| $\begin{aligned} & \text { Term } \vec{~} \\ & \text { Year } \downarrow \end{aligned}$ | Term 1a | Term 1b | Term 2a | Term 2b | Term 3a | Term 3b |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 7 | Algebraic Thinking Sequences Describe and find terms in sequences, look at linear and non-linear sequences, describe term-to-term rules and look at sequences on graphs. Understand and use algebraic notation Work with function machines, finding inputs and outputs in numerical and algebraic form. We will also begin substituting into expressions to generate sequences. Equality and equivalence Solve one step linear equations using bar modelling as well as using inverse operations and we will simplify expressions by collecting like terms. | Place value and Proportion Place value and ordering integers and decimals Use place value to order or compare numbers and place numbers on a number line. We will also round numbers, find the range and median of a set of numbers and begin looking at numbers in standard form. <br> Fraction, decimal and percentage equivalence Representations of fractions, decimals and percentages, convert between them and calculate equivalent fractions. | Applications of Number Solving problems with addition \& subtraction Mental and written methods of addition and subtraction, solve problems involving perimeters and money. We will also use tables, frequency trees, bar charts and line charts. <br> Solving problems with multiplication and division Use factors and multiples, convert between metric units and multiply and divide by powers of 10. We will also use written methods of multiplying and dividing to solve problems involving areas of 2D shapes. <br> Fractions \& percentages of amounts Find the fraction or percentage of a given amount using written and calculator methods. | Directed Number <br> Operations and equations with directed number Add, subtract, multiply and divide with positive and negative numbers, evaluate algebraic expressions involving directed numbers and begin solving two step equations. We will also look at roots and powers. <br> Fractional Thinking Addition and subtraction of fractions Different representation of fractions, find equivalent fractions and add or subtract fractions, including mixed numbers and improper fractions. We will also begin to look at adding and subtracting algebraic fractions. | Lines and Angles Constructing, measuring and using geometric notation Types of angles, draw and measure angles, construct triangles and polygons using compasses and protractors. We will also draw and interpret pie charts. Developing geometric reasoning Various angle rules, including those that meet on a straight line, angles in triangles and quadrilaterals, and use these rules to solve angle problems. We will also begin looking at angle rules involving parallel lines and polygons. | Reasoning with Number Developing number sense Use mental arithmetic, as well as using factors and estimation in mathematical problems. <br> Sets and probability Use Venn diagrams and sample spaces to calculate probabilities, developing the use of probability vocabulary Prime numbers and proof Find factors, multiples, prime and triangular numbers, then find LCMs and HCFs as well as prime decompositions. |
| 8 | Proportional Reasoning Ratio and scale Different representations of ratios, dividing into ratios and solving problems involving ratios. <br> Multiplicative change Direct proportion, conversion graphs, similar shapes and scale drawings. Multiplying and dividing fractions Multiplying and dividing fractions, including mixed numbers and algebraic fractions. | Representations W orking in the Cartesian plane Coordinates, recognising and plotting straight line graphs by understanding gradients and y -intercepts. Representing data Scatter graphs, correlations, lines of best fit, frequency tables and the difference between continuous and discrete data. <br> Tables \& Probability Sample spaces, two way tables and Venn diagrams. | Algebraic Techniques Brackets, equations and inequalities Expanding and factorising into single brackets, forming and solving equations with brackets and forming and solving inequalities. <br> Sequences Generate sequences using rules and find the nth term of linear sequences. <br> Indices Multiply and divide expressions using laws of indices. | Developing Number Fractions and percentages Convert between fractions, decimals and percentages, use them in calculations and find percentage changes with or without a calculator. Standard index form Convert numbers into standard form, multiply, divide, add and subtract numbers given in standard form and compare numbers in standard form. Number sense Rounding and estimation, find error intervals, convert between metric units and solve problems involving time and money. | Developing Geometry Angles in parallel lines and polygons Work with angle rules between parallel lines, look at the properties of triangles and quadrilaterals and calculate angles in polygons. Area of trapezia and circles Calculate areas and perimeters of triangles, rectangles and circles, calculate areas of parallelograms and trapezia, as well as looking at compound shapes. Line symmetry and reflection Recognise line symmetry and reflect shapes in horizontal, vertical and diagonal lines. | Reasoning with Data The data handing cycle Types of graphs and charts, including pictograms, bar charts, pie charts and line graphs. We will look at grouped data and establish which type of chart is most suitable, as well as considering when graphs and charts can be misleading. <br> Measures of location Use and compare mean, median, mode and range, grouped and ungrouped frequency tables and outliers. |
| 9 | Reasoning with Algebra Straight line graphs Gradients and intercepts of straight line graphs, rearrange and plot straight lines given in the form $y=m x+c$ and write the equation of a straight line from a graph. <br> Forming and solving equations Solve one and two step equations and inequalities, including those with the unknown on both sides. We will also be rearranging formulae. | Constructing in 2 and 3 Dimensions Three dimensional shapes Create nets of 3D shapes, draw plans and elevations, calculate surface areas of some prisms and calculate volumes of cubes, cuboids, cones, pyramids and spheres. <br> Constructions and Congruency Constructing loci, drawing perpendicular bisectors, angles bisectors and identifying congruent triangles. | Reasoning with Number Numbers Types of numbers, including integers, real and rational numbers. We will find HCFs and LCMs, calculate with fractions and look at numbers in standard form. Using percentages Convert between fractions, decimals and percentages, calculate percentage changes and reverse percentages with or without a calculator. | Reasoning with Geometry Deduction Angle rules in parallel lines, solve angle problems, including with algebraic terms in various shapes, using geometric reasoning. Rotation and translation Rotational symmetry, rotate shapes, translate points and shapes using vector notation and combine multiple transformations. | Reasoning with Proportion Enlargement and similarity Enlarge shapes by integer, fractional and negative scale factors, as well as looking at similar shapes and right angled triangles. <br> Solving ratio and proportion problems Solve problems involving direct and inverse proportion, look at graphs, calculate with ratios and consider 'best buy' problems. | Representations Probability Calculate relative frequency, expected outcomes and independent events, as well as drawing probability trees and using them to calculate probabilities with and without replacement. <br> Algebraic Representation Draw quadratic and reciprocal graphs, represent inequalities and use graphs to solve simultaneous equations. |



All students will calculate expected frequencies from experimental probabilities. They will calculate probabilities for more than one event using sample space diagrams and from tree diagrams. Higher tier students will also Higher tier students will also
calculate conditional probabilities

## Collecting, representing and interpreting data

All students will construct and interpret frequency tables, frequency polygons, two-way tables, line graphs, bar charts, pie charts, time-series stem and leaf diagrams and scatter graphs. They will calculate averages from a list and a frequency table, and use and to compare distributions. Higher tier students will aso Higher tier students will also construct and interpret histograms,
cumulative frequency graphs and box plots.

Non-calculator methods
All students will recap adding, subtracting, multiplying and dividing with decimals and fractions. They will understand limits of accuracy and construct error intervals for numbers that have been rounded or truncated. Higher tier students will also calculate with surds, including rationalising denominators. They will also perform calculations with upper and lower bounds.

## ndices and roots

All students will understand and use he laws of indices, including with negative indices. They will apply these to calculating with standard form. Higher tier students will also work with fractional indices.

## Types of number and sequences

 Alls will find the HCF and CM of two or more numbers. They will explore linear, geometric, quadratic and Fibonacci sequences.Higher tier students will explore sequences involving surds, and find the nth term of quadratic sequences.

## Graphs

Graphs of circles, cubes and quadratics Sketch graphs of quadratic functions, identify roots, $y$-intercept and turning point by completing the square, identify if a quadratic equation has any real roots, find approximate solutions to quadratic equations, solve simultaneous equations graphically, find graphically the intersection points of a straight line with a circle, solve quadratic inequalities, represent the solution set for inequalities using set notation, and show the solution set of several inequalities in two variables on a graph.
Gradient and area under graphs Sketch graphs of reciprocal and exponential functions, solve exponential growth and decay problems, estimate area under a graph, interpret the gradient of linear or non-linear graphs, estimate the gradient of a non-linear graph at a given point, use a velocity-time graph to estimate the acceleration at a specific time, and interpret the gradient of a graph in financial contexts.

## Circles

Circle geometry Investigate loci to draw circles and perpendicular lines, find the equation of a tangent to a circle at a given point, and construct the graph of a circle centred at the origin.
Circle theorems Identify parts of a circle, prove and use circle theorems Apply circle theorems to more complex geometric problems.

## Further Algebra

Algebraic fractions Simplify algebraic fractions, add, subtract, multiply and divide algebraic fractions, and solve equations involving algebraic fractions.

## Further Algebra

Functions Write a ratio as a linear function, use function notation, find the inverse of a function, find the composite of two functions, and analyse transformations o graphs of functions.
Algebraic Proof Learn to represent different types of integers algebraically, and use these representation to construct algebraic proofs.

## Geometric Proof

C ongruence and geometric proof Prove results such as the angle sum of a triangle, use formal geometric proof for the similarity of two given triangles, prove the congruence of triangles and other shapes using formal arguments, and solve angle problems by first proving congruence
Vectors Understand and use vector notation, represent vectors, combinations of vectors and scalar multiples pictorially, perform vector calculations using column vectors, find the magnitude of a vector, calculate the resultant of two vectors, solve geometric problems, and construct geometric proofs using vectors.

## Revision

Y12
Teacher

## Pure <br> GCSE Recap

Chapter 1 - Algebraic Expressions Recap and build upon techniques learn from GCSE on ways to manipulate algebraic expressions. This includes expanding and factorising quadratics, index laws and surds.

## Graphs and Coordinate Geometry

Chapter 5-Straight Line Graphs Formalise different ideas explored in GCSE on equations of straight lines. We will then delve deeper into coordinate geometry and the use of linear functions in modelling problems.

Chapter 6-Circles Further develop our knowledge of circles, now including when the centre is not the origin. This is then combined with knowledge from previous chapters to solve coordinate geometry problems.

## Calculus

Chapter 12 - Differentiation Introduce the topic of calculus, focusing specifically on differentiating polynomials and other powers of $x$. We will explore the uses of different order derivatives and their use in real life modelling, particularly in the process of 'optimisation'.

Chapter 13 - Integration In this chapter, we will explore the partial inverse of differentiation; integration. We will learn how to integrate polynomials and other powers of $x$. We will also look at how to use integration to calculate areas bounded by curves.

## CCSE Recap

Chapter 2 - Quadratics Recap solving quadratic equations from GSCE. We will use this knowledge to learn about sketching a quadratic function and the importance of the discriminant.

Chapter 3 - Equations and Inequalities Recap knowledge from GCSE on solving both linear and quadratic equations and inequalities, as well as simultaneous equations.

## Graphs and Coordinate Geometry

Chapter 4 - Graphs and Transformation Expand upon knowledge of graphs from GSCE, exploring the graphs of polynomials of different degrees. Afterwards, we will look at the result of graphs after a transformation, now including stretching parallel to each axis.

## Further Algebra

Chapter 7 - Algebraic Methods Practice new methods of manipulating algebraic expressions, including using the factor theorem with cubic expressions. We will use these methods to help construct mathematical proofs.

Chapter 8 - Binomial Expansion Explore the different components of the Binominal Expansion, such as Pascal's triangle and factorial notation. We will use this knowledge to make approximations of complicated functions.

## Exponentials and Logarithms

Chapter 14 - Exponentials and Logarithms Explore the meaning and use of exponents and logarithms. We will interpret models that use exponential functions, learn and apply the laws of logarithms, and solve equations in the form $a x=b$.

## Statistics <br> Statistical Sampling

Chapter 1 - Data Collection Consider the advantages and disadvantages of different forms of sampling. We shall also consider different types of real- world statistical data.

## Data Representation and Interpretation

Chapter 2 - Measures of location and spread Build upon GCSE work on analysing data. Calculate measures of central tendency, such as the mean, median and mode, and other measures of location, such as quartiles and deciles. Students will extend their knowledge of measures of spread to include interpercentile range, variance and standard deviation.

Chapter 3 - Representations of data Extend knowledge gained at GCSE about boxplots, cumulative frequency graphs and histograms. Use knowledge gained in this unit to analyse and compare two data sets and make conclusions based on inferences.

Chapter 4 - Correlation Consider the correlation of bivariate data and explore the use of linear regression models.

## Probability

Chapter 5 - Probability Consider different methods for calculating probability, such as sample space, Venn and tree diagrams. Also determine whether two events are independent or mutually exclusive.

## AS Trigonometry

Chapter 9 - Trigonometric ratios Recap the trigonometric formulas used in GCSE and how we can apply them when problem solving. We will then explore the different trigonometric functions, sketching their graphs and applying transformations.

Chapter 10 -Trigonometric Identities and Equations Develop our understanding of different trigonometric relationships, before moving onto using these to solve various trigonometric equations, including quadratics.

## Vectors

Pure Chapter 11 - Vectors Build upon work studied at GCSE on vectors. Calculate the magnitude and direction of a vector and use this to solve problems. Use vectors to solve geometric problems, producing universal results and apply these results to real-world contexts.

## Quantities and units in Mechanics

Chapter 8 - Modelling in mechanics Learn about assumptions used in Mathematical modelling. Apply knowledge of vectors from GCSE to real-life scenarios

## Kinematics 1

Chapter 9 - Constant acceleration Build upon GCSE knowledge of speed, distance and time to interpret velocity and displacement-time graphs and solve problems relating to both. Also learn how to derive formulae based on constant acceleration and apply these in different contexts including both horizontal and vertical motion. Also solve multi-stage problems, including those where objects are falling freely due to gravity.

## Statistical Distributions

Chapter 6-Statistical distributions Introduce discrete probability distributions and become familiar with different representations for them. Also leam how to calculate probabilities of single values from a binomial distribution using a calculator. We will then extend our understanding of binomial distributions and learn to calculate cumulative probabilities.

## Statistical Hypothesis Testing

Chapter 7 -Hypothesis testing Learn to formulate a hypothesis about an event occurring within a population, using technical language, based upon assumptions made about that population. We will then use our knowledge of binomial
distribution to test our hypotheses against a sample of the population by considerin multiple methods such as finding critical regions and calculating the probability of a test statistic. We will then use these findings to draw conclusions in real-world contexts.

Slack for revision and end of year exams

## Further Algebra

Chapter 1 (A2) - Algebraic methods Recap arithmetic involving algebraic fractions and look at splitting algebraic fractions into partial fractions. We also look at a new method of proving that statements are true; proof by contradiction

Chapter 2 (A2) - Functions Build upon prior knowledge of function notation, and inverse and composite functions from GCSE. We extend this to modulus functions and explore the graphs of these functions.

## Forces and Newton's Laws

Chapter 10 - Forces and motion Draw complete force diagrams to consider all forces acting on an object. Use knowledge of vectors to apply them in the context f forces and use Newton's three laws of motions to calculate an object's acceleration and solve problems using these results. Apply knowledge of Newton's three laws to solve problems with connected particles, such as pulleys.

## Kinematics 2

Chapter 11 - Variable acceleration Draw upon knowledge from various topics of the year 1 pure mathematics course and apply them to real-world contexts. We will use differentiation and integration to solve kinematic problems and we will derive constant acceleration formulae

## Slack for revision and end of year exams

## Sequences and Series (A2)

Chapter 3 - Sequences and Series Build upon GCSE knowledge of linear and geometric sequences, and learn to calculate the sum of a series. We will then progress onto application of arithmetic and geometric series to real- life problems.

## Further Algebra (A2)

Chapter 4 - Binomial Expansion Build upon binomial expansion from AS. Explore non-integer and negative indices and link it to series and partial fractions.

Chapter 9 - Differentiation Explore differentiating a wider range of functions (trigonometric, logarithms, exponentials etc.) as well as products, quotients and composites of these functions. Also look at differentiating functions written as parametric equations. We also begin to explore rates of changes and how we can form differential equations.

Chapter 11 - Integration Explore integrating a wider range of functions (trigonometric, logarithms, exponentials etc.). Look at different integration techniques such as integration by parts and integration by substitution. We also apply these different techniques to solving first order

Chapter 8 - Parametric Equations Explore a new class of equations where we express 2 variables in terms of a third variable called a 'parameter'.

## Numerical Methods

Pure Chapter 10 - Numerical methods We shall consider different methods for finding or approximating the roots of functions. We will learn how to use change of sign, iteration and the Newton-Raphson procedure

## Statistics

## Regression and Correlation

Chapter 1 -Regression, correlation and hypothesis testing Bivariate (paired) data can show a strong relationship that is not linear. We shall use logarithms to examine trends in non-linear data. We shall also consider correlation in bivariate data and carry out hypothesis tests for possible correlation.

## Conditional Probability

Chapter 2 Conditional probability Extend on work studied in AS probability. Use set notation and explore conditional probability using multiple representations, including Venn diagrams and two way tables. Also use probability formulae and solve problems using conditional probability.

## The Normal Distribution

Chapter 3 - The normal distribution Learn the characteristics of the normal distribution curve and use it to calculate values and probabilities using a calculator Building upon work done in Year 12, find means and standard deviations for normally distributed, continuous random variables and also use this distribution as an approximation to the binomial distribution. Finally, we shall apply everything learned last year regarding hypothesis testing to continuous random variables and the normal distribution.

## Moment

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Chapter 4 - Moments Calculate the turning effect of a force applied to a rigid body, consider all turning forces acting on a body to calculate the overall force and examine what this means in a real-world context. Students will calculate moments on rods, both uniform and non-uniform, and solve problems with objects at the point of tilting.

## Applications of Kinematic

Chapter 6 - Projectiles Analyse the motion of a projectile by considering its horizontal and vertical motion separately. Learn that the horizontal motion can be modelled as having constant velocity, but that they will have to include acceleration due to gravity in the vertical motion. Both of these will draw heavily upon the 'SUVAT' work done in Year 12. We will also derive the equation of the path of a projectile and formulae for time of flight, range and greatest height.

## Applications of Forces

Chapter 7 - Application of forces (Statics) When the forces acting upon a body are balanced, it is static or in equilibrium. We will use this to find unknown forces involving pulleys, strings, rough surfaces and inclined planes.
(Dynamics) As more force is applied to an object, forces become unbalanced and we reach a dynamic situation where the object starts moving. We will learn that, in this situation, we not only need to consider unknown forces involving pulleys, strings, rough surfaces and inclined planes, but also Newton's laws of motion

## Further Kinematics

Chapter 8 -Further kinematics Combine previous work on vectors with that on motion to produce vector equations for displacement, velocity and acceleration We will also use calculus from Pure studies and learn to differentiate and integrate equations of motion with respect to time. This will enable us to now consider variable acceleration in addition to the constant acceleration of 'SUVAT'.

## A2 Trigonometry

Cfeter 5 Radians introduce a new measure for angles and explore how affects calculations involving
preparation for A2 calculus.

Chapter 6 - Trigonometric Functions Here we explore reciprocal and functions. We then use these to solve a wider range of trigongmetric equations.

Chapter 7 - Trigonometry and Modelling Introduce compound angle formulae and harmonic form and use these to model real-life situations. These will also be used in A2 Mechanics.

## Vectors 2

Pure Chapter 12 -Vectors (3D) This topic extends the work on vectors in two Pure Chapter 12-Vectors (3D) This topic extends the work on vect
dimensions that was done at GCSE and in Year 12. We will begin by dimensions that was done at GCE and in Year 12. We will begin by
understanding Cartesian coordinates in three dimensions $(x, y, z)$. We will then learn to use vectors to describe positions in relation to the three dimensions before using these vectors to solve geometric and mechanical problems.

## Mechanics

## Forces at any angle

Chapter 5 - Forces and friction Consider the role friction has in kinematic systems and be able to understand and calculate the magnitude of friction in each situation. Work with forces on inclined planes and explore how the change o the angle of incline of the slope affects the forces acting on an object. We will use knowledge gained in year 1 to solve more complex problems involving constant acceleration.
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## Key:

Shape



Data
Ratio \& Proportion
Algebra

