Year 10 Core **Term: Autumn 1**	**Unit Title: Algebra 1**	**Duration: 14 hrs.**
Prior • the ability to use negative numbers with the four operations and recall and use hierarchy of operations and understand inverse operations; • dealing with decimals and negatives on a calculator; • using index laws numerically.	Some of this will be a reminder from Key Stage 3 and could be introduced through investigative material such as handshake, frogs etc.	**Grade**
Objectives: **Algebra: the basics (6 hours)** • Use notation and symbols correctly; • Write an expression; • Select an expression/equation/formula/identity from a list; • Manipulate and simplify algebraic expressions by collecting 'like' terms; • Multiply together two simple algebraic expressions, e.g. $2a \times 3b$; • Simplify expressions by cancelling, e.g. $\frac{4x}{2} = 2x$; • Use index notation and the index laws when multiplying or dividing algebraic terms; • Understand the ≠ symbol and introduce the identity ≡ sign; **Expressions and substitution into formula (8 hours)** • Multiply a single number term over a bracket; • Write and simplify expressions using squares and cubes; • Simplify expressions involving brackets, i.e. expand the brackets, then add/subtract; • Argue mathematically to show algebraic expressions are equivalent; • Recognise factors of algebraic terms involving single brackets; • Factorise algebraic expressions by taking out common factors; • Write expressions to solve problems representing a situation; • Substitute numbers into simple algebraic expressions; • Substitute numbers into expressions involving brackets and powers; • Substitute positive and negative numbers into expressions; • Derive a simple formula, including those with squares, cubes and roots; • Substitute numbers into a (word) formula;	**Notes/Common misconceptions** Emphasise correct use of symbolic notation, i.e. $3 \times y = 3y$ and not $y3$ and $a \times b = ab$. Use lots of concrete examples when writing expressions, e.g. 'B' boys + 'G' girls. Plenty of practice should be given and reinforce the message that making mistakes with negatives and times tables is a different skill to that being developed. Simplify $4p - 2q + 3p + 5q$. Simplify $z^4 \times z^3$, $y^3 \div y^2$, $(a^7)^2$. Simplify $x^{-4} \times x^2$, $w^2 \div w^{-1}$. Expand and simplify $3(t - 1)$. Understand $6x + 4 \neq 3(x + 2)$. Argue mathematically that $2(x + 5) = 2x + 10$. Evaluate the expressions for different values of x: $3x^2 + 4$ or $2x^3$. The convention of not writing a coefficient with a single value, i.e. x instead of $1x$, may cause confusion. Some students may think that it is always true that $a = 1$, $b = 2$, $c = 3$. If $a = 2$ sometimes students interpret $3a$ as 32. Making mistakes with negatives, including the	E/F D C **C** **D** **E** **C**

	squaring of negative numbers	
Extension Forming and solving equations involving algebra and other areas of mathematics such as area and perimeter.		
Common Vocabulary Expression, identity, equation, formula, substitute, term, 'like' terms, index, power, collect, substitute, expand, bracket, factor, factorise, linear, simplify	**Functional / Rich activities:** Substitution - Differentiated Worksl Expand and simplify 1 - Connect 4 - Soluti Expand and simplify 1 - Connect 4.pdf Whodunnit - simplifying expressions Whodunnit - simplifying expressior **Exam Questions:**	

Year 10 Core **Term:**	**Unit Title: Algebra 2**	**Duration: 14hrs**
Prior Students should be able to plot coordinates and read scales Students should be able to substitute into a formula.		**Grade**
Objectives: **Real-life graphs (8 hours)** • Use input/output diagrams; • Draw, label and scale axes; • Use axes and coordinates to specify points in all four quadrants in 2D; • Identify points with given coordinates and coordinates of a given point in all four quadrants; • Find the coordinates of points identified by geometrical information in 2D (all four quadrants); • Find the coordinates of the midpoint of a line segment; Read values from straight-line graphs for real-life situations; • Draw straight line graphs for real-life situations, including ready reckoner graphs, conversion graphs, fuel bills graphs, fixed charge and cost per unit; • Draw distance–time graphs and velocity–time graphs; • Work out time intervals for graph scales; • Interpret distance–time graphs, and calculate: the speed of individual sections, total distance and total time; • Interpret information presented in a range of linear and non-linear graphs; • Interpret graphs with negative values on axes; • Interpret gradient as the rate of change in distance–time and speed–time graphs, graphs of containers filling and emptying, and unit price graphs. **Straight-line graphs (6 hours)** • Use function machines to find coordinates (i.e. given the input x, find the output y); • Plot and draw graphs of $y = a$, $x = a$, $y = x$ and $y = -x$; • Recognise straight-line graphs parallel to the axes; • Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane; • Plot and draw graphs of straight lines of the form $y = mx + c$ using a table of values; • Sketch a graph of a linear function, using the gradient and y-intercept; • Identify and interpret gradient from an equation $y = mx + c$; • Identify parallel lines from their equations;	**Notes/Common misconceptions** With distance–time graphs, students struggle to understand that the perpendicular distance from the x-axis represents distance. Clear presentation of axes is important. Ensure that you include questions that include axes with negative values to represent, for example, time before present time, temperature or depth below sea level. Careful annotation should be encouraged: it is good practice to get the students to check that they understand the increments on the axes. Use standard units of measurement to draw conversion graphs. Use various measures in distance–time and velocity–time graphs, including miles, kilometres, seconds, and hours. When not given a table of values, students rarely see the relationship between the coordinate axes. Emphasise the importance of drawing a table of values when not given one. Values for a table should be taken from the x-axis.	F E E C D C

• Plot and draw graphs of straight lines in the form $ax + by = c$; • Find the equation of a straight line from a graph; • Find the equation of the line through one point with a given gradient; • Find approximate solutions to a linear equation from a graph; • Find the gradient of a straight line from real-life graphs too.		B
Extension		
Common Vocabulary Linear, graph, distance, time, coordinate, quadrant, real-life graph, gradient, intercept, function, solution, parallel	**Reasoning / problem solving opportunities:** Students should be able to decide what the scales on any axis should in order to draw a correct graph. Conversion graphs can be used to provide opportunities for students to justify which distance is further, or whether or not certain items can be purchase in different currencies. **Exam Questions:**	

<table>
<tr><td>Year 10 Core
Term:</td><td>Unit Title: Algebra 4</td><td>Duration: 9 hrs.</td></tr>
<tr><td>Prior
Students should be able to square negative numbers.
Students should be able to substitute into formulae.
Students should be able to plot points on a coordinate grid.
Students should be able to expand single brackets and collect ‘like’ terms.</td><td></td><td>Grade</td></tr>
<tr><td>Objectives:
Quadratic equations: expanding and factorising (5 hours)
• Define a ‘quadratic’ expression;
• Multiply together two algebraic expressions with brackets;
• Square a linear expression, e.g. $(x + 1)^2$;
• Factorise quadratic expressions of the form $x^2 + bx + c$;
• Factorise a quadratic expression $x^2 - a^2$ using the difference of two squares;
• Solve quadratic equations by factorising;
• Find the roots of a quadratic function algebraically.

Quadratic equations: graphs (4 hours)
• Generate points and plot graphs of simple quadratic functions, then more general quadratic functions;
• Identify the line of symmetry of a quadratic graph;
• Find approximate solutions to quadratic equations using a graph;
• Interpret graphs of quadratic functions from real-life problems;
• Identify and interpret roots, intercepts and turning points of quadratic graphs.</td><td>Notes/Common misconceptions

x terms can sometimes be ‘collected’ with x^2.

This unit can be extended by including quadratics where $a \neq 1$.
Emphasise the fact that x^2 and x are different ‘types’ of term – illustrate this with numbers.

Squaring negative numbers can be a problem.

The graphs should be drawn freehand and in pencil, joining points using a smooth curve.
Encourage efficient use of the calculator.
Extension work can be through plotting cubic and reciprocal graphs, solving simultaneous equations graphically.</td><td></td></tr>
<tr><td>Extension</td><td></td><td></td></tr>
<tr><td>Common Vocabulary
Quadratic, function, solve, expand, factorise, simplify, expression, graph, curve, factor, coefficient, bracket</td><td>Reasoning/ problem solving opportunities:
Visual proof of the difference of two squares.

Matching graphs with their respective functions.

Exam Questions:</td><td></td></tr>
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Year 10 Core Term:	**Unit Title: Algebra 5**	**Duration:5 hrs.**
Prior Students should be able to draw linear graphs. Students should be able to plot coordinates and sketch simple functions with a table of values. Students should be able to substitute into and solve equations. Students should have experience of using formulae. Students should recall and use the hierarchy of operations and use of inequality symbols.		**Grade**
Objectives: **Rearranging equations, graphs of cubic and reciprocal functions and simultaneous equations (5 hours)** • Know the difference between an equation and an identity and use and understand the ≠ symbol; • Change the subject of a formula involving the use of square roots and squares; • Answer 'show that' questions using consecutive integers (n, $n + 1$), squares a^2, b^2, even numbers $2n$, and odd numbers $2n + 1$; • Solve problems involving inverse proportion using graphs, and read values from graphs; • Find the equation of the line through two given points; • Recognise, sketch and interpret graphs of simple cubic functions; • Recognise, sketch and interpret graphs of the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$; • Use graphical representations of indirect proportion to solve problems in context; • identify and interpret the gradient from an equation $ax + by = c$; • Write simultaneous equations to represent a situation; • Solve simultaneous equations (linear/linear) algebraically and graphically; • Solve simultaneous equations representing a real-life situation, graphically and algebraically, and interpret the solution in the context of the problem;	**Notes/Common misconceptions** The effects of transforming functions are often confused. Emphasise the need for good algebraic notation. **POSSIBLE SUCCESS CRITERIA** Solve two simultaneous equations in two variables (linear/linear) algebraically and find approximate solutions using a graph. Identify expressions, equations, formulae and identities from a list.	
Extension		
Common Vocabulary Reciprocal, linear, gradient, functions, direct, indirect, estimate, cubic, subject, rearrange, simultaneous, substitution, elimination, proof	**Reasoning/ problem solving opportunities:** Simple simultaneous equations can be formed and solved from real life scenarios, such as 2 adult and 2 child tickets cost £18, and 1 adult and	

	3 child tickets costs £17. What is the cost of 1 adult ticket? **Exam Questions:**	

Year 10 core **Term: Autumn 1**	**Unit Title: Handling data 1**	**Duration: 15 hrs.**
Prior Students should be able to read scales on graphs, draw circles, measure angles and plots coordinates in the first quadrant, and know that there are 360 degrees in a full turn and 180 degrees at a point on a straight line. Students should have experience of tally charts. Students will have used inequality notation. Students must be able to find the midpoint of two numbers. Students should be able to use the correct notation for time using 12- and 24-hour clocks.	Misleading graphs, charts or tables can provide an opportunity for students to critically evaluate the way information is presented. Students should be able to decide what the scales on any axis should be to be able to present information.	**Grade**

Objectives:
 	
Tables, charts and graphs (11 hours)
• Design and use data-collection sheets for grouped, discrete and continuous data, use inequalities for grouped data, and introduce ≤ and ≥ signs; Sort, classify and tabulate data, both discrete and continuous quantitative data, and qualitative data; Extract data from lists and tables;
• Use correct notation for time, 12- and 24-hour clock and work out time taken for a journey from a timetable;
• Construct tables for time–series data;
• Design, complete and use two-way tables for discrete and grouped data;
• Calculate the total frequency from a frequency table;
• Read off frequency values from a table;
• Read off frequency values from a frequency table;
• Find greatest and least values from a frequency table;
• Identify the mode from a frequency table;
• Identify the modal class from a grouped frequency table;
• Plotting coordinates in first quadrant and read graph scales in multiples;
• Produce and interpret:
  • pictograms;
  • composite bar charts;
  • dual/comparative bar charts for categorical and ungrouped discrete data;
  • bar-line charts;
  • vertical line charts;
  • line graphs;
  • line graphs for time–series data;
	Notes/Common misconceptions
	
	Ensure that students are given the opportunity to draw and complete two-way tables from words.
	
	Students struggle to make the link between what the data in a frequency table represents, so for example may state the 'frequency' rather than the interval when asked for the modal group.
	Other averages are covered later on, but you may choose to cover them in this unit.
	
	Misleading graphs are a useful life skill.
		E
		
		D
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• histograms with equal class intervals; • stem and leaf (including back-to-back); • Calculate total population from a bar chart or table; • Find greatest and least values from a bar chart or table; • Find the mode from a stem and leaf diagram; • Identify the mode from a bar chart; • Recognise simple patterns, characteristic and relationships in bar charts and line graphs; **Scatter graphs (4 hours)** • Draw scatter graphs; • Interpret points on a scatter graph; • Identify outliers and ignore them on scatter graphs; • Draw the line of best fit on a scatter diagram by eye, and understand what it represents; • Use the line of best fit make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing; • Distinguish between positive, negative and no correlation using lines of best fit; • Use a line of best fit to predict values of a variable given values of the other variable; • Interpret scatter graphs in terms of the relationship between two variables; • Interpret correlation in terms of the problem; • Understand that correlation does not imply causality; • State how reliable their predictions are, i.e. not reliable if extrapolated.	Students should label the axes clearly, and use a ruler for all straight lines and a pencil for all drawing. Lines of best fit are often forgotten, but correct answers still obtained by sight. Interpreting scales of different measurements and confusion between x and y axes when plotting points. Students need to be constantly reminded of the importance of drawing a line of best fit. Support with copy and complete statements, e.g. as the ___ increases, the ___ decreases. Statistically the line of best fit should pass through the coordinate representing the mean of the data. Remind students that the line of best fit does not necessarily go through the origin of the graph.	**D** **D** **D**
Common Vocabulary Mean, median, mode, range, average, discrete, continuous, qualitative, quantitative, data, scatter graph, line of best fit, correlation, positive, negative, sample, population, stem and leaf, frequency, table, sort, pie chart, estimate	**Functional/ Rich activities:** Scatter Graphs - Boarding Card.pdf 12 and 24 hour clock.pdf **Exam Questions:**	

Year 10 Core **Term:**	**Unit Title: Handling data 2**	**Duration: hrs.**
Prior Students should know how to add and multiply fractions and decimals. Students should have experience of expressing one number as a fraction of another number.		**Grade**
Objectives: **Probability (12 hours)** • Distinguish between events which are impossible, unlikely, even chance, likely, and certain to occur; • Mark events and/or probabilities on a probability scale of 0 to 1; • Write probabilities in words or fractions, decimals and percentages; • Find the probability of an event happening using theoretical probability; • Use theoretical models to include outcomes using dice, spinners, coins; • List all outcomes for single events systematically; • Work out probabilities from frequency tables, frequency trees, and two way tables; • Record outcomes of probability experiments in tables; • Add simple probabilities; • Identify different mutually exclusive outcomes and know that the sum of the probabilities of all outcomes is 1; • Using 1 – p as the probability of an event not occurring where p is the probability of the event occurring; • Find a missing probability from a list or table including algebraic terms; • Find the probability of an event happening using relative frequency; • Estimate the number of times an event will occur, given the probability and the number of trials – for both experimental and theoretical probabilities; • List all outcomes for combined events systematically; • Use and draw sample space diagrams; • Work out probabilities from Venn diagrams to represent real-life situations and also 'abstract' sets of numbers/values; • Use union and intersection notation; • Compare experimental data and theoretical probabilities; • Compare relative frequencies from samples of different sizes; • Find the probability of successive events, such as several throws of a single dice; • Use tree diagrams to calculate the probability of two independent events; • Use tree diagrams to calculate the probability of two dependent events.	**Notes/Common misconceptions** Not using fractions or decimals when working with probability trees. Use this as an opportunity for practical work. Probabilities written in fraction form should be cancelled to their simplest form. Probability without replacement is best illustrated visually and by initially working out probability 'with' replacement. Encourage students to work 'across' the branches working out the probability of each successive event. The probability of the combinations of outcomes should = 1. Emphasise that were an experiment repeated it will usually lead to different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics. Probabilities written in fraction form should be cancelled to their simplest form.	

Extension		
Common Vocabulary Probability, dependent, independent, conditional, tree diagrams, sample space, outcomes, theoretical, relative frequency, fairness, experimental	**Reasoning / problem solving opportunities:** Lotteries provides a real life link to probability. Work out the probabilities of winning on different lotteries. Students should be given the opportunity to justify the probability of events happening or not happening. **Exam Questions:**	

Year 10 Core **Term: Autumn 1**	**Unit Title: Number 1**	**Duration: 16 hrs.**
Prior Students should have knowledge of strategies for multiplying and dividing whole numbers by 2, 4, 5, and 10. Students should be able to read and write decimals in figures and words.	The expectation for Core tier is that much of this work will be reinforced throughout the course. Particular emphasis should be given to the importance of clear presentation of work.	**Grade**
Objectives: **Integers and place value (3 hours)** • Use and order positive and negative numbers (integers) and decimals; use the symbols <, > and understand the ≠ symbol; • Add, subtract, multiply and divide positive and negative numbers (integers); • Recall all multiplication facts to 10 × 10, and use them to derive quickly the corresponding division facts; • Multiply or divide any number by powers of 10; • Use brackets and the hierarchy of operations (not including powers); • Round numbers to a given power of 10; • Check answers by rounding and using inverse operations. **Decimals (4 hours)** • Use decimal notation and place value; • Identify the value of digits in a decimal or whole number; • Compare and order decimal numbers using the symbols <, >; • Understand the ≠ symbol (not equal); • Write decimal numbers of millions, e.g. 2 300 000 = 2.3 million; • Add, subtract, multiply and divide decimals; • Multiply or divide by any number between 0 and 1; • Round to the nearest integer; • Round to a given number of decimal places and significant figures; • Estimate answers to calculations by rounding numbers to 1 significant figure; • Use one calculation to find the answer to another. **Indices, powers and roots (5 hours)** • Find squares and cubes: • recall integer squares up to 10 x 10 and the corresponding square roots; • understand the difference between positive and negative square roots; • recall the cubes of 1, 2, 3, 4, 5 and 10;	**Notes/Common misconceptions** Stress the importance of knowing the multiplication tables to aid fluency. Students may write statements such as 150 – 210 = 60. Questions such as: Phil states 3.44 × 10 = 34.4 and Chris states 3.44 × 10 = 34.40. Who is correct? Show me another number with 3, 4, 5, 6, 7 digits that includes a 6 with the same value as the "6" in the following number 36, 754 Practise long multiplication and division, use mental maths problems with decimals such as 0.1, 0.001. Amounts of money should always be rounded to the nearest penny. Problems involving shopping for multiple items, such as: Rob purchases a magazine costing £2.10, a newspaper costing 82p and two bars of chocolate. He pays with a £10 note and gets £5.40 change. Work out the cost of one bar of chocolate. When estimating, students should be able to justify whether the answer will be an overestimate or underestimate. Significant figures and decimal place rounding are often confused. Some students may think 35 877 = 36 to two significant figures. Students need to be encouraged to learn squares from 2 × 2 to 15 × 15 and cubes of 2, 3, 4, 5 and 10 and corresponding square and cube roots.	**G** **E** **G** **F** **E** **E** **G/F** **E**

• Use index notation for squares and cubes; • Recognise powers of 2, 3, 4, 5; • Evaluate expressions involving squares, cubes and roots: • add, subtract, multiply and divide numbers in index form; • cancel to simplify a calculation; • Use index notation for powers of 10, including negative powers; • Use the laws of indices to multiply and divide numbers written in index notation; • Use brackets and the hierarchy of operations with powers inside the brackets, or raising brackets to powers; • Use calculators for all calculations: positive and negative numbers, brackets, square, cube, powers and roots, and all four operations.	What is the value of 2^3? Evaluate $(2^3 \times 2^5) \div 2^4$. Pupils need to know how to enter negative numbers into their calculator. Use the language of 'negative' number and not minus number to avoid confusion with calculations. Note that the students need to understand the term 'surd' as there will be occasions when their calculator displays an answer in surd form, for example, $4\sqrt{2}$.	
Factors, multiples and primes (4 hours) • List all three-digit numbers that can be made from three given integers; • Recognise odd, even and prime (two digit) numbers; • Identify factors and multiples and list all factors and multiples of a number systematically; • Find the prime factor decomposition of positive integers and write as a product using index notation; • Find common factors and common multiples of two numbers; • Find the LCM and HCF of two numbers, by listing, Venn diagrams and using prime factors: include finding LCM and HCF given the prime factorisation of two numbers; • Understand that the prime factor decomposition of a positive integer is unique – whichever factor pair you start with – and that every number can be written as a product of two factors; • Solve simple problems using HCF, LCM and prime numbers.	1 is a prime number. Particular emphasis should be made on the definition of 'product' as multiplication as many students get confused and think it relates to addition. Use a number square to find primes (Eratosthenes sieve). Using a calculator to check factors of large numbers can be useful. Questions that require multiple layers of operations such as: Pam writes down one multiple of 9 and two different factors of 40. She then adds together her three numbers. Her answer is greater than 20 but less than 30. Find three numbers that Jan could have written down Given the digits 1, 2 and 3, find how many numbers can be made using all the digits. Convince me that 8 is not prime.	**C** **C**
Common Vocabulary Integer, number, digit, negative, decimal, addition, subtraction, multiplication, division, remainder, operation, estimate, power, roots, factor, multiple, primes, square, cube, even, odd	**Functional/ Rich activities:** Mission Impossible - addition and subtract Indices or prime factors - why are pov Decimals - Multiply & Divide - Whodunnit.p Standard form - Connect 4.pdf	

	 Negatives - FollowMe Wsheet.pdf  More Haste … addition and subtract **Exam Questions:**	

Year 10 Core **Term: Fractions, decimals and percentages**	**Unit Title: Number 2**	**Duration: 13hrs.**
Prior Students should be able to use the four operations of number. Students should be able to find common factors. Students have a basic understanding of fractions as being 'parts of a whole'. Students should be able to define percentage as 'number of parts per hundred'. Students should know number complements to 10 and multiplication tables.		**Grade**
Objectives: **Fractions, decimals and percentages (7 hours)** • Use diagrams to find equivalent fractions or compare fractions; • Write fractions to describe shaded parts of diagrams; • Express a given number as a fraction of another, using very simple numbers, some cancelling, and where the fraction is both < 1 and > 1; • Write a fraction in its simplest form and find equivalent fractions; • Order fractions, by using a common denominator; • Compare fractions, use inequality signs, compare unit fractions; • Convert between mixed numbers and improper fractions; • Add and subtract fractions; • Add fractions and write the answer as a mixed number; • Multiply and divide an integer by a fraction; • Multiply and divide a fraction by an integer, including finding fractions of quantities or measurements, and apply this by finding the size of each category from a pie chart using fractions; • Understand and use unit fractions as multiplicative inverses; • Multiply fractions: simplify calculations by cancelling first; • Divide a fraction by a whole number and another fraction; • Recall the fraction-to-decimal conversion and convert fractions to decimals; • Convert a fraction to a decimal to make a calculation easier, e.g. $0.25 \times 8 = \frac{1}{4} \times 8$, or $\frac{3}{8} \times 10 = 0.375 \times 10$; • Recognise recurring decimals and convert fractions such as $\frac{3}{7}$, $\frac{1}{3}$ and $\frac{2}{3}$ into recurring decimals; • Compare and order fractions, decimals and integers, using inequality signs; • Understand that a percentage is a fraction in hundredths; • Express a given number as a percentage of another number; • Convert between fractions, decimals and percentages;	**Notes/Common misconceptions** The larger the denominator the larger the fraction. Incorrect links between fractions and decimals, such as thinking that $\frac{1}{5}$ = 0.15, 5% = 0.5, 4% = 0.4, etc. It is not possible to have a percentage greater than 100%. Emphasise the importance of being able to convert between fractions, decimals and percentages to make calculations easier. When expressing a given number as a fraction of another, start with very simple numbers < 1, and include some cancelling before fractions using numbers > 1. Students should be reminded of basic percentages and fraction conversions. When adding and subtracting fractions, start with same denominator, then where one denominator is a multiple of the other (answers ≤ 1), and finally where both denominators have to be changed (answers ≤ 1). Regular revision of fractions is essential. Demonstrate how to the use the fraction button on the calculator. Use real-life examples where possible. Use long division to illustrate recurring decimals.	

• Order fractions, decimals and percentages, including use of inequality signs.
 	
Percentages (6 Hours)
• Express a given number as a percentage of another number;
• Find a percentage of a quantity without a calculator: 50%, 25% and multiples of 10% and 5%;
• Find a percentage of a quantity or measurement (use measurements they should know from Key Stage 3 only);
• Calculate amount of increase/decrease;
• Use percentages to solve problems, including comparisons of two quantities using percentages;
• Percentages over 100%;
• Use percentages in real-life situations, including percentages greater than 100%:
  • Price after VAT (not price before VAT);
  • Value of profit or loss;
  • Simple interest;
  • Income tax calculations;
• Use decimals to find quantities;
• Find a percentage of a quantity, including using a multiplier;
• Use a multiplier to increase or decrease by a percentage in any scenario where percentages are used;
• Understand the multiplicative nature of percentages as operators.
	It is not possible to have a percentage greater than 100%.
	
	When finding a percentage of a quantity or measurement, use only measurements they should know from Key Stage 3.
	Amounts of money should always be rounded to the nearest penny.
	Use real-life examples where possible.
	Emphasise the importance of being able to convert between decimals and percentages and the use of decimal multipliers to make calculations easier.	

Extension		
Common Vocabulary Decimal, percentage, inverse, addition, subtraction, multiplication, division, fractions, mixed, improper, recurring, integer, decimal, terminating, percentage, VAT, increase, decrease, multiplier, profit, loss	**Reasoning / problem solving opportunities:** Questions that involve rates of overtime pay including simple calculations involving fractional (>1, e.g. 1.5) and hourly pay. These can be extended into calculating rates of pay given the final payment and number of hours worked. Working out the number of people/things where the number of people/things in different categories is given as a fraction, decimal or percentage. Sale prices offer an ideal opportunity for solving problems allowing students the opportunity to investigate the most effective way to work out the "sale" price. Problems that involve consecutive reductions such	

	as: Sale Prices are 10% off the previous day's price. If a jacket is £90 on Monday, what is the price on Wednesday? FDP - Squares.pdf Challenge Cards.pdf **Exam Questions:**	

Year 10 Core **Term: Autumn 1**	**Unit Title: Number 3**	**Duration: 10 hrs.**
Prior Students should know the four operations of number. Students should be able to find common factors. Students should have a basic understanding of fractions as being 'parts of a whole'. Students can define percentage as 'number of parts per hundred'.	.	**Grade**

Objectives:
 	
Ratio
• Understand and express the division of a quantity into a of number parts as a ratio;
• Write ratios in their simplest form;
• Write/interpret a ratio to describe a situation;
• Share a quantity in a given ratio including three-part ratios;
• Solve a ratio problem in context:
  • use a ratio to find one quantity when the other is known;
  • use a ratio to compare a scale model to a real-life object;
  • use a ratio to convert between measures and currencies;
  • problems involving mixing, e.g. paint colours, cement and drawn conclusions;
• Compare ratios;
• Write ratios in form 1 : m or m : 1;
• Write a ratio as a fraction;
• Write a ratio as a linear function;
• Write lengths, areas and volumes of two shapes as ratios in simplest form;
• Express a multiplicative relationship between two quantities as a ratio or a fraction.
 	
Proportion
 	
• Understand and use proportion as equality of ratios;
• Solve word problems involving direct and indirect proportion;
• Work out which product is the better buy;
• Scale up recipes;
• Convert between currencies;
• Find amounts for 3 people when amount for 1 given;
• Solve proportion problems using the unitary method;
• Recognise when values are in direct proportion by reference to the
	Notes/Common misconceptions
	
	Students find three-part ratios difficult.
	Using a ratio to find one quantity when the other is known often results in students 'sharing' the known amount
	
	Emphasise the importance of reading the question carefully.
	Include ratios with decimals 0.2 : 1.
	Converting imperial units to imperial units aren't specifically in the programme of study, but still useful and provide a good context for multiplicative reasoning.
	It is also useful generally for students to know rough metric equivalents of commonly used imperial measures, such as pounds, feet, miles and pints.
	
	Problems involving sharing in a ratio that include percentages rather than specific numbers, such as: In a youth club the ratio of the number of boys to the number of girls is 3 : 2. 30% of the boys are under the age of 14, and 60% of the girls are under the age of 14. What percentage of the youth club is under the age of 14?
	
	Recognise that two paints mixed red to yellow 5 : 4 and 20 : 16 are the same colour.
	If it takes 2 builders 10 days to build a wall, how long will it take 3 builders?
	Scale up recipes and decide if there is enough of each ingredient.
	Given two sets of data in a table, are they in direct proportion?
	
	Problems in context, such as scaling a recipe, or diluting	

• graph form; • Understand inverse proportion: as x increases, y decreases (inverse graphs done in later unit); • Recognise when values are in direct proportion by reference to the graph form; • Understand direct proportion ---> relationship $y = kx$.	lemonade or chemical solutions, will show how proportional reasoning is used in real-life contexts. Find out/prove whether two variables are in direct proportion by plotting the graph and using it as a model to read off other values. Possible link with scatter graphs.	
Common Vocabulary Ratio, proportion, share, parts, fraction, function, direct proportion, inverse proportion, graphical, linear, compare	**Functional/ Rich activities:** **Exam Questions:**	

Year 10 Core Term:	**Unit Title: Number 4**	**Duration:7 hrs.**
Prior Students should be able to interpret scales on a range of measuring instruments. Students should be able to find a percentage of an amount and relate percentages to decimals. Students should be able to rearrange equations and use these to solve problems. Students should know speed = distance/time, density = mass/volume.		**Grade**

Objectives:
Multiplicative reasoning (7 hours)
• Understand and use compound measures:
  • density;
  • pressure;
  • speed:
  • convert between metric speed measures;
  • read values in km/h and mph from a speedometer;
  • calculate average speed, distance, time – in miles per hour as well as metric measures;
  • use kinematics formulae from the formulae sheet to calculate speed, acceleration (with variables defined in the question);
  • change d/t in m/s to a formula in km/h, i.e. d/t × (60 × 60)/1000 – with support;
• Express a given number as a percentage of another number in more complex situations;
• Calculate percentage profit or loss;
• Make calculations involving repeated percentage change, not using the formula;
• Find the original amount given the final amount after a percentage increase or decrease;
• Use compound interest;
• Use a variety of measures in ratio and proportion problems:
  • currency conversion;
  • rates of pay;
  • best value;
• Set up, solve and interpret the answers in growth and decay problems;
• Understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$;
• Interpret equations that describe direct and inverse proportion.
	Notes/Common misconceptions
	
	Some students may think that compound interest and simple interest are the same method of calculating interest.
	Incomplete methods when using multipliers, i.e. reduce £80 by 15% = 80 × 0.15.
	
	Encourage students to use a single multiplier.
	Include simple fractional percentages of amounts with compound interest and encourage use of single multipliers.
	Amounts of money should be rounded to the nearest penny, but emphasise the importance of not rounding until the end of the calculation if doing in stages.
	Use a formula triangle to help students see the relationship for compound measures – this will help them evaluate which inverse operations to use.
	Help students to recognise the problem they are trying to solve by the unit measurement given, e.g. km/h is a unit of speed as it is speed divided by a time.
	
	POSSIBLE SUCCESS CRITERIA
	Know that measurements using real numbers depend upon the choice of unit, with speedometers and rates of change.
	Change m/s to km/h.
	Understand direct proportion as: as x increase, y increases.
	Understand inverse proportion as: as x increases, y decreases.	

Extension		
Common Vocabulary Ratio, proportion, best value, proportional change, compound measure, density, mass, volume, speed, distance, time, density, mass, volume, pressure, acceleration, velocity, inverse, direct	**Reasoning/ problem solving opportunities:** Speed/distance type problems that involve students justifying their reasons why one vehicle is faster than another. Calculations involving value for money are a good reasoning opportunity that utilise different skills. Working out best value of items using different currencies given an exchange rate. **Exam Questions:**	

Year 10 Core **Term:**	**Unit Title: Number 5**	**Duration: 5 hrs.**
Prior Students should know how to do the four operations with fractions. Students should be able to write powers of 10 in index form and recognise and recall powers of 10, i.e. $10^2 = 100$. Students should recall the index laws.		**Grade**
Objectives: **Fractions and reciprocals (5 hours)** • Add and subtract mixed number fractions; • Multiply mixed number fractions; • Divide mixed numbers by whole numbers and vice versa; • Find the reciprocal of an integer, decimal or fraction; • Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined).	**Notes/Common misconceptions** The larger the denominator the larger the fraction. Regular revision of fractions is essential. Demonstrate how to the use the fraction button on the calculator. Use real-life examples where possible. **POSSIBLE SUCCESS CRITERIA** What is the reciprocal of 4, $\frac{1}{2}$, –2, $-\frac{1}{2}$?	
Extension		
Common Vocabulary Add, subtract, multiply, divide, mixed, improper, fraction, decimal, indices, standard form, power, reciprocal, index	**Reasoning/ problem solving opportunities:** Students should be able to justify when fractions are equal and provide correct answers as a counter-argument. Links with other areas of mathematics should be used where appropriate to embed the notion that fractions are not just used in isolation, e.g. use 6 ½ cm instead of 6.5 cm. **Exam Questions:**	

<table>
<tr><td>Year 10 Core
Term:</td><td>Unit Title: Number 6</td><td>Duration:5 hrs.</td></tr>
<tr><td>Prior
Students should know how to do the four operations with fractions.
Students should be able to write powers of 10 in index form and recognise and recall powers of 10, i.e. $10^2 = 100$.
Students should recall the index laws.</td><td></td><td>Grade</td></tr>
<tr><td>Indices and standard form (5 hours)
Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, fractions and powers of a power;
Use numbers raised to the power zero, including the zero power of 10;
Convert large and small numbers into standard form and vice versa;
Add, subtract, multiply and divide numbers in standard form;
Interpret a calculator display using standard form and know how to enter numbers in standard form.</td><td>Notes/Common misconceptions

Some students may think that any number multiplied by a power of ten qualifies as a number written in standard form.
When rounding to significant figures some students may think, for example, that 6729 rounded to one significant figure is 7.

Negative fractional indices are not included at Foundation tier, but you may wish to extend the work to include these.
Standard form is used in science and there are lots of cross curricular opportunities.
Students need to be provided with plenty of practice in using standard form with calculators.

POSSIBLE SUCCESS CRITERIA
Write 51 080 in standard form.
Write 3.74×10^{-6} as an ordinary number.
What is 9^0?</td><td></td></tr>
<tr><td>Extension</td><td></td><td></td></tr>
<tr><td>Common Vocabulary
Add, subtract, multiply, divide, mixed, improper, fraction, decimal, indices, standard form, power, reciprocal, index</td><td>Reasoning/ problem solving opportunities:
Link with other areas of mathematics, such as compound measures, by using speed of light in standard form.</td><td></td></tr>
</table>

	Exam Questions:	

Year 10 Core **Term: SUMMER 1**	**Unit Title: Shape and Space 3**	**Duration: 8 hrs.**
Prior Students should recall basic shapes. Students should be able to plot points in all four quadrants. Students should have an understanding of the concept of rotation. Students should be able to draw and recognise lines parallel to axes and $y = x$, $y = -x$. Students will have encountered the terms clockwise and anticlockwise previously.		**Grade**
Objectives: • Identify congruent shapes by eye; • Understand that rotations are specified by a centre, an angle and a direction of rotation; • Find the centre of rotation, angle and direction of rotation and describe rotations fully using the angle, direction of turn, and centre; • Rotate and draw the position of a shape after rotation about the origin or any other point including rotations on a coordinate grid; • Identify correct rotations from a choice of diagrams; • Understand that translations are specified by a distance and direction using a vector; • Translate a given shape by a vector; • Use column vectors to describe and transform 2D shapes using single translations on a coordinate grid; • Understand that distances and angles are preserved under rotations and translations, so that any figure is congruent under either of these transformations; • Understand that reflections are specified by a mirror line; • Identify correct reflections from a choice of diagrams; • Identify the equation of a line of symmetry; • Transform 2D shapes using single reflections (including those not on coordinate grids) with vertical, horizontal and diagonal mirror lines; • Describe reflections on a coordinate grid; • Scale a shape on a grid (without a centre specified); • Understand that an enlargement is specified by a centre and a scale factor; • Enlarge a given shape using (0, 0) as the centre of enlargement, and enlarge shapes with a centre other than (0, 0); • Find the centre of enlargement by drawing;	**Notes/Common misconceptions** Correct language must be used: students often use ‘turn’ rather than ‘rotate’. Include rotations with the centre of rotation inside the shape. Use trial and error with tracing paper to find the centre of rotation. The directions on a column vector often get mixed up. Student need to understand that the ‘units of movement’ are those on the axes, and care needs to be taken to check the scale When reflecting shapes, the students must include mirror lines on or through original shapes. As an extension, consider reflections with the mirror line through the shape and enlargements with the centre of enlargement inside the shape.	

• Describe and transform 2D shapes using enlargements by:
  • a positive integer scale factor;
  • a fractional scale factor;
• Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides, simple integer scale factors, or simple fractions;
• Understand that distances and angles are preserved under reflections, so that any figure is congruent under this transformation;
• Understand that similar shapes are enlargements of each other and angles are preserved – define similar in this unit;
• Describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements.
	enlargement using negative scale factors is not included.
	
	Emphasise the need to describe the transformations fully, and if asked to describe a 'single' transformation they should not include two types.	

Common Vocabulary Transformation, rotation, reflection, enlargement, translation, single, combination, scale factor, mirror line, centre of rotation, centre of enlargement, column vector, vector, similarity, congruent, angle, direction, coordinate, describe	**Functional/ Rich activities:** **Exam Questions:**	

Year 10 Core **Term: Autumn 1**	**Unit Title: Shape and Space 1**	**Duration: 13 hrs.**
Prior Students should be able to use a ruler and protractor. Students should have an understanding of angles as a measure of turning. Students should be able to name angles and distinguish between acute, obtuse, reflex and right angles.	Students should recognise reflection symmetry, be able to identify and draw lines of symmetry, and complete diagrams with given number of lines of symmetry. Students should recognise rotation symmetry and be able to identify orders of rotational symmetry, and complete diagrams with given order of rotational symmetry.	**Grade**
Objectives: **Properties of shapes, parallel lines and angle facts (8 hours)** • Estimate sizes of angles; • Measure angles using a protractor; • Use geometric language appropriately; • Use letters to identify points, lines and angles; • Use two-letter notation for a line and three-letter notation for an angle; • Describe angles as turns and in degrees and understand clockwise and anticlockwise; • Know that there are 360° in a full turn, 180° in a half turn and 90° in a quarter turn; • Identify a line perpendicular to a given line on a diagram and use their properties; • Identify parallel lines on a diagram and use their properties; • Find missing angles using properties of corresponding and alternate angles; • Understand and use the angle properties of parallel lines. • Recall the properties and definitions of special types of quadrilaterals, including symmetry properties; • List the properties of each special type of quadrilateral, or identify (name) a given shape; • Draw sketches of shapes; • Classify quadrilaterals by their geometric properties and name all quadrilaterals that have a specific property; • Identify quadrilaterals from everyday usage; • Given some information about a shape on coordinate axes, complete the shape; Understand and use the angle properties of quadrilaterals; • Use the fact that angle sum of a quadrilateral is 360°; • Recall and use properties of angles at a point, angles at a point on a straight line, right angles, and vertically opposite angles;	**Notes/Common misconceptions** Emphasise that diagrams in examinations are seldom drawn accurately. Make sure drawings are neat, labelled and accurate. Give students lots of practice. Angles should be accurate to within 2°. Pupils may believe, incorrectly, that perpendicular lines have to be horizontal/vertical or all triangles have rotational symmetry of order 3. Some students will think that all trapezia are isosceles, or a square is only square if 'horizontal', or a 'non-horizontal' square is called a diamond. Some students may think that the equal angles in an isosceles triangle are the 'base angles'. Incorrectly identifying the 'base angles' (i.e. the equal angles) of an isosceles triangle when not drawn horizontally.	

• Distinguish between scalene, equilateral, isosceles and right-angled triangles; • Derive and use the sum of angles in a triangle; • Find a missing angle in a triangle, using the angle sum of a triangle is 180°; • Understand and use the angle properties of triangles, use the symmetry property of isosceles triangle to show that base angles are equal; • Use the side/angle properties of isosceles and equilateral triangles; • Understand and use the angle properties of intersecting lines; • Understand a proof that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices; Use geometrical language appropriately, give reasons for angle calculations and show step-by-step deduction when solving problems. **Interior and exterior angles of polygons (5 hours)** • Recognise and name pentagons, hexagons, heptagons, octagons and decagons; • Understand 'regular' and 'irregular' as applied to polygons; • Use the sum of angles of irregular polygons; • Calculate and use the sums of the interior angles of polygons; • Calculate and use the angles of regular polygons; • Use the sum of the interior angles of an *n*-sided polygon; • Use the sum of the exterior angles of any polygon is 360°; • Use the sum of the interior angle and the exterior angle is 180°; • Identify shapes which are congruent (by eye); • Explain why some polygons fit together and others do not;	Multi-step "angle chasing" style problems that involve justifying how students have found a specific angle. Geometrical problems involving algebra whereby equations can be formed and solved allow students the opportunity to make and use connections with different parts of mathematics. What is the same, and what is different between families of polygons? Pupils may believe, incorrectly, that all polygons are regular. Deduce and use the angle sum in any polygon. Derive the angle properties of regular polygons. Given the size of its exterior angle, how many sides does the polygon have? Study Escher drawings. Use examples of tiling patterns with simple shapes to help students investigate if shapes 'fit together'.	
Common Vocabulary Quadrilateral, angle, polygon, interior, exterior, proof, tessellation, rotational symmetry, parallel, corresponding, alternate, co-interior, vertices, edge, face, sides, triangle, perpendicular, isosceles, scalene, clockwise, anticlockwise, hexagons, heptagons, octagons, decagons, obtuse, acute, reflex, quadrilateral, triangle, regular, irregular, two-dimensional, three-dimensional, measure, line, angle, order, intersecting	**Functional/ Rich activities:** Angle Facts 2 - Triangles including iso Angle Facts 1 - Straight lines into tria **Exam Questions:**	

Year 10 Core	**Unit Title: Shape 2**	**Duration :10 hrs.**
Prior: Students should be able to measure lines and recall the names of 2D shapes. Students should be able to use strategies for multiplying and dividing by powers of 10. Students should be able to find areas by counting squares and volumes by counting cubes. Students should be able to interpret scales on a range of measuring instruments.		**Grade**

Perimeter, area and volume (10 hours)
• Indicate given values on a scale, including decimal value;
• Know that measurements using real numbers depend upon the choice of unit;
• Convert between units of measure within one system, including time and metric units to metric units of length, area and volume and capacity e.g. 1ml = $1cm^3$;
• Make sensible estimates of a range of measures in everyday settings;
• Measure shapes to find perimeters and areas using a range of scales;
• Find the perimeter of
  • rectangles and triangles;
  • parallelograms and trapezia;
  • compound shapes;
• Recall and use the formulae for the area of a triangle and rectangle;
• Find the area of a trapezium and recall the formula;
• Find the area of a parallelogram;
• Calculate areas and perimeters of compound shapes made from triangles and rectangles;
• Recall the definition of a circle and name and draw parts of a circle;
• Recall and use formulae for the circumference of a circle and the area enclosed by a circle (using circumference = 2πr = πd and area of a circle = πr2) using a variety of metric measures;
• Use π ≈ 3.142 or use the π button on a calculator;
• Calculate perimeters and areas of composite shapes made from circles and parts of circles (including semicircles, quarter-circles, combinations of these and also incorporating other polygons);
• Estimate surface areas by rounding measurements to 1 significant figure;
• Find the surface area of a prism;
• Find surface area using rectangles and triangles;
• Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone;
• Sketch nets of cuboids and prisms;
• Recall and use the formula for the volume of a cuboid;
• Find the volume of a prism, including a triangular prism, cube and cuboid;
• Calculate volumes of right prisms and shapes made from cubes and cuboids;
• Estimate volumes etc by rounding measurements to 1 significant figure;
	Notes/Common misconceptions
	
	Shapes involving missing lengths of sides often result in incorrect answers.
	Students often confuse perimeter and area.
	Volume often gets confused with surface area.
	
	Use questions that involve different metric measures that need converting.
	Measurement is essentially a practical activity: use a range of everyday shapes to bring reality to lessons.
	Ensure that students are clear about the difference between perimeter and area.
	Practical examples help to clarify the concepts, i.e. floor tiles, skirting board, etc.
	Discuss the correct use of units.
	Drawings should be done in pencil.
	Consider 'how many small boxes fit in a larger box'-type questions.
	Practical examples should be used to enable students to understand the difference between perimeter, area and volume.
		C
		B/A

Extension		
Common Vocabulary Triangle, rectangle, parallelogram, trapezium, area, perimeter, formula, length, width, prism, compound, measurement, polygon, cuboid, volume, symmetry, vertices, edge, face, units, conversion	**Reasoning / problem solving opportunities:** Given two 2D that shapes have equal areas, work out all the dimensions of the sides of the shapes. Problems involving straight-forward and compound shapes in a real-life context should be explored to reinforce the concept of area. For example, the floor plan of a garden linked to the purchase of grass seed.  Area Exit cards.pdf **Exam Questions:**	

Year 10 Core **Term:**	**Unit Title: Shape 4**	**Duration: 5 hrs.**
Prior Students should be able to rearrange simple formulae and equations, as preparation for rearranging trigonometric formulae. Students should recall basic angle facts. Students should understand when to leave an answer in surd form. Students can plot coordinates in all four quadrants and draw axes.		**Grade**
Objectives: **Right angled triangles: Pythagoras and trig (5 hours)** • Understand, recall and use Pythagoras' Theorem in 2D, including leaving answers in surd form and being able to justify if a triangle is right-angled or not; • Calculate the length of the hypotenuse and of a shorter side in a right-angled triangle, including decimal lengths and a range of units; • Apply Pythagoras' Theorem with a triangle drawn on a coordinate grid; • Calculate the length of a line segment AB given pairs of points; • Understand, use and recall the trigonometric ratios sine, cosine and tan, and apply them to find angles and lengths in general triangles in 2D figures; • Use the trigonometric ratios to solve 2D problems including angles of elevation and depression; • Round answers to appropriate degree of accuracy, either to a given number of significant figures or decimal places, or make a sensible decision on rounding in context of question; • Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of tan θ for θ = 0°, 30°, 45° and 60°.	**Notes/Common misconceptions** Answers may be displayed on a calculator in surd form. Students forget to square root their final answer or round their answer prematurely. Students may need reminding about surds. Drawing the squares on the 3 sides will help to illustrate the theorem. Include examples with triangles drawn in all four quadrants. Scale drawings are not acceptable. Calculators need to be in degree mode. To find in right-angled triangles the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°, use triangles with angles of 30°, 45° and 60°. Use a suitable mnemonic to remember SOHCAHTOA. Use Pythagoras' Theorem and trigonometry together.	
Extension		
Common Vocabulary Triangle, right angle, angle, Pythagoras' Theorem, sine, cosine, tan, trigonometry, opposite, hypotenuse, adjacent, ratio, elevation, depression, length, accuracy	**Reasoning/ problem solving opportunities:** Combined triangle problems that involve consecutive application of Pythagoras' Theorem or a combination of Pythagoras' Theorem and the trigonometric ratios. In addition to abstract problems, students should be encouraged to apply Pythagoras' Theorem and/or the	

	trigonometric ratios to real-life scenarios that require them to evaluate whether their answer fulfils certain criteria, e.g. the angle of elevation of 6.5 m ladder cannot exceed 65°. What is the greatest height it can reach?  Pythagoras - Boarding Card.pdf  Pythagoras - Spot the mistakes.pdf  Pythagoras - Problem Cards (F) ver **Exam Questions:**	

Year 10 Core **Term:**	**Unit Title: Shape 5**	**Duration: 7 hrs**
Prior Students should be able to measure and draw lines.		**Grade**

Objectives:
Constructions, loci and bearing(7 hours)
• Understand congruence, as two shapes that are the same size and shape;
• Visually identify shapes which are congruent;
• Use straight edge and a pair of compasses to do standard constructions:
  • understand, from the experience of constructing them, that triangles satisfying SSS, SAS, ASA and RHS are unique, but SSA triangles are not;
  • construct the perpendicular bisector of a given line;
  • construct the perpendicular from a point to a line;
  • construct the bisector of a given angle;
  • construct angles of 90°, 45°;
• Draw and construct diagrams from given instructions, including the following:
  • a region bounded by a circle and an intersecting line;
  • a given distance from a point and a given distance from a line;
  • equal distances from two points or two line segments;
  • regions may be defined by 'nearer to' or 'greater than';
• Find and describe regions satisfying a combination of loci;
• Use constructions to solve loci problems (2D only);
• Use and interpret maps and scale drawings;
• Estimate lengths using a scale diagram;
• Make an accurate scale drawing from a diagram;
• Use three-figure bearings to specify direction;
• Mark on a diagram the position of point B given its bearing from point A;
• Give a bearing between the points on a map or scaled plan;
• Given the bearing of a point A from point B, work out the bearing of B from A;
• Use accurate drawing to solve bearings problems;
• Solve locus problems including bearings.
	Notes/Common misconceptions
	
	Correct use of a protractor may be an issue.
	
	Drawings should be done in pencil.
	Relate loci problems to real-life scenarios, including mobile phone masts and coverage.
	Construction lines should not be erased.	

Extension		
Common Vocabulary Construct, circle, arc, sector, face, edge, vertex, two-dimensional, three-dimensional, solid, elevations, congruent, angles, regular, irregular, bearing, degree, bisect, perpendicular, loci, map, scale, plan, region	**Reasoning/ problem solving opportunities:** Link problems with other areas of mathematics, such as the trigonometric ratios and Pythagoras' Theorem.	

	Exam Questions:	

<table>
<tr><td>Year 10 Core
Term:</td><td>Unit Title: Shape 6</td><td>Duration: 5 hrs.</td></tr>
<tr><td>Prior
Students should be able to measure and draw lines.</td><td></td><td>Grade</td></tr>
<tr><td>Objectives:
Plans and elevations (5 hours)
• Understand clockwise and anticlockwise;
• Draw circles and arcs to a given radius or given the diameter;
• Measure and draw lines, to the nearest mm;
• Measure and draw angles, to the nearest degree;
• Know and use compass directions;
• Draw sketches of 3D solids;
• Know the terms face, edge and vertex;
• Identify and sketch planes of symmetry of 3D solids;
• Use isometric grids to draw 2D representations of 3D solids;
• Make accurate drawings of triangles and other 2D shapes using a ruler and a protractor;
• Construct diagrams of everyday 2D situations involving rectangles, triangles, perpendicular and parallel lines;
• Understand and draw front and side elevations and plans of shapes made from simple solids;
• Given the front and side elevations and the plan of a solid, draw a sketch of the 3D solid.</td><td>Notes/Common misconceptions

Some pupils may use the wrong scale of a protractor. For example, they measure an obtuse angle as 60° rather than as 120°.
Often 5 sides only are drawn for a cuboid.

This is a very practical topic, and provides opportunities for some hands-on activities.
Whilst not an explicit objective, it is useful for students to draw and construct nets and show how they fold to make 3D solids, allowing students to make the link between 3D shapes and their nets. This will enable students to understand that there is often more than one net that can form a 3D shape.

POSSIBLE SUCCESS CRITERIA
Be able to estimate the size of given angles.
Convert fluently between metric units of length.
Use bearings in a real-life context to describe the bearing between two towns on a map.</td><td></td></tr>
<tr><td>Extension</td><td></td><td></td></tr>
<tr><td>Common Vocabulary
Construct, circle, arc, sector, face, edge, vertex, two-dimensional, three-dimensional, solid, elevations, congruent, angles, regular, irregular, bearing, degree, bisect, perpendicular, loci, map, scale, plan, region</td><td>Reasoning/ problem solving opportunities:
Interpreting scale drawings and maps involving lengths that need to be measured (rather than given in the problem).

Exam Questions:</td><td></td></tr>
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<table>
<tr><td>Year 10 Core
Term:</td><td>Unit Title: Shape 7</td><td>Duration:6 hrs.</td></tr>
<tr><td>Prior
Students should know the formula for calculating the area of a rectangle.
Students should know how to use the four operations on a calculator.</td><td></td><td>Grade</td></tr>
<tr><td>Objectives:
Circles, cylinders, cones and spheres (6 hours)
• Recall the definition of a circle and identify, name and draw parts of a circle including tangent, chord and segment;
• Recall and use formulae for the circumference of a circle and the area enclosed by a circle circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2;
• Use $\pi \approx 3.142$ or use the π button on a calculator;
• Give an answer to a question involving the circumference or area of a circle in terms of π;
• Find radius or diameter, given area or perimeter of a circles;
• Find the perimeters and areas of semicircles and quarter-circles;
• Calculate perimeters and areas of composite shapes made from circles and parts of circles;
• Calculate arc lengths, angles and areas of sectors of circles;
• Find the surface area and volume of a cylinder;
• Find the surface area and volume of spheres, pyramids, cones and composite solids;
• Round answers to a given degree of accuracy.</td><td>Notes/Common misconceptions

Diameter and radius are often confused and recollection which formula to use for area and circumference of circles is often poor.

Emphasise the need to learn the circle formula: ‘Cherry Pie’s Delicious’ and ‘Apple Pies are too’ are good ways to remember them.
Formulae for curved surface area and volume of a sphere, and surface area and volume of a cone, will be given on the formulae sheet in the examination.
Ensure that students know it is more accurate to leave answers in terms of π but only when asked to do so.

POSSIBLE SUCCESS CRITERIA
Recall terms related to a circle.
Understand that answers in terms of pi are more accurate.</td><td></td></tr>
<tr><td>Extension</td><td></td><td></td></tr>
<tr><td>Common Vocabulary
Area, perimeter, formula, length, width, measurement, volume, circle, segment, arc, sector, cylinder, circumference, radius, diameter, pi, sphere, cone, hemisphere, segment, accuracy, surface area</td><td>Reasoning/ problem solving opportunities:
Calculate the radius/diameter given the area/circumference type questions could be explored, including questions that require evaluation of statements, such as Andy states “Diameter = 2 × Radius” and Bob states “‘Radius = 2 × Diameter”. Who is correct?

Exam Questions:</td><td></td></tr>
</table>

Year 10 Core **Term:**	**Unit Title: Shape 8**	**Duration: hrs.**
Prior Students will have used column vectors when dealing with translations. Students can recall and apply Pythagoras' Theorem on a coordinate grid. Students should be able to recognise and enlarge shapes and calculate scale factors. Students know how to calculate area and volume in various metric measures. Students should be able to measure lines and angles and using compasses, ruler and protractor, and construct standard constructions.		**Grade**
Objectives: **Similarity and congruence in 2D (hours)** • Use the basic congruence criteria for triangles (SSS, SAS, ASA and RHS); • Solve angle problems involving congruence; • Identify shapes which are similar; including all circles or all regular polygons with equal number of sides; • Understand similarity of triangles and of other plane shapes, use this to make geometric inferences, and solve angle problems using similarity; • Identify the scale factor of an enlargement of a shape as the ratio of the lengths of two corresponding sides; • Understand the effect of enlargement on perimeter of shapes; • Solve problems to find missing lengths in similar shapes; • Know that scale diagrams, including bearings and maps are 'similar' to the real-life examples.	**Notes/Common misconceptions** Students may incorrectly believe that all polygons are regular or that all triangles have a rotational symmetry of order 3. Often students think that when a shape is enlarged the angles also get bigger. Use simple scale factors that are easily calculated mentally to introduce similar shapes. Reinforce the fact that the sizes of angles are maintained when a shape is enlarged. Make links between similarity and trigonometric ratios. **POSSIBLE SUCCESS CRITERIA** Understand similarity as one shape being an enlargement of the other. Recognise that all corresponding angles in similar shapes are equal in size when the corresponding lengths of sides are not equal in size. Use AB notation for describing lengths and $\angle ABC$ notation for describing angles.	
Extension		
Common Vocabulary Vector, direction, magnitude, scalar, multiple, parallel, collinear, ratio, column vector, congruence, side, angle, compass, construction, shape, volume, length, area, volume,	**Reasoning/ problem solving opportunities:** Using scale diagrams, including bearings and maps, provides a rich source of real-life examples and links	

scale factor, enlargement, similar, perimeter,	to other areas of mathematics. **Exam Questions:**	