

Towns						
Term → Year <b>↓</b>	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.  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.  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.  Fractions & percentages of amounts  Find the fraction or percentage of a given amount using written and calculator methods.	Directed Number 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.  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.  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.  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. 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. Sequences Generate sequences using rules and find the nth term of linear sequences. 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 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.  Measures of location 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=mx+c and write the equation of a straight line from a graph.  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. 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. 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.  Algebraic Representation Draw quadratic and reciprocal graphs, represent inequalities and use graphs to solve simultaneous equations.

	algebraic statements and consider whether they are always, sometimes or never true. We will also expand single and double brackets.		statements, wages and taxes. We will calculate simple and compound interest, as well as looking at exchange rates.	Pythagoras' Theorem Use Pythagoras' Theorem to find missing side lengths in right angled triangles, including looking at proofs of the theorem and looking at using it in 3D shapes.	problems and calculations with density.	
10	Congruence and similarity All students will enlarge shapes from a centre with a positive scale factor. They will understand and use properties of congruence and similarity, and know the conditions for congruent triangles.  Higher tier students will also enlarge shapes from a centre with a negative scale factor, write congruent triangle proofs, and use area and volume scale factors.  Trigonometry All students will find missing lengths and angles in right-angled triangles. They will be able to do this using a calculator, and also without a calculator using exact trigonometric values.  Higher tier will also find missing lengths and angles in non-right-angled triangles using the sine and cosine rules, as well as using the formula for the area of a triangle.	All students will form and solve linear equations and inequalities, including with unknowns on both sides. They will represent solutions to inequalities on number lines, and solve equations by drawing linear graphs.	Angles and bearings All students will read, measure and draw bearings, including on scale diagrams. They will solve angle problems involving bearings, including with trigonometry. Higher tier students will also solve bearings problems involving the sine and cosine rules.  Working with circles All students will calculate the area and arc length of a sector of a circle. They will calculate the volume and surface area of cylinders, spheres and cones. Higher tier students will also use circle theorems to solve geometric problems.  Vectors All students will understand and use vector notation. They will add, subtract and multiply vectors, and look at vector journeys on shapes. Higher tier students will also solve problems involving parallel vectors and co-linear points, and construct geometric proofs.	Percentages and interest All students will calculate percentage change, simple and compound interest, and solve reverse percentage problems. They will calculate amounts after repeated percentage changes, and solve problems involving growth and decay.	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 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 these to compare distributions.  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.  Indices and roots All students will understand and use the 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 All students will find the HCF and LCM 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.

Pythagoras' Theorem Use

Rates Speed, distance, time

Maths and money Bills, bank statements, wages and taxes. We will

Testing conjectures Look at

#### 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

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**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 of 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

#### Revision and Exams

## Y12 Pure

#### Teacher 1

## **GCSE Recap**

**Chapter 1 – Algebraic Expressions** Recap and build upon techniques learnt 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.

## 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 ax=b.

#### **Statistics**

# 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.

# Statistical Distributions

Chapter 6 - Statistical distributions Introduce discrete probability distributions and become familiar with different representations for them. Also learn 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 considering 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.

#### Y12

Teacher 2

## 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.

# 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.

# 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 of 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.

Y13	<u>Pure</u>	Numerical Methods	Revision and Exams
Teacher	1 A2 Calculus	Pure Chapter 10 - Numerical methods We shall consider different methods for	
	Chapter 9 - Differentiation Explore differentiating a wider range of functions	finding or approximating the roots of functions. We will learn how to use change	
	(trigonometric, logarithms, exponentials etc.) as well as products, quotients and	of sign, iteration and the Newton-Raphson procedure	
	composites of these functions. Also look at differentiating functions written as		
	parametric equations. We also begin to explore rates of changes and how we	Statistics	
	can form differential equations.	Regression and Correlation	
	Carriorn amerorniar equations.	Chapter 1 - Regression, correlation and hypothesis testing Bivariate (paired)	
	Chapter 11 - Integration Explore integrating a wider range of functions	data can show a strong relationship that is not linear. We shall use logarithms to	
	(trigonometric, logarithms, exponentials etc.). Look at different integration	examine trends in non-linear data. We shall also consider correlation in bivariate	
	techniques such as integration by parts and integration by substitution. We also		
		data and carry out hypothesis tests for possible correlation.	
	apply these different techniques to solving first order	0 101 10 1 100	
	Observed Brown Program Folders Folders	Conditional Probability	
	Chapter 8 - Parametric Equations Explore a new class of equations where we	Chapter 2 Conditional probability Extend on work studied in AS	
	express 2 variables in terms of a third variable called a 'parameter'.	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.	
		the normal distribution.	
Y13	<u>Pure</u>	Moments	Revision and Exams
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reacher	2 A2 Trigonometry	Chapter 4 - Moments Calculate the turning effect of a force applied to a rigid	
reacher	2 A2 Trigonometry Chapter 5 - Radians Introduce a new measure for angles and explore how it	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	
reacher	Chapter 5 - Radians Introduce a new measure for angles and explore how it		
reacher	Chapter 5 - Radians Introduce a new measure for angles and explore how it affects calculations involving circles. This is an important bridging topic in	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	
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Key:

**Shape** 

**Number** 

**Probability** 

Data

Ratio & Proportion

Algebra