**Autumn Half Term 1**

**Inequalities**

* Show inequalities on number lines;
* Write down whole number values that satisfy an inequality;
* Solve simple linear inequalities in one variable, and represent the solution set on a number line;
* 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;
* Use the correct notation to show inclusive and exclusive inequalities.

**Advanced Trigonometry**

* 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.
* 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).
* Know and apply Area = 0.5ab 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).
* Use the sine and cosine rules to solve 3D problems.
* Understand the language of planes, and recognise the diagonals of a cuboid.
* Solve geometrical problems on coordinate axes.
* Understand, recall and use trigonometric relationships and Pythagoras’ Theorem in right-angled triangles, and use these to solve problems in 3D configurations.
* Calculate the length of a diagonal of a cuboid.
* Find the angle between a line and a plane.

**Autumn Half Term 2**

**Probability**

* Write probabilities using fractions, percentages or decimals;
* Understand and use experimental and theoretical measures of probability, including relative frequency
* 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;
* List all outcomes for single events, and combined events, systematically; Draw and use sample space diagrams
* Know that the sum of the probabilities of all outcomes is 1; Use 1 – p as the probability of an event not occurring
* Work out probabilities from Venn diagrams to represent real-life situations and also ‘abstract’ sets of numbers/values;
* Find a missing probability from a list or two-way table, including algebraic terms;
* Understand conditional probabilities and decide if two events are independent;
* Draw a probability tree diagram based on given information, and use this to find probability and expected number of outcome;
* Compare experimental data and theoretical probabilities; Compare relative frequencies from samples of different sizes.

**Multiplicative Reasoning**

* Express a multiplicative relationship between two quantities as a ratio or a fraction,
* Solve proportion problems using the unitary method;
* Work out which product offers best value and consider rates of pay;
* Work out the multiplier for repeated proportional change as a single decimal number;
* Represent repeated proportional change using a multiplier raised to a power, use this to solve problems with compound interest
* Understand compound measures and: convert between metric speed measures; convert between density or pressure measures;
* Use kinematics formulae from the formulae sheet to calculate speed, acceleration, etc (with variables defined in the question);
* 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;
* Set up and use equations to solve word and other problems involving direct proportion (this is covered in more detail in unit 19);
* Relate algebraic solutions to graphical representation; Recognise when values are in inverse proportion by reference to the graph

**Similarity and Congruence in 2D and 3D**

* Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles using formal arguments
* Solve angle problems by first proving congruence
* Understand similarity of triangles and of other plane shapes, and use this to make geometric inferences;
* Prove that two shapes are similar
* Understand the effect of enlargement on angles, perimeter, area and volume of shapes and solids;
* Identify the scale factor of an enlargement of a similar shape using integer or fraction scale factors;
* Write the lengths, areas and volumes of two shapes as ratios in their simplest form;
* Find missing lengths, areas and volumes in similar 3D solids;
* Know the relationships between linear, area and volume scale factors of mathematically similar shapes and solids;
* Solve problems involving frustums of cones where you have to find missing lengths first using similar triangles.

**Statistics**

* 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 sample and population; Understand how different sample sizes may affect the reliability of conclusions
* Identify possible sources of bias and plan to minimise it;
* 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
* Construct and interpret box plots to find median, quartiles, range and interquartile range and outliers
* Know the appropriate uses of histograms; Construct and interpret histograms from class intervals with unequal width
* 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**

**Quadratics**

* Sketch a graph of a quadratic function, by factorising or by using the formula, identifying roots and y-intercept, turning point;
* Be able to identify from a graph if a quadratic equation has any real roots;
* Find approximate solutions to quadratic equations using a graph;
* Expand the product of more than two linear expressions;
* Sketch a graph of a quadratic function and a linear function, identifying intersection points;
* Sketch graphs of simple cubic functions, given as three linear expressions;
* Solve simultaneous equations graphically:
* find approximate solutions to simultaneous equations formed from one linear function and one quadratic function using a graphical approach;
* 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;
* for problems identifying the solutions to two different inequalities, show this as the intersection of the two solution sets, i.e. solution of x² – 3x – 10 < 0 as {x: –3 < x < 5};
* Solve linear inequalities in two variables graphically;
* Show the solution set of several inequalities in two variables on a graph;
* Use iteration with simple converging sequences.

**Circle Geometry**

* 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°;
* Understand and use the fact that the tangent at any point on a circle is perpendicular to the radius at that point;
* Find and give reasons for missing angles on diagrams using:
* circle theorems;
* 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.
* 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, by:
* finding the gradient of the radius that meets the circle at that point (circles all centre the origin);
* finding the gradient of the tangent perpendicular to it;
* using the given point;
* Recognise and construct the graph of a circle using x2 + y2 = r2 for radius r centred at the origin of coordinates.

**Spring Half Term 2**

**Advanced Algebra**

* 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;
* Change the subject of a formula, where all variables are in the denominators;
* Solve ‘Show that’ and proof questions using consecutive integers (n, n + 1), squares, even numbers 2n, odd numbers 2n +1;
* Use function notation; Find f(x) + g(x) and f(x) – g(x), 2f(x), f(3x) etc algebraically;
* Find the inverse of a linear function; Know that f –1(x) refers to the inverse function;
* For two functions f(x) and g(x), find gf(x).

**Vectors**

* Understand and use vector 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.
* Represent vectors, combinations of vectors and scalar multiples in the plane pictorially.
* Calculate the sum of two vectors, the difference of two vectors and a scalar multiple of a vector using column vectors
* 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.

**Direct and Inverse Proportion**

* Recognise, sketch and interpret graphs of the reciprocal function; State the value of x for which the equation is not defined;
* Recognise, sketch and interpret graphs of exponential functions y = kx for positive values of k and integer values of x;
* Set up, solve and interpret the answers in growth and decay problems;
* Apply to the graph of y = f(x) the transformations y = –f(x), y = f(–x) for linear, quadratic, cubic functions;
* Apply transformations 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;
* Interpret the gradient of linear or non-linear graphs, and estimate the gradient by sketching the tangent and finding its gradient;
* 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 area under a linear or non-linear graph in real-life contexts; including financial and rates of filing emptying of containers
* Recognise and interpret graphs showing direct and indirect proportion; Identify direct proportion from a table of values
* Write statements of proportionality for quantities proportional to the square, cube or other power of another quantity;
* Solve problems involving inverse proportion using graphs by plotting and reading values from graphs;
* Set up and use equations to solve word and other problems involving direct proportion or inverse proportion.

**Summer Term**

Revision

Exam practice

Gap Analysis

Summative Assessment