projectiles and mathematically modelling objects in flight, which can be linked to sports where balls are thrown. Olympic Javeline throwers can be modelled in this unit. **Computing** – links are made to functions – which can be formulated in excel.
13	**Science –** a large amount of the applied modules cross over with different aspects of science. Mechanics mainly overlaps heavily with Physics. **Technology –** we can also study the impact that advances in technology have had on to use and application of mathematical modelling.	**Science** – rearranging of key formulae needed for chemistry, biology and physics **Physics** – the study of moments **Computing-** Much of the work on algorithms and critical path analysis is studied in further maths. The module on decision maths overlaps with different aspects of the computing course. **Technology –** we can also study the impact that advances in technology have had on to use and application of mathematical modelling.	**A-Level Exams in May and June**

How will each unit be **assessed** to show that students are making progress?

In addition to formal assessments which take place at least twice across the year during "whole school exam weeks", students will be assessed and their progress will be tracked and monitored in the following ways:

Year	Term 1	Term 2	Term 3
7	An assessment at the start of the term to identify students' starting points at the beginning of KS3. Key task assessments - fortnightly Mastery assessments at the end of each unit.	Regular assessments of individual units Mastery assessments at the end of each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment. Key task assessments - fortnightly	Regular assessments of individual units Key task assessments - fortnightly Mastery assessments at the end of each unit.
8	Mastery assessments at the end of each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment. Key task assessments - fortnightly	Mastery assessments at the end of each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment. Key task assessments - fortnightly	Mastery assessments at the end of each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment. Key task assessments - fortnightly
9	Regular assessments of individual units Key task assessments - fortnightly Exit questions use exam questions to assess each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses	Regular assessments of individual units Key task assessments - fortnightly Exit questions use exam questions to assess each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses	Regular assessments on individual questions. Key task assessments - fortnightly Exit questions use exam questions to assess each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the

	across the units, this informs the teaching for the period up until the formal assessment.	across the units, this informs the teaching for the period up until the formal assessment.	teaching for the period up until the formal assessment.
10	Regular assessments of individual units Key task assessments - fortnightly Exit questions use exam questions to assess each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment.	Regular assessments of individual units Key task assessments - fortnightly Exit questions use exam questions to assess each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment.	Regular assessments of individual units Key task assessments - fortnightly Exit questions use exam questions to assess each unit. Before each formal assessment, diagnostic tests are used to identify strengths and weaknesses across the units, this informs the teaching for the period up until the formal assessment. Full GCSE Paper used for assessment.
11	Full GCSE Exam Paper used at the end of Term 1. Strengths and weaknesses identified, tracked and assessed. Key task assessments - fortnightly Regular assessments of units are recorded and tracked by KS5 staff.	Full GCSE Exam Paper used at the start of term 2 Strengths and weaknesses identified, tracked and assessed. Key task assessments - fortnightly Full GCSE Exam Paper used at the end of term 2. Regular assessments of units are recorded and tracked by KS5 staff.	GCSE Examination takes place in May/June
12	Regular assessments of units are recorded and tracked by KS5 staff. Mock exam paper for both pure and applied set at the end of term 1 omitting questions not yet covered in the Syllabus.	Regular assessments of units are recorded and tracked by KS5 staff. Mock exam paper for both pure and applied set at the end of term 2 omitting questions not yet covered in the Syllabus.	Regular assessments of units are recorded and tracked by KS5 staff. Mock exam paper for both pure and applied set at the end of term 2 omitting questions not yet covered in the Syllabus.

13	Regular assessments of units are recorded and tracked by KS5 staff. Mock exam paper for both pure and applied set at the end of term 1 omitting questions not yet covered in the Syllabus.	Regular assessments of units are recorded and tracked by KS5 staff. Mock exam paper for both pure and applied set at the end of term 1 omitting questions not yet covered in the Syllabus.	A-Level Examinations take place in May/ June.

Are there any **extra-curricular links, visits or speakers** linked to units of work?

In addition to the extra-curriculum clubs running within the English department which all students are welcome to attend, the following visits are organised yearly:

Year	Term 1	Term 2	Term 3
7		Year 7 and 8 students are invited to take part in the Junior Maths Challenge. This is a national competition run by Leeds University.	Successful students can move on to the Kangaroo rounds of the Maths Challenge. The Olympiad then becomes available for students who have completed the Kangaroo round.
8			
9		Year 9 and 10 students are invited to take part in the Intermediate Maths Challenge. This is a national competition run by Leeds University.	Successful students can move on to the Kangaroo rounds of the Maths Challenge. The Olympiad then becomes available for students who have completed the Kangaroo round.
10			
11			
12		Year 10, 11 and 12 students are invited to take part in the Senior Maths Challenge. This is a national competition run by Leeds University.	Successful students can move on to the Kangaroo rounds of the Maths Challenge. The Olympiad then becomes available for students who have completed the Kangaroo round.

13	Opportunities to visit Bletchley Park for year 13 further mathematics students will be able to explore algorithms and computing linking to decision maths.		

What will students be expected to **know and remember**?

Year	Term 1	Term 2	Term 3
7	**By the end of term 1, students will be expected to know and remember how to do the following:** ● Construct and interpret frequency tables, bar charts, pie charts, and stem and leaf diagrams for simple categorical data, and vertical line (or bar) charts for small sets of ungrouped numerical data and numerical data grouped into a small number of groups ● Recognise graphical misrepresentation through incorrect scales, labels etc. ● Plot and interpret scatter diagrams to recognize and use the language of correlation ● Draw 2-D shapes using given dimensions and angles [g3a] ● Describe and build simple 3-D shapes, including making nets [g3b] ● Find unknown angles in any triangles, quadrilaterals, and regular polygons [g4a] ● Derive and apply formulae to undertake calculations and solve problems involving perimeter and area of rectangles	**By the end of term 2, students will be expected to know and remember how to do the following:** ● Calculate the mean and interpret the mean as an average [S3] ● Calculate the range and interpret the range as a measure of spread ● Describe, interpret and compare two simple datasets of a single variable through appropriate graphical representations, and by considering the mean or median or mode and range of the datasets. ● Draw and translate simple shapes on the coordinate plane, and reflect them in the axes [P2] ● Describe positions on the full coordinate grid (all four quadrants) [P3] ● Apply translations, rotations and reflections to given figures, and identify examples of translations, rotations and reflections (for example, be able to pick out from a group of shapes those that are translations, rotations or reflections of a given shape) ● Compare and order fractions, including fractions > 1	**By the end of term 3, students will be expected to know and remember how to do the following:** ● Substitute numerical values into simple algebraic formulas that model real-world situations or procedures. ● Simplify expressions by collecting like terms ● Use simple function machines to deal with inputs and outputs, recognising basic inverse functions. ● Use interpret algebraic notation, including ab, 3y in place of y + y + y, a^2 in place of a x a, a^3 in place of a x a x a, a^2b in place of a x a x b, $xx\ yy$ instead of x ÷ y, coefficients written as fractions rather than decimals ● Model situations or procedures by translating them into simple algebraic formulas. ● Understand and solve problems involving the exchange rate ● Understand and solve problems involving unit costs set up and solve one-step equations with integer coefficients

7	● Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles [g4b] ● Apply the properties of angles at a point, angles at a point on a straight line, and vertically opposite angle**s** identify the value of each digit in numbers given to three decimal places and multiply and divide numbers by 10, 100 and 1000 giving answers up to three decimal places ● Multiply one-digit numbers with up to two decimal places by whole numbers ● Use written division methods in cases where the answer has up to two decimal Places ● Solve problems which require answers to be rounded to specified degrees of Accuracy ● Use interpret algebraic notation, including ab, 3y in place of y + y + y, a^2 in place of a x a, a^3 in place of a x a x a, a^2b in place of a x a x b, $instead$stead of x ÷ y, coefficients written as fractions rather than decimals ● Model situations or procedures by translating them into simple algebraic formulas. ● Generate terms of a sequence from a term-to-term or a position to term rule ● Begin to generalise their results in words ● Rearrange simple formulae to change the subject	● Add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions multiply simple pairs of proper fractions, writing the answer in its simplest form ● Divide proper fractions by whole numbers [for example, ● Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction ● Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts. ● Recognise the relationship between fractions, decimals and percentages and can express them as equivalent quantities (e.g. One piece of cake that has been cut into 5 equal slices can be expressed as a fifth or 0.2 or 20% of the whole cake). ● Can calculate using fractions, decimals or percentages both as numbers and operators	● Create and solve two-step equations that model real-world situations or procedures. ● Simplify and manipulate expressions to maintain equivalence by multiplying a single term over a bracket and taking out common factors ● Rearrange simple formulae to change the subject ● Use the rules of indices for positive whole number powers. ● Use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places [m5] ● Convert between miles and kilometres [m6] ● Recognise that shapes with the same areas can have different perimeters and vice versa [m7] ● Recognise when it is possible to use formulae for area and volume of shapes [m7] ● Calculate the area of parallelograms and triangles [m7] ● Calculate, estimate and compare the volume of cubes and cuboids using standard units, including cubic centimetres (cm3) and cubic metres (m3), and extending to other units (for example, mm3 and km3) [m8] ● Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places [m9] ● Use ratio notation, including a reduction to the simplest form

			● Relate the language of ratios and the associated calculations to the arithmetic of fractions ● Divide a given quantity into two parts in a given part: part ratio; express the division of a quantity into two parts as a ratio
8	**By the end of term 1, students will be expected to know and remember how to do the following:** ● Round numbers and measures to different degrees of accuracy, for example, to several decimal places or significant figures ● Use the four operations, including formal written methods, applied to integers and decimals, all both positive and negative ● Understanding numbers in contextual calculations ● Round numbers and measures to an appropriate degree of accuracy, for example to the nearest whole number or one decimal place ● Use approximation, through rounding to the nearest whole number or to one decimal place, to estimate answers ● Use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 ● Distinguish between exact representations of roots and their decimal approximations ● Interpret and compare numbers in standard form A x 10n $1 \leq A < x \leq b$ ● Rearrange simple formulae to change the subject ● Find the position to term formula for given linear sequences and for linear sequences that arise from modelling real-world situations.	**By the end of term 2, students will be expected to know and remember how to do the following** ● Complete, read and interpret information presented in tables, pictograms and bar charts (e.g. Find the difference between two bars showing temperatures, where one is 20°C and the other is 13°C, on a scale labelled in multiples of 5) [S1] ● Interpret line graphs (e.g. Begin to find the difference between two temperatures on a line graph, where one is 20°C and the other is 13°C, on a scale labelled in multiples of 5) and simple pie charts (e.g. A pie chart cut into eight pieces for favourite fruit using whole numbers for each section) [S1] ● Plot and interpret scatter diagrams - describe mathematical relations between the two variables in simple words ● Describe, interpret and compare observed distributions of a single variable through appropriate graphical representation involving discrete, ungrouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range) ● Calculate the mean and interpret the mean as an average [S3] ● Calculate the range and interpret the range as a measure of spread	**By the end of term 3, students will be expected to know and remember how to do the following** ● Draw and translate simple shapes on the coordinate plane, and reflect them in the axes [P2] ● Describe positions on the full coordinate grid (all four quadrants) [P3] ● Apply translations, rotations and reflections to given figures, and identify examples of translations, rotations and reflections (for example, be able to pick out from a group of shapes those that are translations, rotations or reflections of a given shape) ● Enlarge a shape with a given centre of enlargement and scale factor. Including fractional and negative enlargements. ● Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction ● Solve problems involving direct proportion ● Use compound units such as unit pricing to solve problems ● Use ratio notation, including a reduction to the simplest form ● Relate the language of ratios and the associated calculations to the arithmetic of fractions

8	● Investigate and recognise special sequences such as triangular numbers, square numbers and Fibonacci numbers ● Model situations or procedures by translating them into simple algebraic formulas. ● Generate terms of a sequence from a term-to-term or a position to term rule ● Begin to generalise their results in words ● Find unknown angles in any triangles, quadrilaterals, and regular polygons [g4a] ● Derive and apply formulae to undertake calculations and solve problems involving perimeter and area of rectangles ● Recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles [g4b] ● Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles ● Classify quadrilaterals by their geometric properties, and provide convincing arguments to support classification decisions ● Derive and use the sum of angles in a triangle ● Draw, sketch and describe regular polygons, and other polygons that are reflectively and rotationally symmetric; ● Derive and illustrate properties [for example, equal lengths and angles] of triangles, quadrilaterals, and other plane figures using appropriate language and technologies	● Associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction ● Recall and use equivalences between simple fractions, decimals and percentages, including in different contexts. ● Recognise the relationship between fractions, decimals and percentages and can express them as equivalent quantities (e.g. One piece of cake that has been cut into 5 equal slices can be expressed as a fifth or 0.2 or 20% of the whole cake). ● Can calculate using fractions, decimals or percentages both as numbers and operators ● Define percentage as 'number of parts per hundred, and know their decimal and fraction equivalents ● Multiply proper and improper fractions and mixed numbers ● Work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 and 3/8) ● Create and solve two-step equations that model real-world situations or procedures. ● Simplify and manipulate expressions to maintain equivalence by multiplying a single term over a bracket and taking out common factors ● Rearrange simple formulae to change the subject ● Use the rules of indices for positive whole number powers. ● Model and interpret real-life situations or procedures graphically. ● Plot graphs of linear functions	● Divide a given quantity into two parts in a given part: part ratio; express the division of a quantity into two parts as a ratio ● Convert between miles and kilometres [M6] ● Recognise that shapes with the same areas can have different perimeters and vice versa [M7] ● Recognise when it is possible to use formulae for area and volume of shapes [M7] ● Calculate the area of parallelograms and triangles [M7] ● Calculate, estimate and compare the volume of cubes and cuboids using standard units, including cubic centimetres (cm3) and cubic metres (m3), and extending to other units (for example, mm3 and km3) [M8] ● Solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places [M9] ● Record and describe the frequency of outcomes of simple probability experiments; try to explain their findings using their ideas about randomness and possible outcomes; make and explain their own merits about the fairness of situations; understand that the probability of an impossible event is 0, and of a certain event is 1, and begin to use the 0-1 probability scale. ● Use systematic listing strategies to list all possible outcomes for four events such as tossing four coins. ● Record outcomes of probability experiments in tables

			● Use a two-circle Venn diagram to calculate related probabilities. ● Enumerate sets systematically making use of tables and grids ● Investigate games
9	**By the end of term 1, students will be expected to know and remember how to do the following:** ● Use place value when calculating with decimals. ● Order positive and negative integers and decimals using the symbols ● Round to a certain number of decimal places or significant figures. ● Add and subtract positive and negative integers and decimals. ● Multiply and divide positive and negative integers and decimals ● Use BIDMAS in multi-stage calculations. ● Use algebraic notation. ● Substitute numbers into formulae and expressions. ● Use and understand the expressions of the words, equations, formulae, terms and factors. ● Collect like terms and simplify expressions involving sums, products, powers and surds. ● Describe and apply the properties of angles at a point, on a line and at intersecting and parallel lines. ● Derive and use the sum of angles in a triangle. ● Derive and apply the properties and definitions of special types of quadrilaterals. ● Solve geometrical problems on coordinate axes. ● Deduce and use the angle sum in any polygon and derive properties of regular polygons.	**By the end of term 2, students will be expected to know and remember how to do the following:** ● Collect like terms and simplify expressions involving sums, products, powers and surds. ● Multiply a single term over a bracket. ● Take out common factors in an expression. ● Calculate with standard and compound units. ● Compare lengths, areas and volumes of similar shapes. ● Use standard units of length, mass, volume, capacity, time and area. ● Convert between units of density ● Solve problems involving force, area and pressure ● Convert between units of pressure ● To convert from one unit speed to another (e.g. Km/h to m/s) ● Draw and interpret linear graphs of real-life scenarios – distance speed and acceleration ● Interpret and construct tables, graphs and charts for discrete, continuous and grouped data. ● Use the median, mean, modal class and range to interpret and compare distributions. ● Find fractions and percentages of amounts. ● Order fractions, decimals and percentages. ● Compare two quantities using percentages ● Work with percentages bigger than 100 Reverse percentages without a calculator and with a calculator	**By the end of term 2, students will be expected to know and remember how to do the following:** ● Find terms of a linear sequence using a term-to-term or position-to-term rule. ● Recognise special types of sequence and find terms using either a term-to-term or position-to-term rule. ● Find terms of a quadratic sequence using a term-to-term or position-to-term rule. ● Use the laws of indices. ● Work with numbers in standard form. ● Calculate the areas of triangles, parallelograms, trapezia and composite shapes. ● Use Pythagoras' theorem to find a missing side in a right-angled triangle. ● Use trigonometric ratios to find missing lengths and angles in triangles. ● Find the exact values of sin θ, cos θ and tan θ for key angles. ● Use the sine and cosine rules to find missing lengths and angles. Express vectors in terms of simple base vectors.

	● Find fractions and percentages of amounts. ● Add and subtract simple fractions and mixed numbers. ● Multiply and divide simple fractions and mixed numbers. ● Convert between fractions, decimals and percentages. ● Identify when a sample may be biased. ● Construct and interpret frequency tables and two-way tables. ● Classify data as Qualitative, Quantitative (Discrete or Continuous), Primary or Secondary ● Construct suitable data collection sheets for specific data ● complete and use a two-way table	● Set up, solve and interpret the answers to growth and decay problems, including compound interest ● Calculate simple and compound interest ● Solve problems involving percentages changes .	
10 F	**By the end of term 1, students will be expected to know and remember how to do the following:** ● Find terms of a linear sequence using a term-to-term or position-to-term rule. ● Recognise special types of sequence and find terms using either a term-to-term or position-to-term rule. ● Find terms of a quadratic sequence using a term-to-term or position-to-term rule. ● Use the laws of indices. ● Work with numbers in standard form. ● Calculate the areas of triangles, parallelograms, trapezia and composite shapes. ● Use Pythagoras' theorem to find a missing side in a right-angled triangle. ● Use trigonometric ratios to find missing lengths and angles in triangles.	**By the end of term 2, students will be expected to know and remember how to do the following:** ● Use fractions and percentages to describe a proportion. ● Divide a quantity in a given ratio and reduce a ratio to its simplest form. ● Use scale factors, scale diagrams and maps. ● Solve problems involving percentage change. ● Work with coordinates in all four quadrants. ● Plot straight-line graphs including diagonal, vertical and horizontal lines. ● Identify gradients and intercepts of straight lines graphically and algebraically. ● Use the form $= m + c$o identify parallel lines. ● Use one point and the gradient of the line to find its equation. ● Use two points to find the equation of a line. Interpret the gradient of a straight-line graph as a rate of change.	**By the end of term 2, students will be expected to know and remember how to do the following:** ● Use experimental data to estimate probabilities and expected frequencies. ● Calculate theoretical probabilities and expected frequencies using the idea of equally likely events. ● Compare theoretical probabilities with experimental probabilities. ● Recognise mutually exclusive events and exhaustive events and know that the probabilities of mutually exclusive exhaustive events sum to 1. ● Identify, describe and construct reflections, rotations, translations and enlargements. ● Solve linear inequalities in one variable and represent the solution on a number line.

	● Use the sine and cosine rules to find missing lengths and angles. Express vectors in terms of simple base vectors. ● Identify when a sample may be biased. **By the end of term 1, students will be expected to know and remember how to do the following:** ● Construct and interpret frequency tables and two-way tables. ● Construct and interpret pictograms, bar-line charts and bar charts. ● Interpret and construct pie charts and know their appropriate use. ● Compare distributions using median, mean, mode and range and identify outliers. ● Interpret and construct tables, graphs and charts for discrete, continuous and grouped data. ● Use the median, mean, modal class and range to interpret and compare distributions.	● Plot and interpret graphs involving distance, speed and acceleration. **By the end of term 2, students will be expected to know and remember how to do the following:** ● Draw graphs to identify and interpret roots, intercepts and turning points of quadratic functions. ● Recognise, sketch and interpret graphs of linear, quadratic and simple cubic functions. ● Recognise, sketch and interpret the reciprocal function $y = \frac{1}{x}$. ● Plot and interpret real-life graphs. ● Derive and solve simple linear equations. ● Solve quadratic equations algebraically by factorising. ● Derive and solve two linear simultaneous equations in two variables. ● Find approximate solutions to two linear simultaneous equations using a graph.	● Derive and solve simple linear equations.

	By the end of term 1, students will be expected to know and remember how to do the following:	By the end of term 2, students will be expected to know and remember how to do the following:	By the end of term 3, students will be expected to know and remember how to do the following:
10 H	● Describe direct and inverse proportion relationships using an equation. ● Recognise graphs showing direct and inverse proportions and interpret the gradient of a straight-line graph. ● Find the instantaneous and average rate of change from a graph. ● Solve repeated proportional change problems. ● Express proportions of amounts as fractions or percentages. ● Divide a quantity in a given ratio. ● Use scale factors to convert between lengths on maps and scale diagrams and the distances they represent. ● Calculate percentage increases and decreases using multiplication. ● Find the original value of a quantity that has undergone a percentage increase or decrease. ● Identify when a sample may be biased. ● Construct and interpret frequency tables, bar charts and pie charts. ● Calculate the mean, median and mode of a data set. ● Calculate the range and interquartile range of a data set. ● Use frequency tables to represent grouped data. ● Construct histograms with equal or unequal class widths. ● Calculate summary statistics from a grouped frequency table.	● Use a standard ruler and compass constructions and solve problems involving loci. ● Use experimental data to estimate the probabilities of future events. ● Calculate theoretical probabilities using the idea of equally likely events. ● Compare theoretical probabilities with experimental probabilities. ● Recognise mutually exclusive events and exhaustive events and know that the probabilities of mutually exclusive exhaustive events sum to 1. ● Use Venn diagrams to represent sets. ● Use a possibility space to represent the outcomes of two experiments and to calculate probabilities. ● Use a tree diagram to show the outcomes of the two experiments. ● Calculate conditional probabilities. ● Describe and transform shapes using reflections, rotations, translations (described as 2D vectors) and enlargements (including fractional and negative scale factors). ● Identify what changes and what is invariant under a combination of transformations. ● Know and apply the relationship between lengths, areas and volumes of similar shapes. ● Identify types of triangles and quadrilaterals and use their properties. ● Identify congruent shapes and use congruence to prove geometric results.	● Use algebraic notation and simplify expressions by collecting like terms. ● Substitute numbers into formulae and expressions. ● Use the laws of indices. ● Multiply a single term over a bracket. ● Take out common factors in an expression. ● Simplify algebraic fractions and carry out arithmetic operations with algebraic fractions. ● Express vectors in terms of simple base vectors. ● Substitute values into formulae and rearrange formulae to change their subject. ● Write an equation to represent a function, and find inputs and outputs. ● Find the inverse of a function and construct and use composite functions. ● Use the terms expression, equation, formula, identity, inequality, term and factor. ● Construct proofs of simple statements using algebra. ● Expand brackets to get a quadratic expression and factorise quadratics into brackets. ● Solve inequalities and display your solution on a number line or a graph. ● Use Pythagoras' theorem to find a missing side in a right-angled triangle. ● Use trigonometric ratios to find missing lengths and angles in triangles. ● Find the exact values of sin θ, cos θ and tan θ for key angles. Use the sine and cosine rules to find missing lengths and angles.

10H	**By the end of term 1, students will be expected to know and remember how to do the following** ● Plot scatter graphs and recognise correlation. Draw lines of best fit and use them to make predictions. ● Use averages and measures of spread to compare data sets. ● Plot straight-line graphs including diagonal, vertical and horizontal lines. ● Identify gradients and intercepts of straight lines graphically and algebraically. ● Use the form $y = mx + c$ to identify parallel lines. ● Use one point and the gradient of the line to find its equation. ● Use two points to find the equation of a line. Interpret the gradient of a straight-line graph as a rate of change. ● Plot and interpret graphs involving distance, speed and acceleration. ● Draw graphs to identify and interpret roots, intercepts and turning points of quadratic functions. ● Recognise, sketch and interpret graphs of linear, quadratic and simple cubic functions. ● Recognise, sketch and interpret the reciprocal function $y = \frac{1}{x}$. ● Plot and interpret real-life graphs. ● Solve linear equations including when the unknown appears on both sides. ● Solve quadratic equations using factorisation, completing the square and the quadratic formula. ● Solve a pair of linear or linear plus quadratic simultaneous equations	● Identify similar shapes and use similarity to find lengths and areas.	● Look at a value that has been rounded and work out upper and lower bounds for the original value.

Year	Term 1	Term 2	Term 3
11 F	**By the end of term 1, students will be expected to know and remember how to do the following:** ● Substitute values into formulae and rearrange formulae to change their subject. ● Write an equation to represent a function, and find inputs and outputs. ● Find the inverse of a function and construct and use composite functions. ● Use the terms expression, equation, formula, identity, inequality, term and factor. ● Construct proofs of simple statements using algebra. ● Expand brackets to get a quadratic expression and factorise quadratics into brackets. ● Express vectors in terms of simple base vectors. ● Draw and interpret plans and elevations of 3D shapes. ● Calculate the volume of cuboids and right prisms. ● Calculate the surface area and volume of spheres, pyramids, cones and composite shapes. ● Know and apply the relationship between lengths, areas and volumes of similar shapes. ● Use angle facts including at a point, on a line, at an intersection and for parallel lines. Use bearings to specify directions. ● Identify types of triangle and quadrilateral and use their properties ● Identify congruent shapes and use congruence to prove geometric results. ● Identify similar shapes and use similarity to find lengths and areas. Calculate the properties of polygons including interior and exterior angles for regular polygons.	**By the end of term 2, students will be expected to know and remember how to do the following:** In preparation for the GCSE Examinations, students will be revising all of the KS4 content. Teachers will be using trackers from the mocks to address areas of weakness. As directed by the HOD, teachers will use question-level analysis tools to direct the revision of key material. There will be a focus on algebra, number, ratio and proportion, geometry, measure, statistics and probability.	**By the end of term 3, students will be expected to know and remember how to do the following:** In preparation for the GCSE Examinations, students will be revising all of the KS4 content. Teachers will be using trackers from the mocks to address areas of weakness. As directed by the HOD, teachers will use question-level analysis tools to direct the revision of key material. There will be a focus on algebra, number, ratio and proportion, geometry, measure, statistics and probability. GCSE Examinations to take place in May/ June.

11 H	**By the end of term 1, students will be expected to know and remember how to do the following:** ● Find the area and circumference of a circle and composite shapes involving circles. ● Calculate arc lengths, angles and areas of sectors. Prove and apply circle theorems. ● Use the standard ruler and compass constructions and solve problems involving loci. ● Perform calculations involving roots and indices, including negative and fractional indices. ● Perform exact calculations involving fractions, surds and π. ● Work with numbers in standard form. ● Solve linear equations including when the unknown appears on both sides. ● Solve quadratic equations using factorisation, completing the square and the quadratic formula. ● Solve a pair of linear or linear plus quadratic simultaneous equations. ● Use iterative processes to find approximate solutions to equations. ● Solve inequalities and display your solution on a number line or a graph. ● Substitute values into formulae and rearrange formulae to change their subject. ● Write an equation to represent a function, and find inputs and outputs. ● Find the inverse of a function and construct and use composite functions. ● Use the terms expression, equation, formula, identity, inequality, term and factor. ● Construct proofs of simple statements using algebra. ● Expand brackets to get a quadratic expression and factorise quadratics into brackets. ● Use Pythagoras' theorem to find a missing side in a right-angled triangle. ● Use trigonometric ratios to find missing lengths and angles in triangles. ● Find the exact values of sin θ, cos θ and tan θ for key angles. ● Use the sine and cosine rules to find missing lengths and angles.	**By the end of term 2, students will be expected to know and remember how to do the following:** In preparation for the GCSE Examinations, students will be revising all of the KS4 content. Teachers will be using trackers from the mocks to address areas of weakness. As directed by the HOD, teachers will use question-level analysis tools to direct the revision of key material. There will be a focus on algebra, number, ratio and proportion, geometry, measure, statistics and probability.	**By the end of term 3, students will be expected to know and remember how to do the following:** In preparation for the GCSE Examinations, students will be revising all of the KS4 content. Teachers will be using trackers from the mocks to address areas of weakness. As directed by the HOD, teachers will use question-level analysis tools to direct the revision of key material. There will be a focus on algebra, number, ratio and proportion, geometry, measure, statistics and probability. **GCSE Examinations to take place in May/ June.**

What will students be expected to **know and remember**?

Years			
12	**By the end of term 1, students will be expected to know and remember how to do the following:** **Pure** ● Factorise, expand linear, quadratic and cubic expressions. ● Solve linear, quadratic, and simultaneous equations. ● Know and use the laws of indices ● Simplify and use the rules of surds Rationalise denominators ● Solve quadratic equations using factorisation, the quadratic formula and completing the square ● Sketch the graph and find the turning point of a quadratic functions ● Find and interpret the discriminant of a quadratic expression ● Use and apply models that involve quadratic functions Sketch the graph and find the turning point of a quadratic function ● Find and interpret the discriminant of a quadratic expression ● Represent linear and quadratic inequalities graphically ● Transform graphs of unfamiliar functions ● Solve length and area problems on coordinate grids ● Use straight lines to construct Mathematical models ● Solve geometric problems involving lines and circles ● Find the angle in a semi-circle involving circles and triangles	**By the end of term 2, students will be expected to know and remember how to do the following:** ● Find individual coefficients in a binomial expansion ● Make approximations using the binomial expansion ● Sketch simple transformations of trigonometric graphs ● Calculate the sine, cosine and tangent of any angle ● Know the exact trigonometric ratios for 30°, 45° and 60° ● Know and use the relationships tan θ = $\frac{sin\theta}{cos\theta}$ and $sin\theta^2 + cos\theta^2 = 1$ ● Solve simple trigonometric equations of the forms $sin\theta = k$, $cos\theta = k$ and $tan\,\theta = k$ ● Solve more complicated trigonometric equations of the ● Form sin $n\theta = k$ and $sin\,(\theta \pm a) = k$ and equivalent equations involving cos and tan ● Solve trigonometric equations that produce quadratics ● Calculate the magnitude and direction of a vector ● Understand and use position vectors **Statistics** ● Understand the binomial distribution as a model and comment on the appropriateness	**By the end of term 3, students will be expected to know and remember how to do the following:** ● Sketch graphs of the form y = ax, y = ex and transformations of these graphs ● Differentiate eAv and understand why this result is important ● Use and interpret models that use exponential functions ● Recognise the relationship between exponents and logarithms ● Recall and apply the laws of logarithms ● Solve equations of the form ax = b ● Describe and use the natural logarithm function -» ● Use logarithms to estimate the values of constants in non-linear models **Mechanics** ● Use differentiation to solve kinematics problems ● Use calculus to solve problems involving maxima and minima ● Use integration to solve kinematics problems ● Use calculus to derive constant acceleration formulae **Year 2** ● Differentiate trigonometric functions, exponentials and logarithms ● Differentiate functions using the chain, product and quotient rules

12	● Cancel factors in algebraic fractions Find the derivative, f'(x) or $\frac{dy}{dx}$ of a simple function ● Use the derivative to solve problems involving gradients, tangents and normals ● Identify increasing and decreasing functions ● Find the second-order derivative, f''(x) or $\frac{d2y}{dx2}$ of a simple function ● Find stationary points of functions and determine their nature ● Sketch the gradient function of a given function ● Model real-life situations with differentiation ● Find y given $\frac{dy}{dx}$ for x^n ● Integrate polynomials ● Find f(x), given f '(x) and a point on the curve ● Evaluate a definite integral ● Find the area bounded by a curve and the y-axis ● Find areas bounded by curves and straight lines **Mechanics** ● Derive the constant acceleration formulae and use them to solve problems ● Use the constant acceleration formulae to solve problems involving vertical motion under gravity **Statistics** ● Understand the large data set and how to collect data from it, identify types of data and calculate simple statistics ● Calculate measures of central tendency such as the mean, median and mode ● Calculate measures of location such as percentiles and deciles	● Calculate individual probabilities for the binomial distribution ● Calculate cumulative probabilities for the binomial distribution ● Understand the language and concept of hypothesis testing ● Understand that a sample is used to make an inference about a population ● Find critical values of a binomial distribution using tables ● Carry out a one-tailed test for the proportion of the binomial distribution and interpret the results ● Carry out a two-tailed test for the proportion of the binomial distribution and interpret the results **Mechanics** ● Draw force diagrams and calculate resultant forces Understand and use Newton's first law ● Calculate resultant forces by adding vectors ● Understand and use Newton's second law, F=ma ● Apply Newton's second law to vector forces and acceleration ● Understand and use Newton's third law ● Solve problems involving connected particles ● Understand that displacement, velocity and acceleration may be given as functions of time	● Differentiate parametric equations ● Differentiate functions which are defined implicitly Use the second derivative to describe the behaviour of a function ● Solve problems involving connected rates of change and construct simple differential equations **Transition to Year 13** ● Understand and use the modulus function ● Understand mappings and functions, and use domain and range ● Combine two or more functions to make a composite function ● Know how to find the inverse of a function graphically and algebraically ● Sketch the graphs of the modulus functions,)' = \f(x)\ and y = f(|x|)Apply a combination of two (or more) transformations to the same curve ● Transform the modulus function **Mechanics** ● Model motion under gravity for an object projected horizontally ● Resolve velocity into components ● Solve problems involving particles projected at an angle ● Derive the formulae for the time of flight, range and greatest height, and the equation of the path of a projectile

	● Calculate measures of spread such as range, interquartile range and inter-percentile range ● Calculate the variance and standard deviation ● Understand and use coding ● Identify outliers in data sets ● Draw and interpret statistical diagrams.		
13	**By the end of term 1, students will be expected to know and remember how to do the following:** **Pure 2** ● Integrate standard mathematical functions including trigonometric and exponential functions and use the reverse of the chain rule to integrate functions of the form $f(ax + b)$ ● Use trigonometric identities in integration ● Use the reverse of the chain rule to integrate more complex functions ● Integrate functions by making a substitution, using integration by parts and using partial fractions ● Use integration to find the area under a curve ● Use the trapezium rule to approximate the area under a curve. ● Solve simple differential equations and model real-life situations with differential equations ● Use proof by contradiction to prove true statements ● Multiply and divide two or more algebraic fractions ● Add or subtract two or more algebraic fractions ● Convert an expression with linear factors in the ● denominator into partial fractions ● Convert an expression with repeated linear factors in the denominator into partial fractions ● Divide algebraic expressions	**By the end of term 2, students will be expected to know and remember how to do the following:** **Pure 2:** ● Find the nth term of an arithmetic sequence ● Prove and use the formula for the sum of the first n terms of an arithmetic series ● Find the nth term of a geometric sequence ● Prove and use the formula for the sum of a finite geometric series ● Prove and use the formula for the sum to infinity of a convergent geometric series ● Use sigma notation to describe series ● Generate sequences from recurrence relations ● Model real-life situations with sequences and series ● Expand (1 + x)" for any rational constant n and determine the range of values of x for which the expansion is valid ● Expand (a + bx)" for any rational constant n and determine the range of values of x for which the expansion is valid ● Use partial fractions to expand fractional expressions Convert between degrees and radians and apply this to trigonometric graphs and their transformations	**By the end of term 3, students will be expected to know and remember how to do the following:** **Pure 2:** ● Convert parametric equations into Cartesian form by substitution ● Convert parametric equations into a Cartesian form using trigonometric identities ● Understand and use parametric equations of curves and sketch parametric curves ● Solve coordinate geometry problems involving parametric equations ● Use parametric equations in modelling in a variety of contexts ● Locate roots of f(x) 0 by considering changes in the sign ● Use iteration to find an approximation to the root of the equation f(x) O ● Use the Newton-Raphson procedure to find approximations ● to the solutions of equations of the form f(x) 0 ● Use numerical methods to solve problems in context ● Understand 3D Cartesian coordinates ● Use vectors in three dimensions

13	● Convert an improper fraction into partial fraction form **Mechanics 2 – Moments** ● Resolve forces into components ● Use the triangle law to find a resultant force ● Solve problems involving smooth or rough inclined planes ● Understand friction and the coefficient of friction. ● Use $F = \mu R$ ● Calculate the turning effect of a force applied to a rigid body ● Calculate the resultant moment of a set of forces acting on a rigid body ● Solve problems involving uniform rods in equilibrium ● Solve problems involving non-uniform rods ● Solve problems involving rods on the point of tilting ● **Statistics 2 – Probability** ● Understand set notation in probability ● Understand conditional probability ● Solve conditional probability problems using two-way tables and Venn diagrams ● Use probability formulae to solve problems ● Solve conditional probability using tree diagrams	● Know the exact values of angles measured in radians ● Find an arc length using radians ● Find areas of sectors and segments using radians ● Solve trigonometric equations in radians ● Use approximate trigonometric values when is small ● Understand the definitions of secant, cosecant and cotangent and their relationship to cosine, sine and tangent ● Understand the graphs of secant, cosecant and cotangent and their domain and range ● Simplify expressions, prove simple identities and solve equations involving secant, cosecant and cotangent ● Prove and $use\ sec^2 x \equiv 1 + tan^2 x$ and $cosec^2 x \equiv 1 + cot^2 x$ ● Understand and use inverse trigonometric functions and their ● domain and ranges. ● Prove and use the addition formulae ● Understand and use the double-angle formulae ● Solve trigonometric equations using the double-angle and addition formulae ● Write expressions of the form $acos\,\theta \pm bsin\,\theta$ in the forms $Rcos(\theta \pm \alpha\ or\ R\ sin(\theta \pm \alpha)$ ● Prove trigonometric identities using a variety of identities ● Use trigonometric functions to model real-life situations ●	● Use vectors to solve geometric problems ● Model 3D motion in mechanics with vectors **Mechanics 2 –** ● Work with vectors for displacement, velocity and acceleration when using the vector equations of motion ● Use calculus with harder functions of time involving variable acceleration ● Differentiate and integrate vectors with respect to time

13		**Mechanics 2 – Forces** ● Find an unknown force when a system is in equilibrium ● Solve statics problems involving weight, tension and pulleys ● Understand and solve problems involving limiting equilibrium ● Solve problems involving motion on rough or smooth inclined planes ● Solve problems involving connected particles that require the resolution of forces **Statistics 2 – Probability** ● Understand exponential models in bivariate data ● Use a change of variable to estimate coefficients in an exponential model ● Understand and calculate the product-moment correlation coefficient ● Carry out a hypothesis test for zero correlation ●	

What will students be expected to **know and remember**?

Further Mathematics

Years			
AS	**By the end of term 1, students will be expected to know and remember how to do the following:** **Core Pure** ***Complex numbers*** ● Understand and use the definitions of imaginary and complex numbers ● Add and subtract complex numbers ● Multiply complex numbers ● Understand the definition of a complex conjugate ● Divide complex numbers ● Solve quadratic equations that have complex roots ● Solve cubic or quartic equations that have complex roots ● Evaluate and simplify series of the form where f(r) is linear, quadratic or cubic ***Matrices*** ● Understand the concept of a matrix ● Define the zero and identity matrices ● Add and subtract matrices Multiply a matrix by a scalar Multiply matrices ● Calculate the determinant of a matrix Find the inverse of a matrix ● Use matrices to solve systems of equations Interpret simultaneous equations geometrically ***Algebra and Functions*** ● Show complex numbers on an Argand diagram ● Find the modulus and argument of a complex number ● Write a complex number in the modulus-argument form ● Represent loci on an Argand diagram ● Represent regions on an Argand diagram	**By the end of term 2, students will be expected to know and remember how to do the following:** **Core Pure** ● Understand the properties of linear transformations and represent them using matrices ● Perform reflections and rotations using matrices ● Carry out enlargements and stretches using matrices ● Find the coordinates of invariant points and the equations of invariant lines ● Carry out successive transformations using matrix products ● Understand linear transformations in three dimensions ● Use inverse matrices to reverse linear transformations ***Vectors*** ● Understand and use the vector and Cartesian forms of the equation of a straight line in three dimensions ● Understand and use the vector and Cartesian forms of the equation of a plane ● Calculate the scalar product for two 3D vectors Calculate the angle between two vectors, two lines, a line and a plane, or two planes ● Understand and use the scalar product form of the equation of a plane ● Determine whether two lines meet and determine the point of intersection	**By the end of term 3, students will be expected to know and remember how to do the following:** **Core Pure** ***Hyperbolic functions*** ● Understand the definitions of hyperbolic functions ● Sketch the graphs of hyperbolic functions Understand and use the inverse hyperbolic functions ● Prove identities and solve equations using hyperbolic functions ● Differentiate and integrate hyperbolic functions **Decision Mathematics** ***Travelling Salesman*** ● Explain the differences between classical and practical problems ● Use a minimum spanning tree method to find an upper bound ● Use a minimum spanning tree method to find a lower bound ● Use the nearest neighbour algorithm to find an upper bound

AS	● Derive and use the relationships between the roots of a quadratic equation ● Derive and use the relationships between the roots of a cubic equation ● Derive and use the relationships between the roots of a quartic equation ● Evaluate expressions relating to the roots of polynomials ● Find the equation of a polynomial whose roots are a linear transformation of the roots of a given polynomial ● Find the volume of revolution when a curve is rotated around the x-axis ● Find the volume of revolution when a curve is rotated around the y-axis ● Find more complicated volumes of revolution ● Model real-life objects using volumes of revolution ***Proof*** ● Understand the principle of proof by mathematical induction and prove results about sums of series ● Prove results about divisibility using induction ● Prove results about matrices using induction **Further Mechanics** ***Momentum and Impulse*** ● Calculate the momentum of a particle and the impulse of « force ● Solve problems involving collisions using the principle of conservation of momentum ● Use the impulse-momentum principle and the principle of conservation of momentum in vector form ***Work Energy and Power***	● Calculate the perpendicular distance between two lines, a point and a line, or a point and a plane **Further Mechanics** ***Work Energy and Power*** ***Elastic Collision in One dimension*** ● Solve problems involving the direct impact of two particles by using the principle of conservation of momentum and Newton's law of restitution ● Apply Newton's law of restitution to problems involving the direct collision of a particle with a smooth plane Surface ● Find the change in energy due to an impact or the application of an impulse ● Solve problems involving successive direct impacts **Decision Mathematics** ***Algorithms on Graphs*** ● Use Kruskal's algorithm to find a minimum spanning tree ● Use Prim's algorithm on a network to find a minimum spanning tree ● Apply Prim's algorithm to a distance matrix ● Use Dijkstra's algorithm to find the shortest path between two vertices in a network ● Use Floyd's algorithm ***Route inspection*** ● Use the orders of nodes to determine whether a graph is Eulerian semi-Eulerian or neither	

AS	● Calculate the work done by a force when its point of application moves ● Calculate the kinetic energy of a moving particle and the potential energy of a particle ● Use the principle of conservation of mechanical energy and the work-energy principle ● Calculate the power developed by an engine **Decision Mathematics** ***Algorithms*** ● Use and understand an algorithm given in words ● Understand how flow charts can be used to describe algorithms ● Carry out a bubble sort ● Carry out a quick sort ● Carry out the three bin-packing algorithms and understand their strengths and weaknesses. ● Determine the order of an algorithm ***Graphs and networks*** ● Know how graphs and networks can be used to create mathematical models ● Be familiar with basic terminology used in graph theory ● Know some special types of graphs -* ● Understand how graphs and networks can be represented using matrices ● Use the planarity algorithm to determine whether or not a given graph is planar	● Use the route inspection (Chinese postman) algorithm to find the shortest route in a network ● Use the route inspection algorithm in networks with more than four odd nodes ***Linear programming.*** ● Formulate a problem as a linear programming problem ● Illustrate a two-variable linear programming problem graphically ● Locate the optimal point in a feasible region using the objective line (ruler) method ● Use the vertex testing method to locate the optimal point ● Determine solutions that need integer values	
	By the end of term 1, students will be expected to know and remember how to do the following: **Core Pure** ● Express a complex number in exponential form	**By the end of term 2, students will be expected to know and remember how to do the following:** **Core Pure** ***Further Calculus*** ● Evaluate improper integrals	**By the end of term 3, students will be expected to know and remember how to do the following:** **In preparation for the exams** **Core Pure** ● Consolidation of Core Pure

A2	● Multiply and divide complex numbers in exponential form ● Understand de Moivre's theorem ● Use de Moivre's theorem to derive trigonometric identities ● Use de Moivre's theorem to find sums of series ● Know how to solve completely equations of the form z" - ● giving special attention to cases where a = 1 and b = 0 ***Polar coordinates*** ● Understand and use polar coordinates ● Convert between polar and Cartesian coordinates Sketch curves with r given as a function of 0θ ● Find the area enclosed by a polar curve ● Find tangents parallel to, or at right angles to, the initial line ***Further algebraic and functions series*** ● Understand and use the method of differences to sum finite series ● Find and use higher derivatives of functions ● Know how to express functions as an infinite series in ascending powers using Maclaurin series expansion ● Be able to find the series expansions of compound functions **Further Mechanics** ***Elastic strings and springs*** ***Elastic energy*** ● Use Hookes law to solve equilibrium problems involving elastic strings or springs	● Understand and evaluate the mean value of a function ● Integrate rational functions using trigonometric substitutions ● Integrate using partial fractions ● Evaluate improper integrals ● Understand and evaluate the mean value of a function ● Integrate rational functions using trigonometric substitutions ● Integrate using partial fractions ● ● Find volumes of revolution around the x-axis ● Find volumes of revolution around the y-axis ● Find volumes of revolution for curves defined parametrically ● Model real-life applications of volumes of revolution ***Differential Equations*** ● Solve first-order differential equations using an integrating factor ● Solve second-order homogeneous differential equations using the auxiliary equation ● Solve second-order non-homogeneous differential equations using the complimentary function and the particular integral ● Find particular solutions to differential equations using given boundary conditions ● Model real-life situations with first-order differential equations	**Further Mechanics** ● Consolidation of Further Mechanics **Decision Mathematics** ● Consolidation of Decision

A2	● Use Hooke's law to solve dynamics problems involving elastic strings Or springs ● Find the energy stored in an elastic string or spring ● Solve problems involving elastic energy using the principle of conservation of mechanical energy and the work-energy principle **Decision Mathematics** ***The Simplex Algorithm*** ● Understand and use slack and surplus variables is ● Solve maximising and minimising linear programming problems using simplex tableaux ● Use the simplex tableau method to solve linear programming problems requiring integer solutions ● Understand and use the two-stage simplex method for maximising and minimising problems which may include and 2= constraints ● Understand and use the Big-M method for maximising and minimising problems which may include « and constraints	● Use differential equations to model simple harmonic motion ● Model damped and forced oscillations using differential equations ● Model real-life situations using coupled first-order differential equations **Further Mechanics** ***Elastic Collisions in two dimensions*** ● Solve problems involving the oblique impact of a smooth sphere with a fixed surface ● Solve problems involving the oblique impact of two smooth spheres ● Solve problems involving successive oblique impacts of a sphere with a smooth plane surface **Decision Mathematics** ***Critical path analysis*** ● Model a project by an activity network using a precedence table ● Use dummy activities - ● Identify and calculate early and late event times in activity networks ● Identify critical activities	