Our Lady's Catholic College

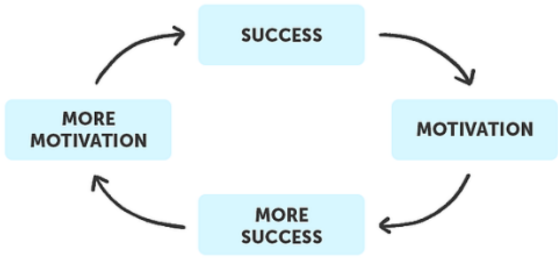
MATHEMATICS

Our Lady's Catholic College, Morecambe road, Lancaster, La12rx

Department Vision and Values

We firmly believe that everybody can be a mathematician and that all students have the right to experience mathematics in a safe but academically challenging environment.

It is our belief that every student in mainstream education has the potential to successfully engage with the GCSE course. There is no evidence that compels us to believe that there is anything innate in our students that means they cannot be successful in our classrooms. We are aware that students may have had experiences in mathematics that has led them to believe that this isn't the subject for them. In these cases, we need to get students into a success/motivation cycle. We do not believe that engagement in maths needs to come from elsewhere; from gratuitous examples of its use in "real-life" or from activities where the maths takes a back seat. We believe that the ability to overcome a problem, to explore a fascinating pattern and grapple with complex ideas are possible to be endorphin-rich, enjoyable experiences which all students are entitled to. If they are lacking motivation, it is our job to ensure they are having success. If, in the short term, it means making them feel successful through whatever means necessary, then we know that this can pay off in the long run and is worth the initial investment in time. Where possible this feeling of success will come from appropriately pitching the content from the curriculum but if it means going "off-script" for a short period of time with a greater good in mind then so be it.



Implementation

We aim to turn our vision into reality by focussing on three key areas:

1. Evidence-based Teaching and Learning
2. Ambitious Curriculum for All
3. Assessment to improve

2. Ambitious Curriculum for All

Curriculum Intent

We strongly believe in providing students with an ambitious mathematics curriculum that takes into account their prior attainments; equips them with essential skills and knowledge, sparks curiosity, and prepares them effectively for both daily life and future careers. We place heavy emphasis in achieving numerical fluency in Year 7 and our mathematics curriculum aims to offer students the following opportunities:

- Cultivate fluency in foundational mathematical concepts: Through frequent and diverse practice, students will progressively engage with increasingly complex problems. This approach will enable them to develop a deep conceptual understanding, as well as the ability to recall and apply their knowledge rapidly and accurately
- Foster mathematical reasoning: Students will learn to think mathematically by exploring various lines of inquiry, formulating conjectures about relationships and generalizations, and constructing arguments, justifications, and proofs using the language of mathematics
- Enhance problem-solving skills: Students will develop the capacity to apply their mathematical knowledge to a wide range of routine and non-routine problems. As they progress, they will acquire more sophisticated problem-solving techniques, including the ability to break down complex problems into a series of manageable steps. They will also develop perseverance in their quest for solutions
- Foster effective communication and justification: Our curriculum will emphasize the development of oracy - students' ability to communicate, justify, argue, and prove mathematical ideas using appropriate vocabulary. This skill will enable them to express their thoughts clearly and effectively in a mathematical context
- Promote character development: Our curriculum recognizes the importance of character education. By engaging with mathematics, students will develop valuable traits such as resilience, confidence, and independence. These qualities will enable them to make positive contributions not only within the school environment but also in their local community and the broader world
- In summary, our mathematics curriculum aims to empower and challenge students to realise their absolute best by providing them with a rich, engaging, and comprehensive learning experience. We strive to ignite their passion for mathematics, equip them with the necessary skills and knowledge necessary to become a successful member of our society in the 21st century.

Key Stage 3 Curriculum Overview

Year 7	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	Baseline Assessments	Unit 1 - Place Value				Unit 2 - Calculations				Unit 3 - Negatives			Unit 4 - Fractions		
MIGS		F	F	F	S	F	F	F	S	F	F	S	F	F	F
Spring	Unit 4 - Fractions		Unit 5 - Indices					Unit 6 - Algebra							
MIGS	F	S	F	F	F	F	S	F	F	F	F				
Summer	Unit 6 - Algebra	Unit 7 - Measures				Unit 8 - Area					Unit 9 - FDP				
MIGS	S	F	F	F	S	F	F	F	F	S	F	F	S		

Year 8	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	Assessments	Unit - 1 Expressions						Unit 2 - Angles					Unit 3 - Formulae		
MIGS		F	F	F	F	F	S	F	F	F	F	S	F	F	S
Spring	Unit 4 - Area					Unit 5 - Equations					Unit 6				
MIGS	F	F	F	F	S	F	F	F	F	S	F				
Summer	Unit 6 - Number Theory and Sequences				Unit 7 - Co-ordinates					Unit 8 - Statistics					
MIGS	F	F	F	S	F	F	F	F	S	F	F	F	S		

Year 9	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	Unit 1 - Non Calculator FDP						Unit 2 - Linear Graphs				Unit 3 - Transformations			Unit 4 - Non-Calculator Ratio & Proportion	
MIGS	F	F	F	F	F	s	F	F	F	s	F	F	s	F	F
Spring	Unit 4 - Non-Calculator Ratio & Proportion		Unit 5 - Angles & Similarity				Unit 6 - Trigonometry				Unit 7				
MIGS	F	S	F	F	F	S	F	F	F	S	F				
Summer	Unit 7 - Probability			Unit 8 - Maps & Constructions					Unit 9 - Calculations						
MIGS	F	F	S	F	F	F	F	S	F	F	F	F	S		

Key Stage 4 Curriculum Overview

Year 10	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	1. Equations and Inequalities			2. Congruence, Similarity and Enlargement		3. Right Angled Triangles			4. Angles and Bearings	5. Simultaneous Equations			6. Circles and Volume		
MIGS	F	F	S	F	S	F	F	S	FS	F	F	S	F	F	S
Spring	7. Vectors	8: Ratios and Fractions		9. Percentages and Interest		10. Data			11. Probability						
MIGS	FS	F	S	F	S	F	F	S	F	F	S				
Summer	12. Number		13. Sequences			14. Indices and Roots			Exams		15. Problem solving		Maths Careers		
MIGS	F	S	F	F	S	F	F	S	S	S	F	F	F		

Year 11	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	1. Solving Equations and Inequalities		2. Linear and Non-Linear Graphs				3. Multiplicative Reasoning		4. Rearranging Equations and Using Functions		5. Geometric Reasoning			6. Algebraic Reasoning	7. Transforming and Constructing
MIGS	F	S	F	F	F	S	F	S	F	S	F	F	S	F	S
Spring	7. Transforming and Constructing	8. Probability and statistics		Exam Practice 1		Feeback and re-teach	Exam Practice 2		Feeback and re-teach	Exam Practice 2					
MIGS	FS	F	S	S	S	F	S	S	FS	S	S				
Summer	Feeback and re-teach	Exam Practice 1		Feeback and re-teach	Exam Practice 1		Feeback and re-teach	Exams							
MIGS	F	S	S	F	S	S									

Key Stage 5 Overview

Year 12	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	Unit 1: Algebra and functions, Unit 1: Statistical sampling, Unit 2a: Data presentation and interpretation, Unit 6: Quantities and units in mechanics, Unit 7a: Kinematics 1 (constant acceleration)								Unit 2: Coordinate geometry in the (x, y) plane, Unit 3: Further algebra, Unit 2b: Data presentation and interpretation, Unit 7b: Kinematics 1 (constant acceleration)						
MIGS	F	F	F	S	F	F	F	S	F	F	F	S	F	F	S
Spring	Unit 4: Trigonometry, Unit 5: Vectors (2D), Unit 3: Probability, Unit 4: Statistical distributions, Unit 8a: Forces & Newton's laws					Unit 6: Differentiation, Unit 7: Integration, Unit 5a: Statistical hypothesis testing, Unit 8b: Forces & Newton's laws									
MIGS	F	F	F	F	S	F	F	S	F	F	S				
Summer	Unit 8: Exponentials and logarithms, Unit 5b: Statistical hypothesis testing, Unit 9: Kinematics 2 (variable acceleration), Revision (AS level)							Exams		Unit 1: Proof, Unit 2: Algebraic and partial fractions					
MIGS	F	F	S	F	F	S	S	S	S	F	F	F	S		

Year 13	Week 1 (Wed)	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15 (12:30 finish)
Autumn	Unit 3: Functions and modelling, Unit 4: Series and sequences, Unit 5: The binomial theorem, Unit 1: Regression and correlation, Unit 1: Regression and correlation								Unit 6: Trigonometry, Unit 7: Parametric equations, Unit 2: Probability , Unit 5: Forces at any angle						
MIGS	F	F	F	S	F	F	F	S	F	F	F	S	F	F	S
Spring	Unit 8: Differentiation, Unit 8: Differentiation, Unit 3a: The Normal distribution, Unit 6: Applications of kinematics						Unit 10: Integration (part 1), Unit 11: Integration (part 2), Unit 3b: The Normal distribution, Unit 7: Applications of forces								
MIGS		F		F		S		F	F		S				
Summer	Unit 12: Vectors (3D), Unit 3c: The Normal distribution, Unit 8: Further kinematics, Revision (A level)								Exams						
MIGS	F	F	F	S	F	F	F	S							

F denotes Formative Assessments and S denotes Synoptic Assessments (See Assessments notes below)

Y7 – Y13 Curriculum Content

Year 7		Know and Know how to
Topic	**Skills**	**Learning Objectives (small steps)**
7.1 Place Values	Writing numbers in figures, up to the millions.	Know 1. that decimal point never moves and operations on numbers moves the figures Know how to 1. Identify the value of the digit in a given number 2. Write down a number with given value of place value. E.g. Write a number with a value of 600 or Write a 5-digit number with a value of 3000. Is it possible to write a 4-digit number with a value of 40000? 3. Order integer numbers
7.1 Place Values	Converting between fractions and decimals using the place value structure.	Know 1. The anatomy of a fraction Know how to 1. Say and Write simple fractions (Mixed, Ones, tenths, hundredths and thousandths) as decimals. E.g. 3/10 as 0.3, 7 and 9/10 as 7.9 2. Write decimal numbers as Mixed numbers or fractions. 3. Write down the value of a chosen digit in a given number 4. Say and Write complex fractions (e.g. 203/1000) as decimals
7.1 Place Values	Recognising different types of decimals and using recurring decimal dot notation.	Know 1. The terms - Identify Terminating, Recurring and Irrational numbers Know how to 1. Write their own T, R and I decimal numbers 2. Add Recurring decimals 3. identify when the square root sign produces irrational numbers
7.1 Place Values	Using inequality symbols to order and compare decimals and fractions using place value.	Know 1. and recognise the inequality signs Know how to 1. Use the inequality signs to make true statements 2. Compare decimals and use the correct inequality signs 3. Order a group of decimals 4. work out the intervals of a number line 5. correctly place a number on a number line 6. Write a decimal number between two given decimals (Midpoint)
7.1 Place Values	Rounding to the nearest integer or a given number of decimal places.	Know 1. d.p. stands for rounded to ___ decimal places 2. sf stands for rounded to ____ significant figures Know how to 1. use a number line to round decimals off integers 2. Use the Line and Decider method to round decimals to integers 3. use the line and Decider method to round to decimals to a given number of decimal places 4. Work out the smallest and biggest number a number could have been before it was rounded
7.1 Place Values	Rounding integers and decimals to a given number of significant figures.	Know how to 1. Identify the first significant figure in any given integer 2. Identify any significant figures in any given integer
7.2 Calculations	Using the column method to add and subtract with decimals	Know how to 1. Set up Decimal addition and subtraction by lining up the decimal point 2. Add and subtract decimals using the column method

7.2 Calculations	Using short division to convert fractions to decimals	Know 1. Division can be expressed as a fraction and vice versa Know how to 1. Set up a short division 2. Complete a short division with a terminating decimal 3. Divide Integers with decimal answers 4. Divide Decimal by an integer
7.2 Calculations	Multiplying and dividing by 10,100,1000. Extension: Multiplying & dividing by 0.1,0.01 etc	Know 1. The connection between the Place Value table and Multiplying dividing by powers of 10 Know how to 1. Multiplying and dividing by 10,100,1000. 2. What happens when you multiply or divide a number by 10, 100 and 1000 3. Multiplying by 0.1, 0.01 etc 4. Dividing by 0.1, 0.01 etc
7.2 Calculations	Multiplying decimals using related calculations	Know how to 1. Use a base calculation to work out answers to similar questions
7.2 Calculations	Consider the effect of dividing by 0.5, 0.1, 0.01 and 0	Know 1. The effect of dividing by 0.5, 0.1 and 0 Know how to 1. use the effect of dividing by 0.5, 0.1, 0
7.2 Calculations	Consider the effect of changing either divisor or dividend in a calculation - how does the answer change?	Know 1. and describe what happens when the divisor or dividend increases 2. and describe what happens when the divisor or dividend decreases
7.3 Negatives	Place negative numbers in order of size	Know how to 1. order negative numbers 2. order negative decimal numbers 3. Compare negative numbers using inequality sign
7.3 Negatives	Calculate simple additions and subtractions by considering journeys along the number line	Know how to 1. Carry out directed numbers calculations using empty number line Addition) Use Starting number method. E.g. -5 + 6 means start at -5 and go up 6. 2. Create or complete zero-sum pairs 3. Carry out directed numbers calculations using empty number line Subtraction) Use Starting number method. E.g. -5 + 6 means start at -5 and go up 6.
7.3 Negatives	Add or subtract a negative number	Know how to 1. add negative numbers with "adding a negative number " notation. E.g. 7 + - 4. Do not use two negative makes a positive rule! Use algebra tiles! 2. Subtract Negative numbers Care needs to be taken with this module as it is one of the most difficult skills to correct!
7.3 Negatives	Multiply and divide with negative numbers	Know 1. the definition of Product Know how to 1. multiply two more integers 2. predict the sign of the product
7.3 Negatives	Mixed practice calculating with all four operations	Know how to 1. Add, subtract, multiply and divide integers
7.3 Negatives	Extension: Add, subtract, multiply and divide with negative decimals	Know how to 1. Add, subtract, multiply and divide simple +/- decimal numbers
7.4 Fractions	Recognising that 1 whole is made up of a number of equal parts.	Know 1. parts of a fractions Know how to 1. say fractions correctly 2. write down fractions from shaded diagrams place fractions on a number line 3. understands how one whole can be represented by a fraction 4. change one whole in fractions calculations

7.4 Fractions	Convert between mixed numbers and improper fractions.	Know 1. that amount bigger than 1 can be represented by improper fractions and mixed numbers Know how to 1. Convert improper fractions to Mixed Number 2. Convert Mixed Numbers to improper fractions
7.4 Fractions	Find a fraction of an amount. Solve reverse fraction problems.	Know 1. The word "of" can mean multiply 2. Calculators has fraction, mixed number and S/D button Know how to 1. find fractions of an amount using non-calculator method. 1%, 10% etc 2. find fractions of an amount using a calculator
7.4 Fractions	Identify equivalent fractions & simplify fractions.	Know: 1. that equivalent Fractions have the same value Know how to: 1. create equivalent fractions by multiplying or dividing 2. simplify fractions to their simplest form
7.4 Fractions	Convert between fractions and decimals using equivalent fractions, short division & place value.	Know: 1. Fractions are the same as division Know how to: 1. convert fractions into decimals by changing the denominators into powers of ten 2. convert fractions into decimals by cancelling first then changing the denominator into powers of ten 3. Convert fractions into decimals by short division 3. convert decimals into fractions using place value tables
7.4 Fractions	Add and subtract fractions with like or unlike denominators.	Know: 1. Fraction can be added or subtracted is the denominators are the same Know how to: 1. add fractions with the same denominator 2. add fractions with different denominators
7.4 Fractions	Multiply fractions, identify reciprocals and divide fractions.	Know: 1. "lots of" and "of" means multiply 2. to always check the fraction answers are in their simplest form and the correct format (e.g. mixed number) 3. what a reciprocal means 4. that dividing by a number is the same as multiplying by its reciprocal Know how to: 1. multiply fractions without common factors 2. multiply fractions with common factors with cancelling before or after multiplying 3. Multiply an integer and a fraction 4. Find the reciprocal of a fraction/integer 5. Divide fractions by fractions and integers
7.4 Fractions	Extension: use all four operations with fractions and mixed numbers.	Know: 1. Structure of a mixed number Know how to: 1. multiply fractions without common factors 2. multiply fractions with common factors with cancelling before or after multiplying 3. Multiply an integer and a fraction 4. Find the reciprocal of a fraction/integer 5. Divide fractions by fractions and integers 6. carry out all four operations with Mixed numbers
7.4 Fractions	Combining skills from the previous 3 chapters, calculate fluently with fractions, decimals and negatives.	
7.5 Indices	Use index notation with positive, negative, fractional and decimal bases.	Know how to 1. Use integer notation with positive integer bases 2. Use integer notation with fractional and decimal bases 3. Use integer notation with negative bases
7.5 Indices	Recognise and use zero and negative indices.	Know how to 1. Use integer notation with zero and negative indices

7.5 Indices	Use the multiplication, division and power laws of indices.	Know how to 1. Multiply with indices of the same base 2. Divide with indices of the same base 3. Index Law: Power law 4. Combine index laws
7.5 Indices	Calculate roots with integer and decimal answers. Estimate square roots. Extension: roots of negative and fractional numbers.	Know how to 1. Find integer roots 2. Understand indices notation for roots 3. Define a surd 4. Find decimal roots 5. Estimate roots 6. Find roots of negative numbers 7. Understand that negative numbers cannot be square rooted 8. Find roots of fractions
7.5 Indices	Use the order of operations correctly and know how to use a calculator with indices, roots, fractions and negatives.	Know 1. and understand BIDMAS Know how to 1. use order of operations (BIDMAS) not involving indices 2. use order of operations (BIDMAS) involving indices 3. Use a calculator with indices, roots, fractions and negatives
7.6 Intro to Algebra	Recognise like terms. Add and subtract terms to simplify expressions.	Know how to 1. Identify like and unlike terms 2. Add and subtract like terms containing the same variable and no indices 3. Add and subtract like terms including a variable and an integer (no indices) 4. Collect like terms including multiple variables (no indices)
7.6 Intro to Algebra	Multiply variables, using index notation and the laws of indices.	Know how to 1. Simplify products of integers and different variables 2. Simplify products of integers and variables, including a repeated variable. Write in index notation. 3. Simplify products including a variety of repeated variables, and understand which are like terms to be collected into the same index. 4. Understand the difference between simplifying by adding and simplifying by multiplying. 5. Collecting variables with the same base into one power 6. Raising a variable with a power to another power 7. Combining index laws
7.6 Intro to Algebra	Extension: Multiply and divide fractions involving variables.	Know how to 1. Multiply fractions with a simple algebraic numerator or denominator by a simple numerical fraction or integer. 2. Multiply fractions containing different variables 3. Find the reciprocal of an algebraic fraction 4. Dividing simple algebraic fractions containing different variables
7.6 Intro to Algebra	Use all four operations with variables.	Know how to 1. Write divisions in algebraic notation as a fraction 2. Simplify mixed calculations using standard algebraic notation
7.6 Intro to Algebra	Substitute positive and negative numbers into expressions.	Know how to 1. Substitute positive integers into simple 1 and 2 step expressions 2. Substitute negative integers into simple 1 and 2 step expressions 3. Substitute fractions into simple expressions 4. Substitute integers into more complex expressions
7.6 Intro to Algebra	Solve equations involving one or two steps.	Know how to 1. Solving one-step equations by addition and subtraction 2. Solving one-step equations by multiplication and division 3. Solving one-step equations with indices and roots 4. Solving two-step equations 5. Solving two-step equations involving fractions
7.7 Working with Measures	Estimate the answer to calculations & identify error intervals of rounded measurements.	Know how to 1. Round numbers to 1 significant figure. 2. Estimate calculations. 3. Calculate error intervals. 4. Calculate upper and lower bounds.

7.7 Working with Measures	Work with large and small numbers and measures written in standard form.	Know 1. location of the standard form button Know how to 1. Express numbers in standard form. 2. Convert from standard form to ordinary numbers.
7.7 Working with Measures	Estimate metric lengths & heights. Convert between metric units for length.	Know 1. Units of metric lengths 2. Lengths and Heights uses the same units Know how to 1. Estimate most likely units e.g. A car would more likely be 3m long rather than 3cm long. 2. Understand metric conversions e.g. 100cm=1m. 3. Convert metric lengths e.g. How many m are there in 2.5km?. 4. Converting metric lengths with standard form.
7.7 Working with Measures	Calculate perimeters, including the circumference or circles. Write expressions for lengths & perimeters. Solve equations involving perimeter.	Know how to 1. Calculate perimeters of shapes. 2. Calculate missing side lengths of compound shapes. 3. Calculate the perimeter of compound shapes. 4. Calculate missing side lengths given the perimeter. 5. Write an expression for perimeter. 6. Understand the diameter and radius of a circle. 7. Calculate the circumference of a circle. 8. Form and solve equations with perimeter.
7.7 Working with Measures	Convert between units of time and calculate time intervals. Extension: calculate speeds, distances and times.	Know 1. Units of time Know how to 1. Convert between units of time. 2. Convert between 24 hour and 12-hour clock formats. 3. Calculations with time. 4. Calculate speed, distance and time.
7.8 Shapes, Area & Pythagoras	Recognise parallel, perpendicular and equal length lines. Construct squares. Recognise quadrilaterals by their properties.	Know: 1. the different names for the types of quadrilateral 2. the markings to indicate parallel lines on a shape 3. that perpendicular lines will create a right angle 4. the meaning of symmetry vs rotational symmetry Know how to 1. Construct squares and other shapes with correct mathematical notation to show parallel lines and equal line lengths 2. To draw lines of symmetry on a shape 3. To find the order of rotational symmetry in a shape 4. To identify a quadrilateral based on the listed properties of the shape
7.8 Shapes, Area & Pythagoras	Know that area is measured in squares. Estimate areas using square mm, cm, m, and km. Extension: Convert between metric areas.	Know: 1. the difference between mm, cm, m 2. the meaning of the notational markings to show equal side lengths in a shape 3. to label the units of area as "squared" Know how to: 1. Calculate the area of squares (inc. when only given one side length) 2. Calculate the area of rectangles 3. Convert between mm, cm and m. 4. Find the area of a square or rectangle with different units for length, e.g. 20mm side and a 4cm side.

7.8 Shapes, Area & Pythagoras	Find the area of parallelograms, triangles, trapezia, compound shapes and circles.	Know: 1. the formula to work out the area of triangle 2. the formula to work out the area of a parallelogram 3. the formula to work out the area of trapezia Know how to: 1. Calculate the area of triangles (inc. extreme scalene triangles) 2. Calculate the area of parallelograms 3. Calculate the area of trapezia 4. Calculate the area of rectilinear shapes (L shapes) by breaking them into two smaller rectangles 5. Calculate the area of compound shapes that are composed of two different shapes, e.g. a triangle and a rectangle.
7.8 Shapes, Area & Pythagoras	Use Pythagoras to calculate diagonal lengths.	Know: 1. the Hypotenuse length in a right-angle triangle 2. the Pythagoras formula Know how to: 1. use the Pythagoras formula to find the Hypotenuse when given the two other sides 2. find a short length when given the Hypotenuse and one other side of a right-angle triangle 3. apply Pythagoras to real-life examples to find a missing length, e.g. a ladder against a wall
7.9 Fractions, Decimals & Percentages	Compare and order fractions and decimals. Extension: Convert recurring decimals to fractions.	Know: 1. The bigger the denominator, the smaller the unit 2. Apart from the very simple fractions, you should make sure the denominators are the same when you are comparing fractions 3. A fraction is bigger than 1 if the Denominator is bigger than Numerator Know how to: 1. Compare fractions and mixed number using the inequality signs 2. Convert decimals into fractions or Mixed Numbers 3. Compare fractions and Mixed Numbers with decimals
7.9 Fractions, Decimals & Percentages	Convert between fractions, decimals & percentages & compare and order them.	Know: 1. that percentages more than 100% will result in number bigger than 2. that Percentages, fractions and Decimal are all interconnected and any number in one of these formats can be converted into the other two Know how to: 0) How to input a fraction into a scientific calculator 1. Convert percentages into fractions and Mixed number in their simplest form 2. Convert any fractions (with factors of ten as denominator) into percentages without a calculator 3. Convert any fractions (non-simplest form) into percentages without a calculator 4. Convert fractions into percentages in pictorial form 5. Convert percentages into decimals 6. Convert any decimals into Percentages 7. Convert decimals into percentages 8. Convert fractions into decimals using a calculator using a calculator or short division
7.9 Fractions, Decimals & Percentages	Calculate a percentage of an amount mentally and using decimal multipliers.	Know: 1. "percentage of" means multiply by the decimal equivalent Know how to: 1. find percentage of an amount by chunking (23% = 10% + 10% + 1% +1% + 1%)
7.9 Fractions, Decimals & Percentages	Extension: Calculate percentage changes using decimal multipliers.	Know: 1. "percentage of" means multiply by the decimal equivalent Know how to: 0) write any percentage increase as a decimal multiplier 1. increase an decrease an amount by a percentage change 2. Distinguish the different multipliers for Finding the percentage of an amount, Increasing and deceasing by a given percentage. 3. Extract information from worded questions for calculating amount or percentage change

Year 8		Know and Know how to
Topic	Skills	Learning Objectives (small steps)
8.1 Expressions	Simplify expressions by collecting like terms.	Know 1. Algebraic terms such as Expressions, Terms, variables, unknown 2. Algebraic verbs such as collecting, simplify 3. any letters can represent any value and that different letters represent different values Know how to 1. Collect (only) like terms with positive and negative terms 2. Separate expressions with different terms 3. Collect like terms with two more types of variables 4. Write lengths and perimeters as algebra expressions. 5. Distinguish terms involving indices 6. Collect like terms with different indices
8.1 Expressions	Multiply expressions using index notation and the laws of indices.	Know how to 1. Multiply variables with positive coefficients and indices 2. Multiply variables with positive and negative coefficients and indices 3. Use the index Power Law with coefficient 4. Use the index Power Law with coefficient
8.1 Expressions	Simplify algebraic fractions and divide terms. Simplify expressions using all four operations.	Know how to 1. simplify algebraic fractions with single variables of power 1 2. simplify algebraic fractions with single variables of power 2 or more 3. simplify algebraic fractions with multiple variables of power 2 or more 4. simplify expressions with all four operations
8.1 Expressions	Use all four operations with variables and the order of operations to write expressions with and without context.	Know how to 1. Write expressions from function machines involving four operations 2. Write more complex expressions from function machines involving four operations and indices
8.1 Expressions	Multiply a term over a bracket. Factorise an expression into a single bracket. Extension: multiply out brackets and simplify. Write expressions for area.	Know 1. The process of factorising is the reverse of expanding brackets 2. the difference between factorise and fully factorise Know how to 1. Expand single brackets using the grid method (positive outside with coefficient) 2. Expand single brackets using the grid method (negative outside with coefficient) 3. find the HCF of two numbers 4. find the HCF of a number and a algebraic term 5. find the HCF of algebraic terms with indices 6. apply expanding brackets in solving area problems
8.2 Angles	Describe angles using three letter codes. Recognise types of angles and the notation for equal angles.	Know 0. Three letter Angle notation 1. the definition of angle, quarter turn, half turn and full turn and their degrees equivalent 2. the degree symbol 3. that there are other ways of measuring angles other than degrees 4. Types of angles - acute, obtuse and reflex 5. Angles that are the same are marked with double arcs 6. definition of an right angle and its symbol 7. the Greek letter Theta is often use to denote angles

8.2 Angles	Calculate angles on straight lines and adjacent angles around a full turn.	Know 1. Half turn is equivalent to 180 degrees 2. that angles on a straight line add up to 180 degrees and it only applies when the angles make up the half turn 3. that angles round a point add up to 360 degrees Know how to 1. calculate missing angle in half turn problems when one or more angles are given 2. calculate missing angle in full turn problems when one or more angles are given
8.2 Angles	Identify corresponding, alternate and co-interior angles. Find missing angles around parallel lines.	Know 1. Parallel lines notation 2. alternate, corresponding and co-interior angles are created whenever a line transverse a set of parallel lines 3. rule of corresponding, alternate and co-interior angles 4. Geometric reasoning must be stated when answering angle questions Know how to 1. identify alternate, corresponding and co-interior angles from a complex diagram 2. work out angles involving alternate, corresponding and co-interior angles by inspection 3. calculate angles involving alternate, corresponding and co-interior angles in multi-step problems
8.2 Angles	Recognise types of triangles and calculate the missing angles in triangles	Know 1. Types of triangles. Scalene, Isosceles, Equilateral and their length and angle properties 2. Angles inside a triangle add to 180 degrees Know how to 1. Calculate missing angles from the triangle types above 2. Calculate missing angles in more complex diagrams
8.2 Angles	Calculate missing angles in quadrilaterals. Reason geometrically to solve multi-step problems.	Know 1. definition of a quadrilateral 2. Angles inside quadrilaterals add up to 360 degrees 3. types of quadrilaterals, Parallelogram, Trapezium, Kite, arrowhead, Rhombus Know how to 1. Calculate missing angles in quadrilaterals 2. Calculate missing angles in special quadrilaterals
8.3 Formulae	Write a formula to describe a relationship between variables. Substitute positive and negative numbers into formulae.	Know 1. A formula is an equation that describe a relationship between variables. Know How to 1. construct a formula from descriptions or diagrams. E.g. Bar Modelling 2. Work out the value of Variables by substitution. E.g. positive and negative integers
8.3 Formulae	Change the subject of a formula requiring one operation. Extension: work with formulae where the subject is squared or rooted.	Know 1.What the subject of a formula or equation is (where appropriate) 2. That the subject can be on the left or right hand-side. 3. and state inverse operations for 4 operations, squares and cubes Know How to 1. change the subject with one step operation (+/-) 2. change the subject with one step operation (+/-) with -1 coefficient 3. 1. change the subject with one step operation (multiply and divide)
8.3 Formulae	Change the subject of a formula requiring two operations.	Know 1. subject can be found by using inverted BIDMAS Know How to 1. change the subject with a two-step operation

8.4 Area, Volume & 3D	Review how to calculate the area of triangles, parallelograms and trapezia. Write algebraic expressions for the area of shapes.	Know Know How to 1. write an algebraic expression for area for any simple shapes 2. Work out the sides of squares and parallelogram when the area is given
8.4 Area, Volume & 3D	Calculate the area of circles, semi-circles and quarter circles. Find the area of shaded regions and compound shapes. Write expressions for the area of compound shapes.	Know 1. the formula of a circle Know How to 1. calculate the area of a semi-circle 2. calculate the area of a quarter circle 3. Find the area of shaded regions that contain circle 4. calculate the area of compound area with circular parts
8.4 Area, Volume & 3D	Recognise faces, vertices & edges. Name 3D shapes and know the difference between a pyramid and prism. Recognise and draw the nets of 3D shapes. Calculate the surface area of cuboids.	Know 1. the definition of prism (excludes cylinder) 2. the definition of a face 3. the definition of an edge 4. the definition of a vertex(vertices) 5. the definition of a net Know How to 1. name prisms according to the shape of the cross-sectional area 2. name pyramids according to the shape of the cross-sectional area 3. draw nets of 3D shape 4. work out the name of the 3D shape from their nets 5. work out the dimension of a 3D shape from its net 6. calculate the surface area of a cuboid
8.4 Area, Volume & 3D	Recognise units for volume and capacity. Calculate the volume of cuboids. Calculate the volume of prisms and cylinders.	Know 1. the definition of volume 2. the definition of a meter cube 3. the definition of capacity 4. the metric units of capacity 5. the format of the units for lengths, areas, volume and capacity 6. the formula of volume of prisms Know how to 1. work out the volume of cuboids 2. work out the volume of prisms 3. work out the volume of cylinders
8.5 Forming & Solving Equations	Review how to solve equations involving one operation. Solve equations involving roots and indices.	Know 1. the definition of expressions, formula and equation. 2. Solving means to find the value of the unknown. Know How to 1. solve one-step equation by addition and subtraction 2. solve one-step equation by division and multiplication 3. solve one-step equation involving negative coefficients 4. solve one-step equation involving decimal coefficients (multiply first) 5. solve one-step equation involving x2 = 6. solve one-step equation involving x3 = 7. solve one-step equation involving root x =

8.5 Forming & Solving Equations	Solve equations involving two steps. Set up and solve two step equations in the context of solving angles problems.	Know 1. Solving means to find the value of the unknown. Know how to 1. Solve two step equations with positive coefficients of the unknown. 2. Solve two step equations with negative coefficients of the unknown. 3. Form and solve equations on straight lines. 4. Form and solve equations around a point. 5. Form and solve equations with angles inside a triangle. 6. Form and solve equations within quadrilaterals. 7. Form and solve equations on parallel lines using parallel lines rules.
8.5 Forming & Solving Equations	Solve equations involving multiple steps, division, roots, brackets and collecting like terms. Set up and solve equations involving these operations in the context of area, perimeter, angles and number problems.	Know 1. Fractions are division. 2. Solving means to find the value of the unknown. 3. Formulas for the area of triangles and quadrilaterals. 4. Algebraic notations for even/odd numbers. 5. Algebraic notations for consecutive numbers. 6. Algebraic notations for consecutive even/odd numbers. Know how to 1. Solve multi step equations involving fractions. 2. Solve Multi step questions involving brackets. 3. Solve multi step equations involving indices and roots. 4. Form and solve equations with the area of triangles. 5. Form and solve equations with the area of rectangles. 6. Form and solve equations with the area of trapeziums. 7. Form and solve equations with the area of parallelograms. 8. Form and solve equations using Algebraic notations for even/odd and consecutive numbers. 9. Form and solve equations using perimeter. 10. Form and solve equations involving the volume of prisms. 11. Form and solve equations involving the surface area of prisms.
8.5 Forming & Solving Equations	Solve equations where the variable appears on both sides of the equals sign. Set up and solve double sided equations.	Know how to 1. Solve equations with unknowns on both sides. 2. Solve equations with unknowns on both sides, Involving brackets. 3. Form and solve equations by equating areas and perimeters.
8.6 Number Theory & Sequences	Recognise factors of a number. Identify whether numbers are prime or composite. Write a number as a product of its prime factors. Find the highest common factor of a pair of numbers.	Know 1. What factors are. 2. What a prime number is. 3. What a composite number is. 4. What product of prime factors means. Know how to 1. Find factors of a number. 2. Find the Highest common factor of two numbers. 3. Find factors of expressions. 4. Find the highest common factor of two expressions. 5. Determine whether a number is prime or not. 6. Determine whether a number is composite or not. 7. Find prime factors of a number. 8. Express a number as a product of its prime factors.
8.6 Number Theory & Sequences	Recognise multiples, factors, squares, cubes and primes. Find the lowest common multiple of a pair of numbers. Extension: Use divisibility tests to identify whether a number is a multiple of 2,3,4,5,6,8 or 9. Identify sets of real and imaginary numbers.	Know 1. What multiples are. 2. Divisibility tests e.g. All even numbers end in 0, 2, 4, 6 or 8. 3. What real, imaginary and irrational numbers are. Know how to 1. Find multiples of a number. 2. Find the lowest common multiple of two numbers. 3. Use divisibility tests to recognise multiples. 4. Use knowledge of factors, multiples, squares, cubes and primes to recognise different types of numbers e.g. Circle the even square number. 5. Determine whether numbers are real, imaginary, rational or irrational.

8.6 Number Theory & Sequences	Recognise expressions that result in odd numbers, even number or multiples of a number.	Know 1. Algebraic notations for odd and even numbers. 2. Algebraic notations for multiples of a given number. Know how to 1. Write expressions in algebraic form for even numbers. 2. Write expressions in algebraic form for odd numbers. 3. Write expressions in algebraic form for multiples of any given number. 4. Determine whether an expression would fit certain criteria e.g. If a was a positive integer would 2a+4 always be an even number? 5. Simple proof e.g. Show that 4(a+5)+5(a+5) is always a multiple of 9.
8.6 Number Theory & Sequences	Identify and use the term-to-term rules for arithmetic, geometric and Fibonacci style sequences.	Know 1. What linear sequences are. 2. What non-linear sequences are. 3. Triangle numbers. 4. Geometric sequences. 5. Fibonacci sequences. Know how to 1. Find term-to-term rules for linear sequences. 2. Find term-to-term rules for Non-linear sequences. 3. Find term-to-term rules for Geometric sequences. 4. Continue sequences given the first term and the term-to-term rule. 5. Continue sequences. 6. Find missing terms in sequences. 7. Continue triangle numbers. 8. Continue Fibonacci sequences. 9. Determine the type of sequence.
8.6 Number Theory & Sequences	Generate sequences from an nth term rule. Find the nth term rule for an arithmetic sequence. Determine whether a particular number will appear in a sequence.	Know how to 1. Substitute into the nth term formula to find the first 5 terms of a sequence. 2. Substitute into the nth term formula to find any term in a given sequence. 3. Find the nth term of an increasing linear sequence. 4. Find the nth term of a decreasing linear sequence. 5. Determine whether a term is in a given sequence from the nth term of the sequence.
8.7 Functions, Co-ordinates & Graphs	Recognise a function written in algebra and work out tables of values.	Know 1. definition of a function Know how to 1. Produce a table of values from a given function 2. Change from function machine to algebraic form and vice versa
8.7 Functions, Co-ordinates & Graphs	Plot co-ordinates & recognise their x and y values. Solve geometrical problems involving co-ordinates and shape properties.	Know 1. Co-ordinates are written in the (x, y) format 2. co-ordinates should be plotted with crosses 3. The x and y values correspond to the x and y in a function Know how to 1. write down co-ordinates of given point 2. draw a point with given co-ordinates 3. check whether a point exists in a given function or inequality 4. calculate distance between two points 5. find the co-ordinates of missing point using the properties of special quadrilaterals
8.7 Functions, Co-ordinates & Graphs	Plot sets of co-ordinates that follow rules, e.g. y = 5 and y = 3x - 1	Know 1. definition of Linear graphs and their structures including gradient and y intercepts 2. Common mistakes with drawing axes 3. How gradient and intercept affects linear graphs Know how to 1. Plot x = graphs 2. Plot y = graphs 3. Plot y = x graphs 4. Draw a pair of axes with any given scale 5. Read the scale from give axes 6. Plot y = mx+c 7. link a given function with table of values and plotting a linear graph

8.7 Functions, Co-ordinates & Graphs	Plot and recognise the graphs of quadratic and cubic graphs. Plot graphs of exponential growth.	Know 1, the definition and properties of quadratic graphs and how they link with sequences 2. the definition and properties of cubic graphs and how they link with sequences Know how to 1. use a scientific calculator to produce a table of values 2. plot quadratic graphs 3. plot cubic graphs
8.7 Functions, Co-ordinates & Graphs	Read values from a graph and use graphs to solve simultaneous equations.	Know 1. solving equations can be done graphically. Read the x intercept 2. the structure of simultaneous equations 2. simultaneous equations can be solved graphically Know how to 1. use graphs to find x when y is given and vice versa 2. solve equations using graphs 3. solve simultaneous equations graphically
8. Introduction to Statistics	Recognise how surveys and sampling methods can be biased. Record raw data into frequency tables, including grouped frequency tables. Recognise discrete, continuous, qualitative and quantitative data types.	Know: 1. the definition of bias 2. the definition of frequency 3. Understand inequality notation 4. the definition of qualitative 5. the definition of quantitative 6. the definition of discrete 7. the definition of Continuous Know how to: 1. how to design an affective questionnaire 2. to design and complete frequency tables 3. to design and complete a grouped frequency table 4. to identify and classify types of data
8. Introduction to Statistics	Draw and interpret pictograms, bar charts, pie charts and scatter graphs. Recognise how graphs can be misleading.	Know: 1. Features of a pictogram 2. Features of a bar chart Know How to: 1. draw a pictogram 2. Interpret a pictogram 3. draw a bar chart 4. Interpret a bar chart
8. Introduction to Statistics	Calculate the mean, median, mode and range of a set of listed data. Work backwards from knowing an average to working out missing data items.	Know: 1. The definition of mean 2. The definition of mode 3. The definition of median Know How to: 1. Find the mean of a seat of value 2. Find the missing number when given the mean 3. Find the mode of a set of data 4. Find the median of a set of data

Year 9		Know and Know how to
Topic	**Skills**	**Learning Objectives (small steps)**
9.1 Non-Calculator Fractions, Decimals & Percentages	Convert between terminating decimals and their equivalent fractions and percentages	Know 1. the meaning of a recurring decimal and the notation for it 2. that a third isn't the same as 0.3 Know how to 1.Convert simple fractions to percentages and vice versa without a calculator but can check with one 2. Convert simple fractions to decimals and vice versa without a calculator but can check with one 3. Convert between Percentages and decimals and vice versa without a calculator but can check with one 4. Convert between simple FDP freely without a calculator 5. convert fractions to recurring decimals and vice versa
9.1 Non-Calculator Fractions, Decimals & Percentages	Order and compare fractions. Add, subtract, multiply and divide with fractions and mixed numbers. Identify reciprocals and recognise the reciprocal graph. Divide fractions and mixed numbers. Calculate with all four operations and the order of operations.	Know 1. the terminology for a mixed number fraction 2. the difference between a proper and improper fraction Know how to 1. Compare and order fractions 2. Adding and subtracting fractions 3. Multiplying fractions with fractions 4. Multiplying fractions with mixed numbers 5. Dividing fractions 6. Do the 4 operations with mixed numbers 7. Recognise and write the reciprocals of any number given fractions 8. Complete calculations involving mixed FDP and BIDMAS
9.1 Non-Calculator Fractions, Decimals & Percentages	Multiply decimals & solve problems involving money. Find a fraction and percentage of an amount. Calculate a percentage change. Solve reverse fraction and percentage problems. Write one number as a percentage of another.	Know 1. if you multiply by a number smaller than one the answer will get smaller, however if you divide by a number smaller than one it will get bigger Know how to 1. Convert between metric units by multiplying and dividing by powers of 10 2. Multiply decimal number using written method 3. Use a base multiplication with answers to work out the answer to a similar question, e.g. 13 x 24 = 312, work out the answer to 1.3 x 2.4 4. Use short division to work out an integer divided by a decimal 5. Write a number as a fraction of another number 6. Work out simple percentage of any number. e.g. 27% of 130 WAC 7. Apply a percentage to any amount 8. Work out the original amount given the percentage change (Use the bar model)
9.2 Linear Graphs & Gradient	Plot co-ordinates. Plot linear graphs with positive, fractional and negative gradients. Plot the graphs of implicit functions. Recognise co-ordinates that will be on the line.	Know 1. The equation y = n and x = m where n and m are integers Know how to 1. Check whether a given point lies on line/graph / satisfy the equation 2. Recognise implicit equations
9.2 Linear Graphs & Gradient	Work out the gradient of a line or line segment.	Know 1. Know that the gradient is the same as steepness of a graph at a point 2. What zero and infinite gradient means Know how to 1. Express the gradient as a fraction 2. Use the formula of change in y divided by change in x to find a gradient 3. Find the gradient of a line segment if only given two coordinates 4. Work out a missing coordinate if given the gradient and one coordinate

9.2 Linear Graphs & Gradient	Work out the equation of a line. Recognise the gradient and intercept from an equation.	Know 1. That the letter m represents the gradient of a line 2. That the letter c represents the y-intercept 3. A negative number for m implies a negative gradient Know how to 1. Work out the equation of a line when given the gradient and the y-intercept 2. Work out the equation of a line when given a graph 3. Identify the gradient and y-intercept even when the formula requires rearranging, e.g. $3y + 6x - 2 = 0$
9.2 Linear Graphs & Gradient	Plot and use graphs in context. Recognise the meaning of the gradient and y-intercept for real life graphs.	Know 1. Y-intercept refers to the starting amount of a situation Know how to 1. Apply the knowledge of $y=mx+c$ to real-life graphs and the meaning attached 2. Know what the gradient represents in straight line graphs in context, i.e. change in rate of something (a variable).
9.3 Transformations	Translate a shape by a given vector.	Know 1. Basic vector notation Know How to 1. Write a vector from words, e.g. "3 right, 4 down" 2. Translate a shape by a given vector 3. Describe a translation when given two shapes that have been translated
9.3 Transformations	Reflect shapes in horizontal, vertical and diagonal mirror lines.	Know 1. Equations of horizontal and vertical lines on a graph Know how to 1. Draw an equation of a given vertical or horizontal line 2. Reflect a shape from a given horizontal and vertical line 3. Reflect a shape on a diagonal line, e.g. $y=x$ 4. Describe a reflection from a given diagram of a reflected shape
9.3 Transformations	Rotate shapes around a given point.	Know 1. The difference between rotate, translate and reflect 2. The difference between clockwise and anti-clockwise Know how to 1. Rotate a shape 90 degrees clockwise or anti-clockwise 2. Rotate a shape 180 degrees and understand why clockwise or anti-clockwise will have no effect on the final answer 3. Rotate a shape up to 270 degrees either clockwise or anti-clockwise 4. Describe a rotation including identifying the point of rotation
9.3 Transformations	Enlarge shapes by positive integer and fractional scale factors. Enlarge shapes by negative scale factors.	Know 1. Enlargement by a number greater than 1 will cause a shape to become bigger 2. Enlargement scale factor less than 1 will cause a shape to become smaller Know how to 1. enlarge a shape by a scale factor 2. enlarge a shape by a fractional scale factor 3. describe an enlargement between two shapes including identifying the coordinate for the enlargement point 4. enlarge a shape by a negative scale factor
9.3 Transformations	Describe transformations and combine transformations. Recognise points of invariance.	Know 1. What a point of invariance is Know how to 1. Perform more than one transformation on a given shape 2. Describe more than one transformation that has been done on a shape sometimes condensing two transformations into a single transformation 3. Identify points of invariance

9.4 Non-Calculator Ratio & Proportion	Use ratio notation, simplify ratio and identify equivalent ratio. Write ratio in the form n:1 or 1:n.	Know 1. The form 1:n or n:1 2. The shape of direct and indirect proportion graphs Know how to 1. Write a ratio for a given set of items 2. Simplify a ratio even when conversion is necessary beforehand, e.g. £3.50 : 90p 3. Write a ratio in the form 1:n or n:1 4. Apply 1:n ratios to direct proportion questions, e.g. best buy situations 5. Use indirect proportion to solve problems 6. Can apply algebra to solve proportion problems
9.4 Non-Calculator Ratio & Proportion	Convert between ratios, fractions and percentages. Share in a given ratio.	Know 1. The relationship between ratios and fractions Know how to 1. Convert basic ratios into fractions and percentages without a calculator 2. Convert all types of ratios into fractions and percentages using a calculator, including 3. Know how to use a bar model to represent ratios 4. Can use a bar model to share a given amount in a ratio 5. Can use a bar model to find the whole when one part is known 6. Can use a bar model to find the whole when the difference is known between two of the ratios.
9.5 Angles & Similarity	Review of angle notation, angles on straight lines, in triangles, quadrilaterals and around parallel lines.	Know 1. Angle notation, i.e. angle DEF. 2. Different types of angles in parallel lines Know how to 1. Calculate missing angles on a straight line and around a point 2. Calculate missing angles in triangles, including isosceles 3. Calculate missing angles in quadrilaterals, including special shapes, e.g. kites 4. Calculate missing angles in parallel lines 5. Can apply their knowledge of angle rules to combine rules to solve problems
9.5 Angles & Similarity	Recognise and name polygons. Calculate interior and exterior angles in polygons.	Know 1. The names of all polygons up to and including decagons 2. The difference between regular and irregular shapes Know how to 1. Calculate exterior angles of regular polygons using 360/n 2. Calculate the interior angle of a regular polygon 3. Calculate a missing interior angle of an irregular polygon 4. Can combine knowledge of interior and exterior angles to find a missing angle when two or more polygons are put together
9.5 Angles & Similarity	Identify similar shapes. Use similarity to find missing information.	Know 1.Scale factors connect similar shapes which can be written either as a multiplier or in a ratio format. 2. Angles are the same in similar shapes Know how to 1. Write similar shapes as ratios 2. Use integer scale factors to find missing sides 3. Use non-integer scale factors to find missing sides 4. Find missing lengths in similar triangles, including triangles within triangles.
9.6 Pythagoras & Trigonometry	Calculate missing lengths in right angled triangles using the Pythagorean theorem. Recognise Pythagorean triples and prove a triangle is right angled.	Know 1.Hypotenuse of a right-angle triangle 2. Pythagoras formula 3. Pythagorean triples Know how to 1. Use Pythagoras to find the hypotenuse of a right-angle triangle 2. Use Pythagoras to find a short side of a right-angle triangle 3. Use the Pythagoras formula to prove if a triangle is right angled. 4. Apply Pythagoras to different types of problems, e.g. the height of an isosceles triangles
9.6 Pythagoras & Trigonometry	Use sin, cos and tan ratios to find missing sides and angles in right angled triangles.	Know 1. The sides of a right-angle triangle 2. Sin ratio formula 3. Cos ratio formula 4. Tan ratio formula Know how to 1. Use Sin, Cos and Tan on a calculator to find a decimal number for an angle and also to do the inverse to find an angle 2. Label the sides of a right-angle triangle 3. Use Sin, Cos and Tan to find a missing angle in a right-angle triangle 4. Use Sin, Cos and Tan to find a missing side in a right-angle triangle

9.7 Probability	Describe probabilities on the probability scale. Recognise mutually exclusive outcomes.	Know 1. Words related to probability 2. Which type of events are mutually exclusive 3. Understand what type of events are mutually exclusive 4. Exhaustive events add up to 1 Know how to 1. Can plot probability of events on a probability scale 2. State simple probability for different types of events from given information 3. Calculate a missing probability by using the knowledge exhaustive events add up to 1 or 100%.
9.7 Probability	Use sample space diagrams. Systematically list all the outcomes of an event. Use the product rule for counting with independent and dependent events.	Know 1. Dependent versus independent events Know how to 1. Complete a sample space diagram and use it to calculate probabilities of events 2. Systematically list all the different outcomes for an event 3. Use the product rule for calculating the number of events for both dependent and independent events
9.7 Probability	Calculate relative frequencies. Work out expectation. Identify fair and biased events.	Know 1. Difference between bias versus unbiased outcomes Know how to 1. Calculate relative frequencies from a set of data 2. Calculate expectation of an event occurring once the relative frequency of an event has been calculated 3. Use relative frequency to decide whether an outcome of events is biased or not biased.
9.7 Probability	Use frequency trees, two-way tables & Venn diagrams to sort and analyse data.	Know 1. Venn diagram notation and meaning including: union, intersect, universal set, belongs to and empty set 2. Complement notation and meaning Know how to 1. Construct frequency trees and find probabilities 2. Construct two-way tables and find probabilities 3. Construct Venn diagrams and find probabilities
9.8 Maps & Constructions	Measure bearings and use map scales. Calculate bearings using angle facts.	Know 1. Correct format for bearings (clockwise, 3 figures, from north) Know how to 1.Measure bearings using a protractor from one point to another 2.Measure and draw bearings at a set distance using maps and scales 3.Find bearings using angle rules on lines and around points 4.Find bearings using right angles trigonometry
9.8 Maps & Constructions	Construct the locus of points from a point or a line. Find the points equidistant from two points or two lines. Bisect a line or an angle. Construct the perpendicular to a point.	Know 1.The definition of Loci 2.When to use perpendicular bisect and angle bisector to find equidistant points. Know how to 1.Construct the locus of points from a point or a line 2.Construct the perpendicular bisector of a line 3.Find the points equidistance from two points 4.Construct the angle bisector 5.Find the points equidistant from 2 lines 6.Construct the perpendicular to a point 7.Use loci to find regions 8.Construct loci using map scales
9.8 Maps & Constructions	Construct triangles accurately using a protractor. Identify congruent triangles.	Know 1.Definition of congruence Know how to 1.Construct ASA and SAS triangles using a protractor 2.Construct SSS triangles using a pair of compasses 3. Identify congruent triangles using SAS, AAS, RSS and SSS rules
9.8 Maps & Constructions	Draw the plans and elevations of a shape. Identify a shape from its plans and elevations.	Know 1.The orientation of plan, front and side views 2.Conventions for drawing plans and elevations i.e. dashed lines for hidden edges Know how to 1.Draw plan, front and side elevations of 3D shapes 2.Identify a 3D shape from its plan, front and side elevations

9.9 Percentages (Calculator Methods)	Use a decimal multiplier to calculate a percentage of an amount, to increase or decrease by a percentage and to calculate the percentage changed. Calculate percentage profit and loss.	Know 1.Definition of interest Know how to 1.Use decimal multiplier to calculate percentage of an amount 2.Use decimal multiplier to calculate percentage increase or decrease 3.Use decimal multiplier to calculate percentage change Calculate percentage profit and loss
9.9 Percentages (Calculator Methods)	Solve original amount problems and calculate successive percentage changes, including compound interest.	Know 1.Difference between simple interest and compound interest 2.Definitions of exponential growth and decay and their relative graphs Know how to 1.Calculate reverse percentage problems to find the original amount 2.Calculate repeated percentage change using decimal multipliers 3.Calculate compound interest using decimal multipliers 4.Calculate using exponential growth and decay

Year 10		Know and Know how to
Topic	Skills	Learning Objectives (small steps)
1: Equations and Inequalities	1. Solving equations and inequalities 2. Inequality on number lines 3. Solving quadratics by factorising	Know: 1. To know the difference between equation, expression and formulae 2. To know inverse operations 3. To know what factorise means Know how to: 1. Form and solve one-step and two-step inequalities 2. Show solutions to inequalities on a number line 3. Interpret representations on number lines as inequalities 4. Form and solve equations with unknowns on both sides 5. Find solutions to equations using straight line graphs 6. Form and solve inequalities with unknowns on both sides 7. Form and solve more complex equations and inequalities 8. Solve quadratic equations by factorisation 9. Represent solutions to inequalities using set notation 10. Represent solutions to single inequalities on a graph 11. Represent solutions to multiple inequalities on a graph 12. Solve quadratic inequalities in one variable
2: Congruence, Similarity and Enlargement	1. Enlargement 2. Congruency and similarity 3. Area and Volume of similar shapes	Know: 1. What a scale factor is 2. shape properties 3. Formulas for area and volume 4. the difference between perimeter, area and volume Know how to: 1. Enlarge a 2D shape by a fractional scale factor 2. Identify similar shapes 3. Work out missing side lengths and angles in a pair of similar shapes with an integer scale factor 4. Use parallel line rules to work out missing angles (within similar shapes) 5. Establish whether a pair of triangles are similar 6. Understand and use conditions for congruent triangles 7. Work out missing sides and angles in the pair of given similar shapes (any scale factor) 8. Enlarge a shape by a negative scale factor Enlargement 9. Explore areas of similar shapes 10. Explore volumes of similar shapes 11. Solve mixed problems involving similar shapes 12. Prove a pair of triangles are congruent
3: Right Angled Triangles	1. Pythagoras' Theorem 2. Trigonometry 3. Sine and Cosine rule	Know: 1. Exact trig values 2. Know Pythagoras theorem 3. To define key terms, hypotenuse, opposite, adjacent, Theta 4. the trigonometric ratios 5. The formulae for sine and cosine rule Know how to: 1. Calculate shorter sides using Pythagoras 2. Determine whether a triangle is right angled 3. Work fluently with hypotenuse, adjacent and opposite sides 4. Use the Sine/Cosine/Tangent ratios to find missing side lengths Trig Ratios 4. Use the Sine/Cosine/Tangent ratios to find missing angles 5. Select the appropriate method to solve right-angles triangles 6. Work with key angles in right-angles triangles (know the exact values of and for x=0°, 30°, 45°, 60°, and 90°, and for 0°, 30°, 45° and 60°) 7. Use Pythagoras in 3D shapes 8. Use trigonometry in 3D shapes 9. Use the formula 1/2abSinC find the area of a triangle 10. Understand and use the sine rule to find missing sides and angles 11. Understand and use the cosine rule to find missing sides and angles 12. Select the appropriate rule, sine or cosine, to solve trigonometry problems

4: Angles and Bearings	1. Scale drawings 2. Measure and draw bearings 3. Bearing with Pythagoras and trig	Know: 1. The formula for sine and cosine 2. Know Pythagoras theorem 3. To define key terms, hypotenuse, opposite, adjacent, Theta 4. the trigonometric ratios 5. Bearings need 3 digits, measured from north clockwise Know how to: 1. Draw and interpret scale diagrams 2. Understand and represent bearings 3. Measure and read bearings 4. Make scale drawings using bearings 5.Calculate angles using bearing rules 6. Solve bearing problems using Pythagoras and Trigonometry 7. Solve bearing problems using the Sine and Cosine rules
5: Simultaneous Equations	1. Solve simultaneous equations 2. Quadratic simultaneous equations	Know: 1. To know the difference between equation, expression and formulae 2. To know inverse operations Know how to: 1. Determine if a given (x,y) is a solution to a pair of linear simultaneous equations 2. Solve a pair of linear simultaneous equations using graphs 3. Solve a pair of linear simultaneous equations by substituting a known variable 4. Solve simultaneous equations by elimination (no scaling) 5. Solve simultaneous equations by adjusting one equation 6. Solve simultaneous equations by substitution 7. Solve simultaneous equations by elimination (adjusting both equations) 8. Form and solve a pair of linear simultaneous solutions from given information 9. Determine whether a given (x,y) is a solution to both a linear and quadratic equation 10. Solve a pair of simultaneous equations (one linear and one quadratic) using graphs 11. Solve a pair of simultaneous equations (one linear and one quadratic) using algebra
6: Circles and Volume	1. Area and circumference of circles and part circles 2. Surface Area of 3D with circles 3. Volume of 3D shapes with circles 4. Circle theorems	Know: 1. The formulae for area and circumference of circle 2. The key terms of circles; radius, diameter, circumference, tangent, sector, segment, chord 3. The formulae for volume 4. Circle theorems Know how to: 1. Calculate the area of semi-circles and quarter-circles including in terms of pi 2. Calculate the arc length and perimeter of semi-circles and quarter-circles including in terms of pi 3. Work backwards to find the radius and diameter given area/circumference 4. Work out the volume and surface area of cylinders and other prisms 5. Work out missing lengths given the area and/or volume 6. Work out the surface area of any prisms 7. Calculate the area of any sector (including in terms of pi) 8. Calculate the arc length and perimeter of any sector (including in terms of pi) Question Generator-sectors/arcs 9. Understand and use the formulae for volume and surface area of cones and spheres 10. Circe theorems: Circle Theorems 11. Angles at the centre and circumference 12. Angles in a semi-circle 13. Angles in the same segment 14. Angles in a cyclic quadrilateral 15. Calculate the volume and surface area and apply to composite 3D shapes including cones, cylinders and spheres 16. SA of Cuboids, Triangular Prisms 17. Solve area and volume problems involving similar shapes

7: Vectors	1. Represent and understand vector 2. Geometric Proof and reasoning	Know: 1. Vector notation Know how to: 1. Understand and represent vectors 2. Use and read vector notation 3. Draw and understand vectors multiplied by a scalar 4. Draw and understand addition and subtraction of vectors 5. Explore vector journeys in shapes 6. Explore quadrilaterals using vectors 7. Understand parallel vectors 8. Explore collinear points using vectors 9. Use vectors to construct geometric arguments and proofs
8: Ratios and Fractions	1. Working with ratio 2. Direct Proportion graph (link to ratio) 3. Currency Conversions 4. Ratio in area and volume	Know: 1. What a ratio is and a whole 2. The properties of direct proportion graphs Know how to 1. Compare quantities using a ratio 2. Link ratios and fractions 3. Share in a ratio (given a whole or part) Visual representation of sharing quantity into a ratio 4. Use ratios and fractions to make comparisons 5. Link ratios and direct proportion graphs Direct Proportion 6. Solve problems with currency conversion using ratio 7. Combine a set of ratios 8. Link ratios to algebra 9. Mixed ratio problems 10. Ratio in area problems 11. Ratio in volume problems
9: Percentages and Interest	1. Finding percentages 2. Compound interest and depreciation	Know: 1. Percentages are out of 100 2. how to convert between percentage and decimals 3. the formulae for compound interest Know how to: 1. Find the original amount using a given percentage (include more than 100) 2. Find percentage change 3. Calculate simple interest 4. Calculate compound interest and decay 5. Repeated percentage change 6. Solve problems in growth and decay 7. Solve problems involving percentages, ratios and fractions 8. Find the original amount after repeated percentage change 9. Understand iterative processes
10: Data	1. Collect and represent data 2. Averages from tables 3. Construct and interpret statistical diagrams	Know: 1. what each average is and how to find it 2. Inequalities notation 3. Plotting coordinates (directions) Know how to: 1. Understand populations and samples 2. Understand primary and secondary data 3. Construct and interpret frequency polygons; composite bar charts and pie charts 4. Criticise charts and graphs 5. Find and interpret averages from a table 6. Construct and interpret time series graphs 7. Compare distributions using charts and measures 8. Understand the limitations of different types of sampling 9. Construct a stratified sample 10. Construct histograms with equal and unequal class intervals 11. Interpret, analyse and compare distributions using complex charts and measures of average and range
11: Probability	1. probability Statistical diagrams (tree diagrams and Venn diagram) 2. Draw and interpret statistical diagrams (tree diagrams, Venn diagrams, two-way tables)	Know: 1. Probability sums to 1 2. The definition of intersection and union Know how to: 1. Find probabilities from tables, Venn Diagrams and frequency trees 2. Construct and interpret sample spaces for more than one event 3. Using experimental data to estimate probabilities 4. Calculate probability with independent events 5. Use tree diagrams for independent events 6. Use tree diagrams for dependent events 7. Construct and interpret conditional probabilities: tree diagrams; Venn diagrams; and Two-Way tables 8. Understand and use the product rule for counting

12: Number	1. Working with money, bills and best buys 2. Rational and Irrational numbers 3. Surds	Know: 1. The definition of expand, powers, root and surds 2. The index laws 3. Squared and cubed numbers 4. Inequality notation Know how to: 1. Exact answers (e.g. in terms of pi and square roots) 2. Understanding bills and bank statements 3. Perform best buys 4. Break down and solve multi-step problems 5. Understand and use limits of accuracy 6. Understand and use rational and irrational numbers 7. Estimating powers and roots 8. Upper and Lower bounds 9. Simplify surds 10. Rationalising the denominator of surds 11. Calculate with surds, including all four operations 12. Expand single and double brackets with surds
13: Sequences	1. Continue and describe sequences 2. Find the nth term 3. Represent sequence graphically	Know: 1. Definition of linear, quadratic, geometric, Fibonacci 2. Properties of graphs Know how to: 1. Continue the next terms of linear and special sequences including Fibonacci, geometric and quadratic 2. Find the rule for the nth term of a linear sequence 3. Represent sequences in tabular and graphical form 4. Use the nth term rule 5. Decide whether a given term lies in a given sequence 6. Use the nth term rule 7. Decide whether a given term lies in a given sequence
14: Indices and Roots	1. Represent numbers in standard form 2. Calculate with numbers in standard form 3. Index Laws	Know: 1. The index laws 2. Understand the terms power, index, reciprocal Know how to: 1. Add and subtract numbers in standard form 2. Multiply and divide numbers in standard form 3. Use a calculator to work in standard form and to check answers 4. Understand and use basic laws of indices including; multiplying; dividing; and raising to a power 5. Understand and use basic laws of indices including power of zero and negative indices 6. Understand and use fractional indices 7. Understand and use base numbers to help simplify e.g. calculate 64 x 4^3 = 2^x

Year 11		Know and Know how to
Topic	Skills	Learning Objectives (small steps)
1. Solving Equations and Inequalities	1. Solve equations including on both sides 2. Solve inequalities 3. Expanding Brackets 4. Factorising into brackets 5. Algebraic fractions	Know: 1. To know the difference between equation, expression, inequalities and formulae 2. The terms Expand and Factorise Know how to: 1. Form and solve inequalities with unknowns on both sides 2. Expand two binomials 3. Factorise simple quadratic expressions including the difference of two squares 4. Solve quadratic equations by factorisation 5. Simplify complex algebraic expression including algebraic fractions with a single term denominator 6. Solve quadratic equations by completing the square 7. Solve quadratic equations by using the quadratics formula 8. Simplify complex algebraic expressions including algebraic fractions
2. Linear and Non-Linear Graphs	1. Plot linear graphs 2. To find equations of parallel and perpendicular lines 3. Plot and interpret quadratic, cubic and reciprocal graphs 4. Equations to tangents to circles 5. Area under a curve 6. Distance-Time Graphs	Know: 1. To know the difference between equation, expression, inequalities and formulae 2. To know directions of coordinates 3. To know what parallel and perpendicular lines are 4. To know what roots are and mean 5. To know the formulae for area Know how to: 1. Find and use the equation of a straight line, including identifying can calculating the gradient and y-intercept Equation of a Straight Line 2. Reduce equations to the form y=mx+c 3. Find the midpoint of a line segment 4. Plot and read from quadratic graphs 5. Recognise quadratic, cubic and reciprocal graphs 6. Identify gradient and intercept 7. Identify parallel lines 8. Find the equations of a parallel line 9. Solve a pair of simultaneous equations using graphical methods 10. Understand and find roots, intercepts and turning points of quadratic functions graphically Roots, intercepts, turning points 11. Plot and interpret cubic and reciprocal graphs Quadratic and Cubic Graphs 12. Understand and use exponentials graphs (y=k^x where k is positive) 13. Recognise and use the equation of a circle with the centre at the origin, find the equation of a tangent to a circle at a given point 14. Calculate or estimate gradients of quadratic and other non-linear graphs 15. Estimate the area under a curve 16. Interpret results to the two points above in cases such as distance-time graphs, velocity time graphs and graphs in financial contexts
3. Multiplicative Reasoning	1. To work with ratio 2. Solve proportional problems 3. Rates of Change	Know: 1. To define direct and inverse proportion 2. Know what a ratio is and means 3. To know the difference between equation, expression, inequalities and formulae Know how to: 1. Combine ratio 2. Multi-step ratio problems 3. Solve inverse proportion problems 4. Link the gradient of a line y=kx to proportion 5. Understand the gradient of a line as a ratio 6. Density, mass, volume calculations 7. Pressure, force, area calculations 8. Use ‘k’ for direct and inverse proportion problems (include, squares, roots and cubes) 9. Identify and interpret inverse proportion graphs 10. Convert between compound units 11. Recognise the gradient at a point on a curve as the instantaneous rate of change 12. Calculate instantaneous rate of change 13. Calculate average rate of change

4. Rearranging Equations and Using Functions	1. Change the subject 2. Use and solve with formulas for area 3. Substitution	Know: 1. To know the difference between equation, expression, inequalities and formulae 2. To know the formulas for area of shapes 3. To know the formulas for volume of 3D shapes 4. To know the difference between area and perimeter Know how to: 1. Change the subject of a simple formulae 2. Use perimeter, area and volume formula to solve problems 3. Apply the formulae for sector area and arc length 4. Use the formula for volume of a pyramid 5. Change the subject of more complex formulae (excluding those where the subject appears more than once) 6. Solve problems using the kinematics formulae 7. Change the subject of a formula where the subject appears more than once 8. Work with basic functions, substituting in values 9. Work with composite and inverse functions
5. Geometric Reasoning	1. Find values of missing angles including algebraically 2. Use the sine and cosine rule 3. Circle Theorems	Know: 1. Properties of 2D and 3D shapes 2. Pythagoras' Theorem 3. Formulas for sine and cosine rule Know how to: 1. Use chains of reasoning to evaluate angles 2. Find angles using algebraic methods 3. Use the formula 1/2abSinC to find the area of a triangle 4. Understand and use the sine rule to find missing sides and angles 5. Understand and use the cosine rule to find missing sides and angles 6. Circle Theorems Circle Theorems; Perpendicular line from the centre of a circle to a chord; Angle between a tangent and radius; Two tangents from a point and Alternate segment 7. Construct formal geometric proofs for circle theorems
6. Algebraic Reasoning	1. Laws of indices 2. Reasoning and algebraic proof	Know: 1. The definition of reciprocal 2. The basic laws of indices 3. To know squared and cubed numbers and their roots Know how to: 1. Understand and use basic laws of indices including power of zero and negative indices 2. Estimate powers and roots of any number 3. Work with complex indices including fractional and negative indices 4. Solve problems involving variation with powers 5. Construct formal algebraic proofs
7. Transforming and Constructing	1. Constructions and Bisectors 2. Loci 3. Bearings 4. Congruency 5. Transformation of graphs	Know: 1. To define key terms of, bisector, perpendicular, arc, locus, loci, congruent 2. To identify which construction meets the loci 3. To know what each trigonometric graph looks like 4. Know key values for sine, cosine, tangent Know how to: 1. Construct and angle bisector 2. Construct a perpendicular bisector 3. Construct a perpendicular to a given line from/at a given point 4. Calculate bearings using angle rules 5. Solve loci problems 6. Prove that two triangles are congruent 7. Understand and identify invariant points after a series of transformations 8. Recognise, sketch and interpret trigonometric graphs 9. Sketch translations and reflections of the graph of a given function

8. Probability and statistics	1. Statistical diagrams 2. Interpret statistical diagrams 3. Compare statistical information	Know: 1. What probability is and how to represent it 2. Probability sums to 1 3. Know what the range is Know how to: 1. Calculate probabilities with independent events 2. Use tree diagrams for independent events 3. Construct histograms with equal and unequal class intervals 4. Construct and interpret cumulative frequency diagrams 5. Identify and work with quartiles and inter-quartile range 6. Construct and interpret box plots 7. Combine and link prior learning of histograms, cumulative frequency and box plots 8. Compare distributions using a range of different charts and measures
	Year 11	Know and Know how to
Topic	Skills	Learning Objectives (small steps)
1. Solving Equations and Inequalities	1. Solve equations including on both sides 2. Solve inequalities 3. Expanding Brackets 4. Factorising into brackets 5. Algebraic fractions	Know: 1. To know the difference between equation, expression, inequalities and formulae 2. The terms Expand and Factorise Know how to: 1. Form and solve inequalities with unknowns on both sides 2. Expand two binomials 3. Factorise simple quadratic expressions including the difference of two squares 4. Solve quadratic equations by factorisation 5. Simplify complex algebraic expression including algebraic fractions with a single term denominator 6. Solve quadratic equations by completing the square 7. Solve quadratic equations by using the quadratics formula 8. Simplify complex algebraic expressions including algebraic fractions
2. Linear and Non-Linear Graphs	1. Plot linear graphs 2. To find equations of parallel and perpendicular lines 3. Plot and interpret quadratic, cubic and reciprocal graphs 4. Equations to tangents to circles 5. Area under a curve 6. Distance-Time Graphs	Know: 1. To know the difference between equation, expression, inequalities and formulae 2. To know directions of coordinates 3. To know what parallel and perpendicular lines are 4. To know what roots are and mean 5. To know the formulae for area Know how to: 1. Find and use the equation of a straight line, including identifying can calculating the gradient and y-intercept Equation of a Straight Line 2. Reduce equations to the form y=mx+c 3. Find the midpoint of a line segment 4. Plot and read from quadratic graphs 5. Recognise quadratic, cubic and reciprocal graphs 6. Identify gradient and intercept 7. Identify parallel lines 8. Find the equations of a parallel line 9. Solve a pair of simultaneous equations using graphical methods 10. Understand and find roots, intercepts and turning points of quadratic functions graphically Roots, intercepts, turning points 11. Plot and interpret cubic and reciprocal graphs Quadratic and Cubic Graphs 12. Understand and use exponentials graphs (y=k^x where k is positive) 13. Recognise and use the equation of a circle with the centre at the origin, find the equation of a tangent to a circle at a given point 14. Calculate or estimate gradients of quadratic and other non-linear graphs 15. Estimate the area under a curve 16. Interpret results to the two points above in cases such as distance-time graphs, velocity time graphs and graphs in financial contexts

3. Multiplicative Reasoning	1. To work with ratio 2. Solve proportional problems 3. Rates of Change	Know: 1. To define direct and inverse proportion 2. Know what a ratio is and means 3. To know the difference between equation, expression, inequalities and formulae Know how to: 1. Combine ratio 2. Multi-step ratio problems 3. Solve inverse proportion problems 4. Link the gradient of a line y=kx to proportion 5. Understand the gradient of a line as a ratio 6. Density, mass, volume calculations 7. Pressure, force, area calculations 8. Use 'k' for direct and inverse proportion problems (include, squares, roots and cubes) 9. Identify and interpret inverse proportion graphs 10. Convert between compound units 11. Recognise the gradient at a point on a curve as the instantaneous rate of change 12. Calculate instantaneous rate of change 13. Calculate average rate of change
4. Rearranging Equations and Using Functions	1. Change the subject 2. Use and solve with formulas for area 3. Substitution	Know: 1. To know the difference between equation, expression, inequalities and formulae 2. To know the formulas for area of shapes 3. To know the formulas for volume of 3D shapes 4. To know the difference between area and perimeter Know how to: 1. Change the subject of a simple formulae 2. Use perimeter, area and volume formula to solve problems 3. Apply the formulae for sector area and arc length 4. Use the formula for volume of a pyramid 5. Change the subject of more complex formulae (excluding those where the subject appears more than once) 6. Solve problems using the kinematics formulae 7. Change the subject of a formula where the subject appears more than once 8. Work with basic functions, substituting in values 9. Work with composite and inverse functions
5. Geometric Reasoning	1. Find values of missing angles including algebraically 2. Use the sine and cosine rule 3. Circle Theorems	Know: 1. Properties of 2D and 3D shapes 2. Pythagoras' Theorem 3. Formulas for sine and cosine rule Know how to: 1. Use chains of reasoning to evaluate angles 2. Find angles using algebraic methods 3. Use the formula 1/2abSinC to find the area of a triangle 4. Understand and use the sine rule to find missing sides and angles 5. Understand and use the cosine rule to find missing sides and angles 6. Circle Theorems Circle Theorems; Perpendicular line from the centre of a circle to a chord; Angle between a tangent and radius; Two tangents from a point and Alternate segment 7. Construct formal geometric proofs for circle theorems
6. Algebraic Reasoning	1. Laws of indices 2. Reasoning and algebraic proof	Know: 1. The definition of reciprocal 2. The basic laws of indices 3. To know squared and cubed numbers and their roots Know how to: 1. Understand and use basic laws of indices including power of zero and negative indices 2. Estimate powers and roots of any number 3. Work with complex indices including fractional and negative indices 4. Solve problems involving variation with powers 5. Construct formal algebraic proofs

7. Transforming and Constructing	1. Constructions and Bisectors 2. Loci 3. Bearings 4. Congruency 5. Transformation of graphs	Know: 1. To define key terms of, bisector, perpendicular, arc, locus, loci, congruent 2. To identify which construction meets the loci 3. To know what each trigonometric graph looks like 4. Know key values for sine, cosine, tangent Know how to: 1. Construct and angle bisector 2. Construct a perpendicular bisector 3. Construct a perpendicular to a given line from/at a given point 4. Calculate bearings using angle rules 5. Solve loci problems 6. Prove that two triangles are congruent 7. Understand and identify invariant points after a series of transformations 8. Recognise, sketch and interpret trigonometric graphs 9. Sketch translations and reflections of the graph of a given function
8. Probability and statistics	1. Statistical diagrams 2. Interpret statistical diagrams 3. Compare statistical information	Know: 1. What probability is and how to represent it 2. Probability sums to 1 3. Know what the range is Know how to: 1. Calculate probabilities with independent events 2. Use tree diagrams for independent events 3. Construct histograms with equal and unequal class intervals 4. Construct and interpret cumulative frequency diagrams 5. Identify and work with quartiles and inter-quartile range 6. Construct and interpret box plots 7. Combine and link prior learning of histograms, cumulative frequency and box plots 8. Compare distributions using a range of different charts and measures

Year 12		Know and Know how to
Topic	**Skills**	**Learning Objectives (small steps)**
Unit 1: Algebra and functions	1a. Algebraic expressions – basic algebraic manipulation, indices and surds	Know 1. the laws of indices Know How to 1. expanding brackets 2. collecting like terms 3. factorising 4. use the laws of indices for all rational exponents 5. perform all operations with surds 6. rationalise the denominator.
Unit 1: Algebra and functions	1b. Quadratic functions – factorising, solving, graphs and the discriminants	Know how to 1. solve a quadratic equation by factorising; 2. work with quadratic functions and their graphs; 3. use the discriminant of a quadratic function, including the conditions for real and repeated roots; 4. complete the square. e.g. $ax^2+bx+c=a\left(x+\frac{b}{2a}\right)^2+\left(c-\frac{b^2}{4a}\right)$ 5. solve quadratic equations, including in a function of the unknown.
Unit 1: Algebra and functions	1c. Equations - quadratic/linear simultaneous	Know how to 1. solve linear simultaneous equations using elimination and substitution; 2. to use substitution to solve simultaneous equations where one equation is linear and the other quadratic.
Unit 1: Algebra and functions	1d. Inequalities – linear and quadratic (including graphical solutions)	Know how to 1. solve linear and quadratic inequalities; 2. express solutions through correct use of ‘and’ and ‘or’ or through set notation; 3. interpret linear and quadratic inequalities graphically; 4. represent linear and quadratic inequalities graphically.
Unit 1: Algebra and functions	1e. Graphs – cubic, quartic and reciprocal	Know how to 1. use graphs of functions; 2. sketch curves defined by simple equations including polynomials; 3. use intersection points of graphs to solve equations.
Unit 1: Algebra and functions	1f. Transformations – transforming graphs – f(x) notation	Know 1. and understand the effect of simple transformations on the graph of $y=\mathrm{f}(x)$ Know how to 1. sketch the result of a simple transformation given the graph of any function $y=\mathrm{f}(x)$.
Unit 1: Statistical sampling	1a. Introduction to sampling terminology; Advantages and disadvantages of sampling	Know how to 1. use the terms ‘population’ and ‘sample’; 2. use samples to make informal inferences about the population; 3. describe advantages and disadvantages of sampling compared to census.
Unit 1: Statistical sampling	1b. Understand and use sampling techniques; Compare sampling techniques in context	Know 1. type of sampling techniques 2. and understand that different samples can lead to different conclusions about the population. Know how to 1. use sampling techniques; 2. describe advantages and disadvantages of sampling techniques; 3. select or critique sampling techniques in the context of solving a statistical problem

Unit 2a: Data presentation and interpretation	2a. Calculation and interpretation of measures of location and measures of variation; Understand and use coding	Know how to 1. calculate measures of location, 2. calculate measures of mean, 3. calculate measures of median 4. calculate measures of mode 5. calculate measures of variation 6. calculate measures of standard deviation 7. calculate measures of variance 8. calculate measures of range 9. calculate measures of interquartile range 10. interpret and draw inferences from summary statistics
Unit 6: Quantities and units in mechanics	6a. Introduction to mathematical modelling and standard S.I. units of length, time and mass	Know 1. The language used to describe simplifying assumptions. 2. That units behave in the same way as algebraic quantities. Know how to 1. Understand the concept of a mathematical model. 2. Abstract from a real-world situation to a mathematical description (model). 3. Understand the particle model. 4. work with the basic terminology for mechanics. 5. work with commonly-made assumptions when using these models. 6. Analyse the model appropriately. 7. Interpret and communicate the implications of the analysis in terms of the situation being modelled. 8. Understand and use fundamental quantities and units in the S.I. system: length, time and mass.
Unit 6: Quantities and units in mechanics	6b. Definitions of force, velocity, speed, acceleration and weight and displacement; Vector and scalar quantities	Know 1. the difference between position, displacement and distance 2. the difference between velocity and speed 3. the difference between acceleration and magnitude of acceleration; 4. the difference between mass and weight (including gravity); 5. and understand that there are different types of forces. Know how to 1. use derived quantities and units: velocity, acceleration, force, weight;
Unit 7a: Kinematics 1 (constant acceleration)	7a. Graphical representation of velocity, acceleration and displacement	Know how to 1. Draw kinematics graphs. 2. Interpret kinematics graphs, knowing the significance (where appropriate) of their gradients and the areas underneath them.
Unit 2: Coordinate geometry in the (x, y) plane	2a. Straight-line graphs, parallel/perpendicular, length and area problems	Know 1. Understand the equation of a straight line. Know how to 1. Use the equation of a straight line. 2. Apply the gradient conditions for two straight lines to be parallel or perpendicular. 3. Find lengths using equations of straight lines. 4. Find areas using equations of straight lines. 5. Use straight-line graphs in modelling.
Unit 2: Coordinate geometry in the (x, y) plane	2b. Circles – equation of a circle, geometric problems on a grid	Know 1. The equation of a circle 2. The properties of chords and tangents. Know how to 1. Find the midpoint of a line segment. 2. Use the equation of a circle. 3. Use the equation of a circle. 4. Use the properties of chords and tangents.

Unit 3: Further algebra	3a. Algebraic division, factor theorem and proof	Know 1. Factor theorem. Know how to 1. Use algebraic division. 2. Apply the factor theorem. 3. Fully factorise a cubic expression. 4. Use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion. 5. Use methods of proof. 6. Use proof by deduction. 7. Use proof by exhaustion. 8. Use disproof by counter-example.
Unit 3: Further algebra	3b. The binomial expansion	Know how to 1. The binomial expansion of $(a+bx)$^n for positive integer n. 2. Find an unknown coefficient of a binomial expansion.
Unit 2b: Data presentation and interpretation	2b. Interpret diagrams for single-variable data; Interpret scatter diagrams and regression lines; Recognise outliers	Know 1. and understand informal interpretation of correlation; understand that correlation does not imply causation; Know how to 2.interpret diagrams for single variable data; 3. interpret scatter diagrams and regression lines for bivariate data; 4. recognise the explanatory and response variables; 5. be able to make predictions using the regression line and understand its limitations; 6. recognise and interpret possible outliers in data sets and statistical diagrams; 7. select or critique data presentation techniques in the context of a statistical problem; 8. clean data, including dealing with missing data, errors and outliers.
Unit 7b: Kinematics 1 (constant acceleration)	7b. Motion in a straight line under constant acceleration; suvat formulae ; Vertical motion under gravity	Know 1. and recognise when it is appropriate to use the suvat formulae for constant acceleration; Know how to 1. solve kinematics problems using constant acceleration formulae; solve problems involving vertical motion under gravity.
Unit 4: Trigonometry	4a. Trigonometric ratios and graphs	Know 1. the definitions of sine, cosine and tangent for all arguments; 2. the sine and cosine rules; the area of a triangle in the form 12absin$C$ 3. the sine, cosine and tangent functions; their graphs, symmetries and periodicity. Know how to 1. use the definitions of sine, cosine and tangent for all arguments; 2. use the sine and cosine rules; 3. use the area of a triangle in the form 12absin$C$ 4. use the sine, cosine and tangent functions; their graphs, symmetries and periodicity.
Unit 4: Trigonometry	4b. Trigonometric identities and equations	Know 1. and understand and be able to use tanθ=cosθsinθ 2. and understand and use sin sin2θ+cos2θ=1 Know how to 1. solve trigonometric equations within a given interval 2. use tanθ=cosθsinθ 3. use sin sin2θ+cos2θ=1

Unit 5: Vectors (2D)	5a. Definitions, magnitude/direction, addition and scalar multiplication	Know how to 1. se vectors in two dimensions; 2. calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form; 3. add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations.
Unit 5: Vectors (2D)	5b. Position vectors, distance between two points, geometric problems	Know 1. the properties of position vectors Know how to 1. use position vectors; 2. calculate the distance between two points represented by position vectors; 3. vectors to solve problems in pure mathematics and in context, (including forces).
Unit 3: Probability	3a. Mutually exclusive events; Independent events	Know 1. the definitions of mutually exclusive and independent events Know how to 1. use mutually exclusive and independent events when calculating probabilities; 2. make links to discrete and continuous distributions.
Unit 4: Statistical distributions	4a. Use and identify discrete distributions; Calculate probabilities using the binomial distribution (calculator use expected)	Know 1. simple, discrete probability distributions, including the binomial distribution; Know how to 1. use simple, discrete probability distributions, including the binomial distribution; 2. identify the discrete uniform distribution; 3. calculate probabilities using the binomial distribution.
Unit 8a: Forces & Newton's laws	8a. Newton's first law, force diagrams, equilibrium, introduction to i, j system	Know 1. and understand the concept of a force 2. and understand Newton's first law. Know how to 1. understand the concept of a force 2. use Newton's first law.
Unit 6: Differentiation	6a. Definition, differentiating polynomials, second derivatives	Know 1. and understand the derivative of $f(x)$ is the gradient of the tangent to the graph of $y=f(x)$ at a general point (x,y) 2. and understand the gradient of the tangent as a limit and its interpretation as a rate of change; 3. and understand differentiation from first principles for small positive integer powers of x Know how to 1. use the derivative of $f(x)$ as the gradient of the tangent to the graph of $y=f(x)$ at a general point (x,y) 2. sketch the gradient function for a given curve; 3. find second derivatives; 4. differentiate $x2$ for rational values of n, and related constant multiples, sums and differences.
Unit 6: Differentiation	6b. Gradients, tangents, normals, maxima and minima	Know how to 1. apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points; 2. identify where functions are increasing or decreasing.

Unit 7: Integration	7a. Definition as opposite of differentiation, indefinite integrals of x^n	Know 1. know the Fundamental Theorem of Calculus; be able to integrate xn (excluding n = −1), and related sums, differences and constant multiples. Know how to 1.use the Fundamental Theorem of Calculus; be able to integrate xn (excluding n = −1), and related sums, differences and constant multiples.
Unit 7: Integration	7b. Definite integrals and areas under curves	Know how to 1. evaluate definite integrals; 2. use a definite integral to find the area under a curve.
Unit 5a: Statistical hypothesis testing	5a. Language of hypothesis testing; Significance levels	Know 1. understand the language of statistical hypothesis testing, developed through a binomial model. Know how to 1. apply the language of statistical hypothesis testing, developed through a binomial model.
Unit 8b: Forces & Newton's laws	8b. Newton's second law, (no resolving forces or use of F = μR); Newton's third law: equilibrium, smooth pulley problems	Know 1. and understand Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2D (i, j) vectors.); 2. and understand Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles. Know how to 1. use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2D (i, j) vectors.); 2. use Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles.
Unit 8: Exponentials and logarithms	8a. Exponential functions and natural logarithms	Know 1. the function ax and its graph, where a is positive; 2. the function ex and its graph; 3. that the gradient of ekx is equal to $kekx$ and hence understand why the exponential model is suitable in many applications; 4. know the definition of $\log ax$ as the inverse of ax , where a is positive and $x \geq 0$ 5. know the function $\ln x$ and its graph; 6. know $\ln x$ as the inverse function of ex 7. and understand the laws of logarithms:$\log ax + \log ay = \log a(xy)$, $\log ax - \log ay = \log a(xy)$, $k\log ax - \log axk$, (including, for example $k=-1$ and $k=-12$); 8. understand exponential growth and decay in modelling, giving consideration to limitations and refinements of exponential models Know how to 1. use the function ax and its graph, where a is positive; 2. use the function ex and its graph; 3. use the definition of $\log ax$ as the inverse of ax , where a is positive and $x \geq 0$ 4. use the function $\ln x$ and its graph; 5.use $\ln x$ as the inverse function of ex 6.use logarithmic graphs to estimate parameters in relationships of the form $y=axn$, and $y=kbx$, given data for x and y 7. use exponential growth and decay in modelling, giving consideration to limitations and refinements of exponential models
Unit 5b: Statistical hypothesis testing	5b. Carry out hypothesis tests involving the binomial distribution	Know 1. and understand that a sample is being used to make an inference about the population; 2. and appreciate that the significance level is the probability of incorrectly rejecting the null hypothesis. Know how to 1. conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context;

Unit 9: Kinematics 2 (variable acceleration)	9b: Use of integration for kinematics problems i.e. r = ∫ vdt, v = ∫ adt	Know 1. and understand that gradients of the relevant graphs link to rates of change; Know to 1. use calculus (differentiation) in kinematics to model motion in a straight line for a particle moving with variable acceleration; 2. find max and min velocities by considering zero gradients and understand how this links with the actual motion (i.e. acceleration = 0).
Unit 9: Kinematics 2 (variable acceleration)	9b: Use of integration for kinematics problems i.e. r = ∫ vdt, v = ∫ adt	Know 1. and understand that the area under a graph is the integral, which leads to a physical quantity; Know how to 1. use calculus (integration) in kinematics to model motion in a straight line for a particle moving under the action of a variable force; 2. use initial conditions to calculate the constant of integration and refer back to the problem.
Exams		
Unit 1: Proof	1a. Proof - Examples including proof by deduction, proof by exhaustion and disproof by counter example	Know 1. and understand that various types of proof can be used to give confirmation that previously learnt formulae are true, and have a sound mathematical basis; 2. and understand that there are different types of proof and disproof (e.g. deduction and contradiction) 3. when it is appropriate to use which particular method Know how to 1. use an appropriate proof within other areas of the specification later in the course.
Unit 2: Algebraic and partial fractions	2a. Simplifying algebraic fractions	Know how to 1. add, subtract, multiply and divide algebraic fractions; 2. use the factor theorem to shown a linear expression of the form $(a+bx)$ is a factor of a polynomial; 3. use the factor theorem for divisors of the form $(a+bx)$ 4. simplify algebraic fractions by fully factorising polynomials up to cubic.
Unit 2: Algebraic and partial fractions	2b. Partial fractions	Know how to 1. split a proper fraction into partial fractions; 2. split an improper fraction into partial fractions, dividing the numerator by the denominator (by polynomial long division or by inspection).

Year 13		Know and Know how to
Topic	**Key area**	**Learning Objectives (small steps)**
Unit 3: Functions and modelling	**3a. Modulus function**	Know 1. what is meant by a modulus of a linear function; Know How to 2. to sketch graphs of functions involving modulus functions; 3. to solve equations and inequalities involving modulus functions.
Unit 3: Functions and modelling	**3b. Composite and inverse functions**	Know 1. the definition of a one-one and a many-one mappings 2. and understand the condition for an inverse function to exist. Know how to 1.to work out the domain and range of functions; 2. to work out the composition of two functions; 3. to work out the inverse of a function and sketch its graph;
Unit 3: Functions and modelling	**3c. Transformations**	Know 1. the effect of simple transformations on the graph of $y=f(x)$ 2. the effect of composite transformations on equations of curves and be able to describe them geometrically Know how to 1. sketch associated graphs and combinations of the transformations: $y=af(x)$, $y=f(x)+a$, $y=f(x+a)$, $y=f(ax)$ 2. transform graphs to produce other graphs;
Unit 3: Functions and modelling	**3d. Modelling with functions (trigonometric, exponential, reciprocal etc.)**	Know how to 1. use functions in modelling, including consideration of limitations and refinements of the models.
Unit 4: Series and sequences	**4a. Arithmetic and geometric progressions (proofs of sum formulae)**	Know 1. what a sequence of numbers is and the meaning of finite and infinite sequences; 2. what a series is; 3. the difference between convergent and divergent sequences; 4. what is meant by arithmetic series and sequences; 5. what is meant by geometric series and sequences; 6. the condition for a geometric series to be convergent 7. the proofs and derivations of the sum formulae (for both AP and GP) Know how to 1. use the standard formulae associated with arithmetic series and sequences; 2. use the standard formulae associated with geometric series and sequences; 3. find its sum to infinity; 4. solve problems involving arithmetic and geometric series and sequences;
Unit 4: Series and sequences	**4b. Sigma notation**	Know 1. the definition of and be familiar with $\sum$ notation and how it can be used to generate a sequence and series; 2. how this notation will lead to an AP or GP and its sum; that $\sum_1^n 1=n$
Unit 4: Series and sequences	**4c. Recurrence and iterations**	Know 1. that a sequence can be generated using a formula for the nth term or a recurrence relation of the form $x_{n+1}=f(x_n)$ 2. the difference between increasing, decreasing and periodic sequences; 2. and understand how a recurrence relation of the form $U_n=f(U_{n-1})$ can generate a sequence; Know how to 1. describe increasing, decreasing and periodic sequences.

Unit 5: The binomial theorem	**5a. Expanding (a+bx)^n for rational n knowledge of range of validity**	Know how to 1. find the binomial expansion of $(1-x)-1$ for rational values of n and $\|x\|<1$ 2. find the binomial expansion of $(1+x)n$ for rational values of n and $\|x\|<1$ 3. find the binomial expansion of $(1+bx)n$ for rational values of n and $\|x\|<1\|b\|$ 4. find the binomial expansion of $(a+x)n$ for rational values of n and $\|x\|<a$ 5.find the binomial expansion of $(a+bx)n$ for rational values of n and $\|bxa\|<1$ 6. use the binomial theorem to find approximations (including roots).
Unit 5: The binomial theorem	**5b. Expansion of functions by first using partial fractions**	Know how to 1. use partial fractions to write a rational function as a series expansion
Unit 1: Regression and correlation	**1a. Change of variable**	Know how to 1. change the variable in a regression line; 2. estimate values from regression line.
Unit 1: Regression and correlation	**1b. Correlation coefficients, statistical hypothesis testing for zero correlation**	Know 1. about and understand correlation coefficients; Know how to 1. calculate the PMCC (calculator only); 2. interpret a correlation coefficient; 3. conduct a hypothesis test for a correlation coefficient
Unit 4: Moments	**4a. Forces' turning effect**	Know 1. and realise that a force can produce a turning effect; 2. that a moment of a force is given by the formula force × distance giving Nm 3. what the sense of a moment is; 4. and understand that the force and distance must be perpendicular to one another; 5. and realise what conditions are needed for a system to remain in equilibrium; Know how to 1. draw mathematical models to represent horizontal rod problems; 2. solve problems when a bar is on the point of tilting.
Unit 6: Trigonometry	**6a. Radians (exact values), arcs and sectors**	Know 1. and understand the definition of a radian 2. the exact values of sin, cos and tan; Know how to 1. use exact values of sin, cos and tan; 2. convert between radians and degrees; derive and use the formulae for arc length and area of sector.
Unit 6: Trigonometry	**6b. Small angles**	Know 1. and understand the standard small angle approximations for sine, cosine and tangent. Know how to 1. use the standard small angle approximations for sine, cosine and tangent.
Unit 6: Trigonometry	**6c. Secant, cosecant and cotangent (definitions, identities, graphs); Inverse trigonometrical functions**	Know 1. and understand the secant, cosecant and cotangent functions, and their relationships to sine, cosine and tangent; the identities $1+\tan 2x=\sec 2x$ and $1+\cot 2x=\operatorname{cosec} 2x$ Know how to 1. sketch the graphs of secant, cosecant and cotangent; 2. simplify expressions and solve involving sec, cosec and cot; 3. solve identities involving sec, cosec and cot; 4. use the identities $1+\tan 2x=\sec 2x$ and $1+\cot 2x=\operatorname{cosec} 2x$ 5. prove other identities and solve equations in degrees and/or radians 6. work with the inverse trig functions sin−1, cos−1 and tan−1 7. sketch the graphs of sin−1, cos−1 and tan−1

Unit 6: Trigonometry	**6d. Compound and double (and half) angle formulae; geometric proof of compound angle formula**	Know how to 1. prove geometrically the following compound angle formulae for sin $(A\pm B)$, cos $(A\pm B)$ and tan $(A\pm B)$ 2. use compound angle identities to rearrange expressions or prove other identities; 3. use compound angle identities to rearrange equations into a different form and then solve; 4. recall or work out double angle identities; 5. use double angle identities to rearrange expressions or prove other identities; 6. use double angle identities to rearrange equations into a different form and then solve.
Unit 6: Trigonometry	**6e. R cos (x+/-a) or R sin (x+/-a)**	Know how to 1. express $\alpha\cos\theta+b\sin\theta$ as a single sine or cosine function; 2. solve equations of the form $\alpha\cos\theta+b\sin\theta=c$ in a given interval.
Unit 6: Trigonometry	**6f. Proving trigonometric identities**	Know how to 1. construct proofs involving trigonometric functions and previously learnt identities.
Unit 6: Trigonometry	**6g. Solving problems in context (E.g. mechanics)**	Know how to 1. use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces
Unit 7: Parametric equations	**7a. Definition and converting between parametric and Cartesian forms**	Know 1. and understand the difference between the Cartesian and parametric system of expressing coordinates; Know how to 1. convert between parametric and Cartesian forms.
Unit 7: Parametric equations	**7b. Curve sketching and modelling**	Know and recognise some standard curves in parametric form and how they can be used for modelling. Know how to plot and sketch curves given in parametric form;
Unit 2: Probability	**2a. Using set notation for probability. Conditional probability**	Know 1. and understand use probability formulae using set notation 2. and understand the conditional probability formula $\mathrm{P}(A\|B)=\mathrm{P}(A\cap B)\mathrm{P}(B)$ Know how to 1. use probability formulae using set notation; 2. use tree diagrams, Venn diagrams and two-way tables; 3. use the conditional probability formula $\mathrm{P}(A\|B)=\mathrm{P}(A\cap B)\mathrm{P}(B)$.
Unit 2: Probability	**2b. Questioning assumptions in probability**	Know how to 1. model with probability; 2. critique assumptions made and the likely effect of more realistic assumptions.
Unit 5: Forces at any angle	**5a. Resolving forces**	Know 1. and understand the language relating to forces; Know how to 1. identify the forces acting on a particle and represent them in a force diagram; 2. find the resultant force (magnitude and direction); 3. find the resultant of several concurrent forces by vector addition; 4. resolve a force into components and be able to select suitable directions for resolution.

Unit 5: Forces at any angle	**5b. Friction forces (including coefficient of friction mu)**	Know 1. and understand that a rough plane will have an associated frictional force, which opposes relative motion (i.e. the direction of the frictional force is always opposite to how the object is moving or 'wants' to move); 2. and understand that the 'roughness' of two surfaces is represented by a value called the coefficient of friction represented by μ 3. that $0 \le \mu$ but that there is no theoretical upper limit for μ although for most surfaces it tends to be less than 1 and that a 'smooth' surface has a value of μ=0 4. and understand the formula $F \le \mu R$ Know how to 1. draw force diagrams involving rough surfaces which include the frictional force 2. use the formula $F \le \mu R$.
Unit 8: Differentiation	**8a. Differentiating sin x and cos x from first principles**	Know how to 1. find the derivative of $\sin x$ and $\cos x$ from first principles.
Unit 8: Differentiation	**8b. Differentiating exponentials and logarithms**	Know how to 1. differentiate functions involving ex, $\ln x$ and related functions such as $6e4x$ and $5\ln 3x$ 2. sketch the graphs of these functions; differentiate to find equations of tangents and normals to the curve.
Unit 8: Differentiation	**8c. Differentiating products, quotients, implicit and parametric functions**	Know how to 1. differentiate composite functions using the chain rule; 2. differentiate using the product rule; 3. differentiate using the quotient rule; 4. differentiate parametric equations; 5. find the gradient at a given point from parametric equations; 6. find the equation of a tangent or normal (parametric); 7. use implicit differentiation to differentiate an equation involving two variables find the gradient of a curve using implicit differentiation; 8. verify a given point is stationary (implicit).
Unit 8: Differentiation	**8d. Second derivatives (rates of change of gradients, inflections)**	Know how to 1. find and identify the nature of stationary points and understand rates of change of gradient.
Unit 8: Differentiation	**8e. Rates of change problems (including growth and kinematics) - see Integration (part 2) - differential equations**	Know how to 1. use a model to find the value after a given time; 2. set up and use logarithms to solve an equation for an exponential growth or decay problem; 3. use logarithms to find the base of an exponential; model the growth or decay of 2D and 3D objects using connected rates of change; 4. set up a differential equation using given information which may include direct proportion.
Unit 9: Numerical methods - see integration (part 2) for the trapezium rule	**9a. Location of roots**	Know how to l1. locate roots of f(x)=0 by considering changes of sign of f(x) ;use numerical methods to find solutions of equations.
Unit 9: Numerical methods - see integration (part 2) for the trapezium rule	**9b. Solving by iterative methods (knowledge of 'staircase and cobweb' diagrams)**	Know 1. and understand the principle of iteration; 2. and appreciate the need for convergence in iteration; Know how to 1. use iteration to find terms in a sequence; 2. sketch cobweb and staircase diagrams; 3. use cobweb and staircase diagrams to demonstrate convergence or divergence for equations of the form x=g(x)
Unit 9: Numerical methods - see integration (part 2) for the trapezium rule	**9c. Newton-Raphson method**	Know 1. understand how the Newton-Raphson method works in geometrical terms. Know how to 1. solve equations approximately using the Newton-Raphson method;
Unit 9: Numerical methods - see integration (part 2) for the trapezium rule	**9d. Problem solving**	Know how to use 1. use numerical methods to solve problems in context.

Unit 3a: The Normal distribution	**3a: Understand and use the Normal distribution**	Know 1. and understand the properties of the Normal distribution; 2. the position of the points of inflection of a Normal distribution. Know how to 1. find probabilities using the Normal distribution;
Unit 6: Applications of kinematics	**6a. Projectiles**	Know how to 1. find the time of flight of a projectile; 2. find the range and maximum height of a projectile; 3. derive formulae to find the greatest height, the time of flight and the horizontal range (for a full trajectory); 4. modify projectile equations to take account of the height of release; be able to derive and use the equation of the path.
Unit 10: Integration (part 1)	**10a. Integrating x^n (including when n=-1), exponentials, trigonometric and parametrically defined functions**	Know how to 1. integrate expressions by inspection using the reverse of differentiation; 2. be able to integrate xn for all values of n and understand that the integral of $1x$ is ln $\|x\|$ 3. integrate expressions by inspection using the reverse of the chain rule (or function of a function); 4. integrate trigonometric expressions; 5. integrate expressions involving ex 6. integrate a function expressed parametrically;
Unit 10: Integration (part 1)	**10b. Using the reverse of differentiation, and using trigonometric identities to manipulate integrals**	Know 1. and recognise integrals of the form $\int f'(x)f(x)dx = \ln\|f(x)\|+c$ Know how to 1. use trigonometric identities to manipulate and simplify expressions to a form which can be integrated directly.
Unit 11: Integration (part 2)	**11a: Integration by substitution**	Know how to 1. integrate expressions using an appropriate substitution; 2. select the correct substitution and justify their choices.
Unit 11: Integration (part 2)	**11b. Integration by parts**	Know how to 1. integrate an expression using integration by parts; 2. select the correct method for integration and justify their choices.
Unit 11: Integration (part 2)	**11c. Use of partial fractions**	Know How to 1. integrate rational expressions by using partial fractions that are linear in the denominator; 2. simplify the expression using laws of logarithms.
Unit 11: Integration (part 2)	**11d. Areas under graphs (incl. curves expressed parametrically) or between 2 curves, incl. understanding area as limit of a sum**	Know 1. and understand the integration as the limit of a sum; 2. and understand the difference between an indefinite and definite integral and why we do not need + c Know how to 1. use integration as the limit of a sum; 2. integrate polynomials and other functions to find definite integrals, and 3. use these to find the areas of regions bounded by curves and/or lines; be able to use a definite integral to find the area under a curve and the area between two curves. 4. be able to find an area under a curve defined by a pair of parametric equations.
Unit 11: Integration (part 2)	**11e. The trapezium rule**	Know 1. and appreciate the trapezium rule is an approximation and realise when it gives an overestimate or underestimate. Know how to 1. use the trapezium rule to find an approximation to the area under a curve;
Unit 11: Integration (part 2)	**11f. Differential equations**	Know how to write a differential equation from a worded problem; use a differential equation as a model to solve a problem; solve a differential equation; substitute the initial conditions or otherwise into the equation to find + c and the general solution.
Unit 3b: The Normal distribution	**3b. Use the Normal distribution as an approximation to the binomial distribution. Selecting the appropriate distribution.**	Know 1. and understand and be able to apply a continuity correction; Know how to 1. find the mean and variance of a binomial distribution; 2. use the Normal distribution as an approximation to the binomial distribution.

Unit 7: Applications of forces	**7a. Equilibrium and statics of a particle (including ladder problems)**	Know 1. and understand that a body is in equilibrium under a set of concurrent (acting through the same point) forces is if their resultant is zero; 2. that vectors representing forces in equilibrium form a closed polygon; 3. and understand how to solve problems involving equilibrium of a particle under coplanar forces, including particles on inclined planes and 2D vectors; Know how to 1. solve statics problems for a system of forces which are not concurrent (e.g. ladder problems), thus applying the principle of moments for forces at any angle.
Unit 7: Applications of forces	**7b. Dynamics of a particle**	Know know and understand the meaning of Newton's second law; Know how to formulate the equation of motion for a particle in 1-dimensional motion where the resultant force is mass × acceleration; formulate the equation of motion for a particle in 2-dimensional motion where the resultant force is mass × acceleration; formulate and solve separate equations of motion for connected particles, where one of the particles could be on an inclined and/or rough plane.
Unit 12: Vectors (3D)	**12a. Use of vectors in three dimensions; knowledge of column vectors and i, j and k unit vectors**	Know 1. the definition of a unit vector in 3D; 2. understand the position vectors, and calculate the distance between two 3D points represented by position vectors; Know how to 1. extend the work on vectors from AS Pure Mathematics to 3D with column vectors and with the use of i, j and k unit vectors; 2. calculate the magnitude of a 3D vector; 3. add 3D vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations; 4. understand and use position vectors, and calculate the distance between two 3D points represented by position vectors; 5. use vectors to solve problems in pure mathematics and in contexts (e.g. mechanics).
Unit 3c: The Normal distribution	**3c. Statistical hypothesis testing for the mean of the Normal distribution**	Know how to conduct a statistical hypothesis test for the mean of the Normal distribution; interpret the results in context.
Unit 8: Further kinematics	**8a. Constant acceleration (equations of motion in 2D; the i, j system)**	Know 1. and understand the suvat formulae for constant acceleration in 2D; Know how to 1. recognise when the use of constant acceleration formulae is appropriate; 2. write positions, velocities and accelerations in vector form; 3. understand the language of kinematics appropriate to motion in 2 dimensions 4. find the magnitude and direction of vectors; 5. extend techniques for motion in 1 dimension to 2 dimensions by using vectors; 6. use velocity triangles to solve simple problems; 7. understand and use suvat formulae for constant acceleration in 2D; 8. apply the equations of motion to **i**, **j** vector problems; 9. use v = u + at , r = ut + 12at2 etc. with vectors given in i , j or column vector form.
Unit 8: Further kinematics	**8b. Variable acceleration (use of calculus and finding vectors $\dot{r}$ and $\ddot{r}$ at a given time)**	Know 1. and understand the language and notation of kinematics appropriate to variable motion in 2 dimensions, i.e. knowing the notation $r^{\cdot}$ and $r^{\cdot\cdot}$ for variable acceleration in terms of time. Know how to 1. extend techniques for motion in 1 dimension to 2 dimensions by using 2. calculus and vector versions of equations for variable force/acceleration problems;