	Dallam School Curriculum overview	**Department: Mathematics - Higher** **Year Group: 10**

AUTUMN Half Term 1

Theme/ topic: **Calculations, checking and rounding**	Theme/ topic: **Indices, roots, reciprocals and hierarchy of operations**	Theme/ topic: **Factors, multiples, primes, standard form and surds**	Theme/ topic: **Algebra: the basics, setting up, rearranging and solving equations**

By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):

• Add, subtract, multiply and divide decimals, whole numbers including any number between 0 and 1; • Put digits in the correct place in a decimal calculation and use one calculation to find the answer to another; **Key Words** Integer, number, digit, negative, decimal, addition, subtraction, multiplication, division, remainder, operation, estimate,	• Use index notation for integer powers of 10, including negative powers; • Find the value of calculations using indices including positive, fractional and negative indices; • Recall that $n^0 = 1$ and $n^{-1} = \frac{1}{n}$ for positive integers n as well as, $n^{\frac{1}{2}} = \sqrt{n}$ and $n^{\frac{1}{3}} = \sqrt[3]{n}$ for any positive number n; **Key Words** Power, roots	• Identify factors, multiples and prime numbers; • Find the prime factor decomposition of positive integers – write as a product using index notation; • Find common factors and common multiples of two numbers; • Convert large and small numbers into standard form and vice versa; **Key Words** Factor, multiple, primes, square, cube, even, odd, surd, rational, irrational standard form, simplify	• Use algebraic notation and symbols correctly; • Know the difference between a term, expression, equation, formula and an identity; • Write and manipulate an expression by collecting like terms; • Know that squaring a linear expression is the same as expanding double brackets; **Key Words** Expression, identity, equation, formula, substitute, term, 'like' terms, index, power, negative and fractional indices, collect, substitute, expand, bracket, factor, factorise, quadratic, linear, simplify

They will understand (key concepts):

• Round numbers to the nearest 10, 100, 1000, the nearest integer, to a given number of decimal places and to a given number of significant figures;	• Use index laws to simplify and calculate the value of numerical expressions involving multiplication and division of integer powers, fractional and negative powers, and powers of a power	• 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 prime factors; • Understand surd notation	• Simplify expressions by cancelling • Use instances of index laws, including use of zero, fractional and negative powers; • Understand the ≠ symbol (not equal), e.g. $6x + 4 \neq 3(x + 2)$, and introduce identity ≡ sign;

They will know how to (key skills including speaking, reading and writing in this subject):			
- Use the product rule for counting - Estimate answers to one- or two-step calculations, including use of rounding numbers and formal estimation to 1 significant figure: mainly whole numbers and then decimals.	- Solve problems using index laws; - Use brackets and the hierarchy of operations up to and including with powers and roots inside the brackets, or raising brackets to powers or taking roots of brackets; - Use calculators for all calculations: positive and negative numbers, brackets, powers and roots, four operations.	- 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; - Solve problems using HCF and LCM, and prime numbers; - 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; - Simplify surd expressions involving squares (e.g. √12 = √(4 × 3) = √4 × √3 = 2√3).	- Substitute numbers into expressions and formulae from mathematics and other subjects - Multiply a single term over a bracket and recognise factors of algebraic terms involving single brackets and simplify expressions by factorising, including subsequently collecting like terms; - Expand the product of two linear expressions - Factorise quadratic expressions of the form $ax^2 + bx + c$ and using the difference of two squares - Solve linear equations in one unknown, with integer or fractional coefficients; - Set up and solve linear equations to solve a problem; - Derive a formula and set up simple equations from word problems, then solve these equations, interpreting the solution in the context of the problem; - Change the subject of a formula, including cases where the subject is on both sides of the original formula, or involving fractions and small powers of the subject;

AUTUMN Half Term 2			
Theme/ topic: **Sequences**	**Theme/ topic:** **Averages and range**	**Theme/ topic:** **Representing and interpreting data and scatter graphs**	**Theme/ topic:** **Fractions and percentages**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):			
Recognise simple sequences including, triangular, square and cube numbers and Fibonacci-type sequences	Calculate mean and range, find median and mode from a small data set;	**Key Words** Scatter graph, line of best fit, correlation, positive, negative, sample, population, stem and	- Express a given number as a fraction of another; - Find equivalent fractions and compare the size of fractions; - Write a fraction in its simplest form

• Describe in words a term-to-term sequence and identify which terms cannot be in a sequence **Key Words** Arithmetic, geometric, function, sequence, nth term, derive	• Recognise the advantages and disadvantages between measures of average; **Key Words** Mean, median, mode, range, average, discrete, continuous, qualitative, quantitative, data,	leaf, frequency, table, sort, pie chart, estimate	• Find a fraction of a quantity or measurement, including within a context; • Convert between mixed numbers and improper fractions; • Add, subtract, multiply and divide fractions, including mixed numbers; • Understand and use unit fractions as multiplicative inverses; **Key Words** Addition, subtraction, multiplication, division, fractions, mixed, improper, recurring, reciprocal, integer, decimal, termination, percentage, VAT, increase, decrease, multiplier, profit, loss

They will understand (key concepts):

The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.	• Understand that the expression 'estimate' will be used where appropriate, when finding the mean of grouped data using mid-interval values.	• Understand that correlation does not imply causality	• Understand and use unit fractions as multiplicative inverses;

They will know how to (key skills including speaking, reading and writing in this subject):

• Generate sequences of numbers, squared integers and sequences derived from diagrams; • Generate specific terms in a sequence using the position-to-term rule and term-to-term rule; • Find and use (to generate terms) the nth term of an arithmetic sequence; • Use the nth term of an arithmetic sequence to decide if a given number is a term in the sequence, or find the first term above or below a given number;	• Use information provided to complete a two-way table; • Sort, classify and tabulate data and discrete or continuous quantitative data; • Construct and interpret stem and leaf diagrams (including back-to-back diagrams): • find the mode, median, range, as well as the greatest and least values from stem and leaf diagrams, and compare two distributions from stem and	• Produce and interpret composite, comparative and dual bar charts; • Produce and interpret pie charts: • Compare data from pie charts that represent different-sized samples; • Produce and interpret frequency polygons for grouped data: • Produce frequency diagrams for grouped discrete data:	• Convert a fraction to a recurring decimal and vice versa; • Find the reciprocal of an integer, decimal or fraction; • Convert between fractions, decimals and percentages; • Express a given number as a percentage of another number; • Express one quantity as a percentage of another where the percentage is greater than 100% • Find a percentage of a quantity; • Find the new amount after a percentage increase or decrease;

• Identify which terms cannot be in a sequence by finding the nth term; • Continue a quadratic sequence and use the nth term to generate terms; • Find the nth term of quadratic sequences; • Recognise and use simple geometric progressions (rn where n is an integer, and r is a rational number > 0 or a surd); • Continue geometric progression and find term to term rule, including negative, fraction and decimal terms;	leaf diagrams (mode, median, range); • Calculate the mean, mode, median and range from a frequency table (discrete data); • Construct and interpret grouped frequency tables for continuous data: • for grouped data, find the interval which contains the median and the modal class; • estimate the mean with grouped data; •	• Read off frequency values, calculate total population, find greatest and least values; • Produce histograms with equal class intervals: • estimate the median from a histogram with equal class width or any other information, such as the number of people in a given interval; • Produce line graphs: • read off frequency values, calculate total population, find greatest and least values; • Construct and interpret time–series graphs, comment on trends; • Compare the mean and range of two distributions, or median or mode as appropriate; • Draw and interpret scatter graphs in terms of the relationship between two variables; • Draw lines of best fit by eye and use to predict values of a variable given values of the other variable; • Distinguish between positive, negative and zero correlation using lines of best fit, and interpret correlation in terms of the problem; • Explain an isolated point on a scatter graph; • Use the line of best fit make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.	• Work out a percentage increase or decrease, including: simple interest, income tax calculations, value of profit or loss, percentage profit or loss; • Compare two quantities using percentages • Find a percentage of a quantity using a multiplier and use a multiplier to increase or decrease by a percentage in any scenario where percentages are used; • Find the original amount given the final amount after a percentage increase or decrease (reverse percentages), including VAT; • Use calculators for reverse percentage calculations by doing an appropriate division;

SPRING Half Term 1		
Theme/ topic: **Ratio and proportion**	**Theme/ topic:** **Polygons, angles and parallel lines**	**Theme/ topic:** **Pythagoras' theorem and trigonometry**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):		
- Express the division of a quantity into a number parts as a ratio; - Write ratios in form 1 : m or m : 1 and to describe a situation; - Identify direct proportion from a table of values, by comparing ratios of values; **Key Words** Ratio, proportion, share, parts	- Classify quadrilaterals by their geometric properties and distinguish between scalene, isosceles and equilateral triangles; - Understand 'regular' and 'irregular' as applied to polygons; - Explain why the angle sum of a quadrilateral is 360°; use the angle properties of quadrilaterals and the fact that the angle sum of a quadrilateral is 360°; - Use the sum of the exterior angles of any polygon is 360°; - Use the sum of the interior angles of an n-sided polygon; - Use the sum of the interior angle and the exterior angle is 180°; **Key Words** Quadrilateral, angle, polygon, interior, exterior, proof, tessellation, symmetry, parallel, corresponding, alternate, co-interior, vertices, edge, face, sides, Pythagoras' Theorem, sine, cosine, tan, trigonometry, opposite, hypotenuse, adjacent, ratio, elevation, depression, segment, length	- Understand, recall and use Pythagoras' Theorem in 2D; - 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°. **Key Words** Pythagoras' Theorem, sine, cosine, tan, trigonometry, opposite, hypotenuse, adjacent, ratio, elevation, depression, segment, length
They will understand (key concepts):		
The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.	- Understand the proof that the angle sum of a triangle is 180°, and derive and use the sum of angles in a triangle; - Understand and use the angle properties of parallel lines and find missing angles using the properties of corresponding and alternate angles, giving reasons;	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;

They will know how to (key skills including speaking, reading and writing in this subject):		
• Write ratios in their simplest form, including three-part ratios; • Divide a given quantity into two or more parts in a given part : part or part : whole ratio; • Use a ratio to find one quantity when the other is known; • Write a ratio as a fraction and as a linear function; • Use a ratio to compare a scale model to real-life object; • Use a ratio to convert between measures and currencies, e.g. £1.00 = €1.36; • Scale up recipes; • Convert between currencies.	• Use symmetry property of an isosceles triangle to show that base angles are equal; • Find missing angles in a triangle using the angle sum in a triangle AND the properties of an isosceles triangle; • Calculate and use the sums of the interior angles of polygons; use the sum of angles in a triangle and use the angle sum in any polygon to derive the properties of regular polygons; • Find the size of each interior angle, or the size of each exterior angle, or the number of sides of a regular polygon, and use the sum of angles of irregular polygons; • Calculate the angles of regular polygons and use these to solve problems; • Use the side/angle properties of compound shapes made up of triangles, lines and quadrilaterals, including solving angle and symmetry problems for shapes in the first quadrant, more complex problems and using algebra	• Given three sides of a triangle, justify if it is right-angled or not; • Give an answer to the use of Pythagoras' Theorem in surd form; • Calculate the length of the hypotenuse in a right-angled triangle (including decimal lengths and a range of units); • Find the length of a shorter side in a right-angled triangle; • Calculate the length of a line segment AB given pairs of points; • Use the trigonometric ratios to solve 2D problems; • Find angles of elevation and depression;

SPRING Half Term 2		
Theme/ topic: **Graphs: the basics and real-life graphs**	**Theme/ topic:** **Linear graphs and coordinate geometry**	**Theme/ topic:** **Quadratic, cubic and other graphs**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):		
• Identify and plot points in all four quadrants; **Key Words** Coordinate, axes, 3D, graph, speed, distance, time, velocity,	• Plot and draw graphs of $y = a$, $x = a$, $y = x$ and $y = -x$, drawing and recognising lines parallel to axes, plus $y = x$ and $y = -x$; • Identify and interpret the gradient of a line segment; • Recognise that equations of the form $y = mx + c$ correspond to straight-line graphs in the coordinate plane;	• Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape; • Generate points and plot graphs of simple quadratic functions, then more general quadratic functions; **Key Words** Circle, cubic, quadratic

	• Identify and interpret the gradient and y-intercept of a linear graph given by equations of the form y = mx + c; **Key Words** Solution, root, function, linear, approximate, gradient, perpendicular, parallel, equation	

They will understand (key concepts):

The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**

They will know how to (key skills including speaking, reading and writing in this subject):

• Draw and interpret straight-line graphs for real-life situations, including ready reckoner graphs, conversion graphs, fuel bills, fixed charge and cost per item; • Draw distance–time and velocity–time graphs; • Use graphs to calculate various measures (of individual sections), including: unit price (gradient), average speed, distance, time, acceleration; including using enclosed areas by counting squares or using areas of trapezia, rectangles and triangles; • Find the coordinates of the midpoint of a line segment with a diagram given and coordinates; • Find the coordinates of the midpoint of a line segment from coordinates; • Calculate the length of a line segment given the coordinates of the end points; • Find the coordinates of points identified by geometrical information. • Find the equation of the line through two given points.	• Find the equation of a straight line from a graph in the form y = mx + c; • Plot and draw graphs of straight lines of the form y = mx + c with and without a table of values; • Sketch a graph of a linear function, using the gradient and y-intercept (i.e. without a table of values); • Find the equation of the line through one point with a given gradient; • Identify and interpret gradient from an equation ax + by = c; • Find the equation of a straight line from a graph in the form ax + by = c; • Plot and draw graphs of straight lines in the form ax + by = c; • Interpret and analyse information presented in a range of linear graphs: • use gradients to interpret how one variable changes in relation to another; • find approximate solutions to a linear equation from a graph; • Interpret and analyse a straight-line graph and generate equations of lines parallel and perpendicular to the given line;	• Find approximate solutions of a quadratic equation from the graph of the corresponding quadratic function; • Draw graphs of simple cubic functions using tables of values; • Interpret graphs of simple cubic functions, including finding solutions to cubic equations; • Draw graphs of the reciprocal function $\frac{a}{x}$ with $x \neq 0$ using tables of values; • Draw circles, centre the origin, equation $x^2 + y^2 = r^2$.

	• Select and use the fact that when $y = mx + c$ is the equation of a straight line, then the gradient of a line parallel to it will have a gradient of m and a line perpendicular to this line will have a gradient of $\frac{1}{m}$.	

SUMMER Half Term 1

Theme/ topic: **Perimeter, area and circles**	Theme/ topic: **3D forms and volume, cylinders, cones and spheres**	Theme/ topic: **Accuracy and bounds**	Theme/ topic: **Solving quadratic and simultaneous equations**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):			
• Recall and use the formulae for the area of a triangle, rectangle, trapezium and parallelogram using a variety of metric measures; • 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; • Give answers to an appropriate degree of accuracy or in terms of π; **Key Words** Triangle, rectangle, parallelogram, trapezium, area, perimeter, formula, length, width, compound, measurement, polygon, circle, segment, arc, sector, circumference, radius, diameter, pi,	• Recall and use the formula for the volume of a cuboid or prism made from composite 3D solids using a variety of metric measures; • Recall and use the formula for volume of pyramid; • Use the formulae for volume and surface area of spheres and cones; • Give answers to an appropriate degree of accuracy or in terms of π; **Key Words** Prism, cuboid, volume, nets, isometric, symmetry, vertices, edge, face, cylinder, composite, sphere, cone, capacity, hemisphere, frustum, surface area	• Calculate the upper and lowers bounds of numbers given to varying degrees of accuracy; • Use inequality notation to specify an error interval due to truncation or rounding. **Key Words** Bounds, accuracy,	**Key Words** Quadratic, solution, root, linear, solve, simultaneous, inequality, completing the square, factorise, rearrange, surd, function, solve, circle, sets, union, intersection

They will understand (key concepts):			
The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**
They will know how to (key skills including speaking, reading and writing in this subject):			
- Calculate the area of compound shapes made from triangles, rectangles, trapezia and parallelograms using a variety of metric measures; - Find the perimeter of a rectangle, trapezium and parallelogram using a variety of metric measures; - Calculate the perimeter of compound shapes made from triangles and rectangles; - Estimate area and perimeter by rounding measurements to 1 significant figure to check reasonableness of answers; - 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); - Calculate arc lengths, angles and areas of sectors of circles; - Find radius or diameter, given area or circumference of circles in a variety of metric measures; - Form equations involving more complex shapes and solve these equations.	- Find the surface area of prisms using the formulae for triangles and rectangles, and other (simple) shapes with and without a diagram; - Draw sketches of 3D solids and identify planes of symmetry of 3D solids, and sketch planes of symmetry; - Convert between metric measures of volume and capacity, e.g. 1 ml = 1 cm3; - Find the volume and surface area of a cylinder; - Find the surface area of a pyramid; - Solve problems involving more complex shapes and solids, including segments of circles and frustums of cones; - Find the surface area and volumes of compound solids constructed from cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinders; - Form equations involving more complex shapes and solve these equations.	- Calculate the upper and lower bounds of an expression involving the four operations; - Find the upper and lower bounds in real-life situations using measurements given to appropriate degrees of accuracy; - Find the upper and lower bounds of calculations involving perimeters, areas and volumes of 2D and 3D shapes; - Calculate the upper and lower bounds of calculations, particularly when working with measurements;	- Factorise quadratic expressions in the form $ax^2 + bx + c$ - Set up and solve quadratic equations; - Solve quadratic equations by factorisation and completing the square; - Solve quadratic equations that need rearranging; - Solve quadratic equations by using the quadratic formula; - Find the exact solutions of two simultaneous equations in two unknowns; - Use elimination or substitution to solve simultaneous equations; - Set up and solve a pair of linear simultaneous equations in two variables, including to represent a situation; - Interpret the solution in the context of the problem;

SUMMER Half Term 2		
Theme/ topic: **Inequalities**	**Theme/ topic:** **Transformations**	**Theme/ topic:** **Constructions, loci and bearings**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):		
- Show inequalities on number lines; - Write down whole number values that satisfy an inequality; - Use the correct notation to show inclusive and exclusive inequalities. **Key Words** Linear, solve, inequality, rearrange	- Distinguish properties that are preserved under particular transformations; - Recognise and describe rotations – know that that they are specified by a centre and an angle; - Recognise and describe reflections on a coordinate grid – know to include the mirror line as a simple algebraic equation, x = a, y = a, y = x, y = –x and lines not parallel to the axes; - Recognise and describe single translations using column vectors on a coordinate grid; - Know that an enlargement on a grid is specified by a centre and a scale factor; **Key Words** Rotation, reflection, translation, transformation, enlargement, scale factor, vector, centre, angle, direction, mirror line, centre of enlargement, describe, distance, congruence, similar, combinations, single, corresponding,	Know that the perpendicular distance from a point to a line is the shortest distance to the line. **Key Words** Constructions, compasses, protractor, bisector, bisect, line segment, perpendicular, loci, bearing
They will understand (key concepts):		
The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	- Understand and draw front and side elevations and plans of shapes made from simple solids; - Understand, draw and measure bearings;
They will know how to (key skills including speaking, reading and writing in this subject):		
Solve simple linear inequalities in one variable, and represent the solution set on a number line;	Rotate 2D shapes using the origin or any other point (not necessarily on a coordinate grid);	- Given the front and side elevations and the plan of a solid, draw a sketch of the 3D solid; - Use and interpret maps and scale drawings, using a variety of scales and units;

• Solve two linear inequalities in x, find the solution sets and compare them to see which value of x satisfies both solve linear inequalities in two variables algebraically;	• Reflect 2D shapes using specified mirror lines including lines parallel to the axes and also • Identify the equation of a line of symmetry; • Enlarge a shape on a grid without a centre specified; • Describe and transform 2D shapes using enlargements by a positive integer, positive fractional, and negative scale factor; • Translate a given shape by a vector; • Identify the scale factor of an enlargement of a shape; • Enlarge a given shape using a given centre as the centre of enlargement by counting distances from centre, and find the centre of enlargement by drawing; • Describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements; • Describe the changes and invariance achieved by combinations of rotations, reflections and translations.	• Read and construct scale drawings, drawing lines and shapes to scale; • Estimate lengths using a scale diagram; • Calculate bearings and solve bearings problems, including on scaled maps, and find/mark and measure bearings • Use the standard ruler and compass constructions: • bisect a given angle; • construct a perpendicular to a given line from/at a given point; • construct angles of 90°, 45°; • perpendicular bisector of a line segment; • Construct: • 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 which may be defined by 'nearer to' or 'greater than'; • Find and describe regions satisfying a combination of loci, including in 3D; • Use constructions to solve loci problems including with bearings;

	Dallam School Curriculum overview	**Department: Mathematics - Higher** **Year Group: 11**

AUTUMN Half Term 1

Theme/ topic: **Probability**	**Theme/ topic:** **Multiplicative Reasoning**	**Theme/ topic:** **Similarity and congruence in 2D and 3D**	**Theme/ topic:** **Graphs and trigonometric functions**

By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):

• Write probabilities using fractions, percentages or decimals; • Understand selection with or without replacement; • List all outcomes for single events, and combined events, systematically; • Know that the sum of the probabilities of all outcomes is 1;	• Express a multiplicative relationship between two quantities as a ratio or a fraction, e.g. when A:B are in the ratio 3:5, A is B. When 4a = 7b, then a = or a:b is 7:4; • Use kinematics formulae from the formulae sheet to calculate speed, acceleration, etc (with variables defined in the question)	• Identify the scale factor of an enlargement of a similar shape as the ratio of the lengths of two corresponding sides, using integer or fraction scale factors; • Write the lengths, areas and volumes of two shapes as ratios in their simplest form; • Know the relationships between linear, area and volume scale factors of mathematically similar shapes and solids;	• Recognise, sketch and interpret graphs of the trigonometric functions (in degrees) y = sin x, y = cos x and y = tan x for angles of any size. • Know the exact values of sin θ and cos θ for θ = 0°, 30°, 45° , 60° and 90° and exact value of tan θ for θ = 0°, 30°, 45° and 60° and find them from graphs.
Key Words Probability, mutually exclusive, conditional, tree diagrams, sample space, outcomes, theoretical, relative frequency, Venn diagram, fairness, experimental	**Key Words** Ratio, proportion, best value, unitary, proportional change, compound measure, density, mass, volume, speed, distance, time, density, mass, volume, pressure, acceleration, velocity, inverse, direct, constant of proportionality	**Key Words** Congruence, side, angle, compass, construction, shape, volume, length, area, volume, scale factor, enlargement, similar, perimeter, frustum	**Key Words** Axes, coordinates, sine, cosine, tan, angle, graph, transformations,

They will understand (key concepts):

• Understand and use experimental and theoretical measures of probability	• Understand and use compound measures to convert between metric speed measures; density measures and pressure measures;	• Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments, and to verify standard ruler and pair of compasses constructions; • Understand similarity of triangles and of other plane shapes, and use this to make geometric inferences; • Understand the effect of enlargement on angles, perimeter, area and volume of shapes and solids;	

They will know how to (key skills including speaking, reading and writing in this subject):

• Estimate the number of times an event will occur, given the probability and the number of trials; • Find the probability of successive events, such as several throws of a single dice; • Draw sample space diagrams and use them for adding simple probabilities; • Use 1 – p as the probability of an event not occurring where p is the probability of the event occurring; • Work out probabilities from Venn diagrams to represent real-life situations and also 'abstract' sets of numbers/values; • Use union and intersection notation; • Find a missing probability from a list or two-way table, including algebraic terms; • Understand conditional probabilities and decide if two events are independent;	• Solve proportion problems using the unitary method; • Work out which product offers best value and consider rates of pay; • Represent repeated proportional change using a multiplier raised to a power, use this to solve problems involving compound interest and depreciation; • Calculate an unknown quantity from quantities that vary in direct or inverse proportion; • Recognise when values are in direct proportion by reference to the graph form, and use a graph to find the value of k in y = kx; • Relate algebraic solutions to graphical representation of the equations;	• Solve angle problems by first proving congruence; • Prove that two shapes are similar by showing that all corresponding angles are equal in size and/or lengths of sides are in the same ratio/one is an enlargement of the other, giving the scale factor; • Use formal geometric proof for the similarity of two given triangles; • Find missing lengths, areas and volumes in similar 3D solids; • Use the relationship between enlargement and areas and volumes of simple shapes and solids; • Solve problems involving frustums of cones where you have to find missing lengths first using similar triangles.	• Apply to the graph of y = f(x) the transformations y = –f(x), y = f(–x) for sine, cosine and tan functions f(x). • Apply to the graph of y = f(x) the transformations y = f(x) + a, y = f(x + a) for sine, cosine and tan functions f(x).

• Draw a probability tree diagram based on given information, and use this to find probability and expected number of outcome; • Calculate the probability of independent and dependent combined events; • Use a two-way table, tree diagram or Venn diagram, to calculate conditional probability; • Compare experimental data and theoretical probabilities; • Compare relative frequencies from samples of different sizes.	• Recognise when values are in inverse proportion by reference to the graph form; • Set up and use equations to solve word and other problems involving inverse proportion, and relate algebraic solutions to graphical representation of the equations.		

AUTUMN Half Term 2			
Theme/ topic: **Further trigonometry**	**Theme/ topic:** **Collecting data**	**Theme/ topic:** **Cumulative frequency, box plots and histograms**	**Theme/ topic:** **Quadratics, expanding more than two brackets, sketching graphs, graphs of circles, cubes and quadratics**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):			
• Know and apply Area = ab sin C to calculate the area, sides or angles of any triangle. • Know the sine and cosine rules, and use to solve 2D problems (including involving bearings). **Key Words** Side, angle, inverse, square root, 2D, 3D, diagonal, plane, cuboid	**Key Words** Sample, population, fraction, decimal, percentage, bias, stratified sample, random, cumulative frequency, box plot, histogram, frequency density, frequency, mean, median, mode, range, lower quartile, upper quartile, interquartile range, spread, comparison, outlier	• Know the appropriate uses of cumulative frequency diagrams; • Know the appropriate uses of histograms;	**Key Words** Sketch, estimate, quadratic, cubic, function, factorising, simultaneous equation, graphical, algebraic
They will understand (key concepts):			

• Understand the language of planes, and recognise the diagonals of a cuboid. • Understand, recall and use trigonometric relationships and Pythagoras' Theorem in right-angled triangles, and use these to solve problems in 3D configurations.	• Specify the problem and plan: decide what data to collect and what analysis is needed; understand primary and secondary data sources; consider fairness; • Understand what is meant by a sample and a population; • Understand how different sample sizes may affect the reliability of conclusions drawn;	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**

They will know how to (key skills including speaking, reading and writing in this subject):

• Use the sine and cosine rules to solve 3D problems. • Solve geometrical problems on coordinate axes. • Calculate the length of a diagonal of a cuboid. • Find the angle between a line and a plane.	• Identify possible sources of bias and plan to minimise it; • Write questions to eliminate bias, and understand how the timing and location of a survey can ensure a sample is representative	• Construct and interpret cumulative frequency tables, cumulative frequency graphs/diagrams and from the graph: estimate frequency greater/less than a given value; find the median and quartile values and interquartile range • Compare the mean and range of two distributions, or median and interquartile range, as appropriate; • Interpret box plots to find median, quartiles, range and interquartile range and draw conclusions; • Produce box plots from raw data and when given quartiles, median and identify any outliers; • Construct and interpret histograms from class intervals with unequal width; • Use and understand frequency density;	• Sketch a graph of a quadratic function, by factorising or by using the formula, identifying roots, y-intercept and turning point by completing the square; • Be able to identify from a graph if a quadratic equation has any real roots; • Find approximate solutions to quadratic equations using a graph; • Sketch a graph of a quadratic function and a linear function, identifying intersection points; • Solve simultaneous equations graphically: • find graphically the intersection points of a given straight line with a circle; • solve simultaneous equations representing a real-life situation graphically, and interpret the solution in the context of the problem; • Solve quadratic inequalities in one variable, by factorising and sketching the graph to find critical values; • Represent the solution set for inequalities using set notation, i.e. curly brackets and 'is an element of' notation;

		• From histograms:	• for problems identifying the solutions to two different inequalities, show this as the intersection of the two solution sets
		• complete a grouped frequency table;	• Solve linear inequalities in two variables graphically;
		• understand and define frequency density;	• Use iteration with simple converging sequences.
		• Estimate the mean and median from a histogram with unequal class widths or any other information from a histogram, such as the number of people in a given interval.	

SPRING Half Term 1

Theme/ topic: **Circle theorems**	**Theme/ topic:** **Circle geometry**	**Theme/ topic:** **Changing the subject of formulae (more complex), algebraic fractions, solving equations arising from algebraic fractions, rationalising surds, proof**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):		
• Recall the definition of a circle and identify (name) and draw parts of a circle, including sector, tangent, chord, segment; • Prove and use the facts that: • the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference; • the angle in a semicircle is a right angle; • the perpendicular from the centre of a circle to a chord bisects the chord; • angles in the same segment are equal; • alternate segment theorem; • opposite angles of a cyclic quadrilateral sum to 180°; • Find and give reasons for missing angles on diagrams using: • circle theorems;	• Recognise and construct the graph of a circle using $x^2 + y^2 = r^2$ for radius r centred at the origin of coordinates. **Key Words** Radius, centre, tangent, circumference, diameter, gradient, perpendicular, reciprocal, coordinate, equation, substitution, chord, triangle, isosceles, angles, degrees, cyclic quadrilateral, alternate, segment, semicircle, arc, theorem	• Use function notation; • Know that f⁻¹(x) refers to the inverse function; **Key Words** Rationalise, denominator, surd, rational, irrational, fraction, equation, rearrange, subject, proof, function notation, inverse, evaluate

• isosceles triangles (radius properties) in circles; • the fact that the angle between a tangent and radius is 90°; • the fact that tangents from an external point are equal in length.		

They will understand (key concepts):		
• Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point;	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**

They will know how to (key skills including speaking, reading and writing in this subject):		
• Break problems down by applying the circle theorems to challenging angle questions within circles and compound circle shapes.	• Select and apply construction techniques and understanding of loci to draw graphs based on circles and perpendiculars of lines; • Find the equation of a tangent to a circle at a given point	• Rationalise the denominator involving surds; • Simplify algebraic fractions; • Multiply and divide algebraic fractions; • Solve quadratic equations arising from algebraic fraction equations; • Change the subject of a formula, including cases where the subject occurs on both sides of the formula, or where a power of the subject appears; • Solve 'Show that' and proof questions using consecutive integers $(n, n + 1)$, squares a^2, b^2, even numbers $2n$, odd numbers $2n +1$; • Find $f(x) + g(x)$ and $f(x) – g(x)$, $2f(x)$, $f(3x)$ etc algebraically; • Find the inverse of a linear function; • For two functions $f(x)$ and $g(x)$, find $gf(x)$.

SPRING Half Term 2		
Theme/ topic: **Vectors and geometric proof**	**Theme/ topic:** **Reciprocal and exponential graphs; gradient and area under graphs**	**Theme/ topic:** **Direct and inverse proportion**
By the end of this half term pupils will know (key knowledge, including tier 3 vocabulary):		

• Represent vectors, combinations of vectors and scalar multiples in the plane pictorially. **Key Words** Vector, direction, magnitude, scalar, multiple, parallel, collinear, proof, ratio, column	• Recognise, sketch and interpret graphs of the reciprocal function $\frac{a}{x}$ with x ≠ 0 • State the value of x for which the equation is not defined; • Recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k and integer values of x; **Key Words** Reciprocal, linear, gradient, quadratic, exponential, functions, estimate, area, transformations, rate of change, distance, time, velocity	• Recognise and interpret graphs showing direct and inverse proportion; **Key Words** Direct, indirect, proportion, constant of proportionality

They will understand (key concepts):

• Understand and use vector notation, including column notation, and understand and interpret vectors as displacement in the plane with an associated direction. • Understand that 2a is parallel to a and twice its length, and that a is parallel to –a in the opposite direction.	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**	**The majority of new mathematical content in this unit is procedural so falls in to the "they will they know how to" section.**

They will know how to (key skills including speaking, reading and writing in this subject):

• Calculate the sum of two vectors, the difference of two vectors and a scalar multiple of a vector using column vectors (including algebraic terms). • Find the length of a vector using Pythagoras' Theorem. • Calculate the resultant of two vectors. • Solve geometric problems in 2D where vectors are divided in a given ratio. • Produce geometrical proofs to prove points are collinear and vectors/lines are parallel.	• Use calculators to explore exponential growth and decay; • Set up, solve and interpret the answers in growth and decay problems; • Interpret and analyse transformations of graphs of functions and write the functions algebraically, e.g. write the equation of f(x) + a, or f(x – a): • apply to the graph of y = f(x) the transformations y = –f(x), y = f(–x), y = f(x) + a, y = f(x + a) for linear, quadratic, cubic functions; • Estimate area under a quadratic or other graph by dividing it into trapezia;	• Identify direct proportion from a table of values, by comparing ratios of values, for x squared and x cubed relationships; • Write statements of proportionality for quantities proportional to the square, cube or other power of another quantity; • Set up and use equations to solve word and other problems involving direct and inverse proportion; • Use y = kx to solve direct proportion problems, including questions where students find k, and then use k to find another value; • Solve problems involving inverse proportion using graphs by plotting and reading values from graphs;

	- Interpret the gradient of linear or non-linear graphs, and estimate the gradient of a quadratic or non-linear graph at a given point by sketching the tangent and finding its gradient; - Interpret the gradient of non-linear graph in curved distance–time and velocity–time graphs: - for a non-linear distance–time graph, estimate the speed at one point in time, from the tangent, and the average speed over several seconds by finding the gradient of the chord; - for a non-linear velocity–time graph, estimate the acceleration at one point in time, from the tangent, and the average acceleration over several seconds by finding the gradient of the chord; - Interpret the gradient of a linear or non-linear graph in financial contexts; - Interpret the area under a linear or non-linear graph in real-life contexts; - Interpret the rate of change of graphs of containers filling and emptying; - Interpret the rate of change of unit price in price graphs.	