YEAR 8 SCHEME OF WORK - EXTENSION

Autumn Term 1	Factors and powers	Spring Term 1	Transformations	Summer Term 1	Probability
	Working with powers		Fractions, decimals and percentages		Scale drawings and measures
Half Term: Assessment		Half Term: Assessment		Half Term: Assessment	
Autumn Term 2	2D shapes and 3D solids	Spring Term 2	Constructions and loci	Summer Term 2	Graphs
	Real-life graphs				End of Term Assessment
End of Term: Assessment		End of Term: Assessment		End of Year: Assessment	

Year 8 Extension Term: Autumn 1	Unit Title: Factors and powers	Duration: 9 hrs.
Objectives: • use the concepts and vocabulary of prime factorisation • use product notation and the unique factorisation property • round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures] • calculate possible errors resulting from estimating, expressed using inequality notation $a < x \leq b$	**Notes:** • Find the prime factor decomposition of a number • Know the prime factorisation of numbers up to 30, giving answers as powers • Use prime factor decomposition to find the HCF or LCM of 2 numbers • Establish index laws for positive powers where the answer is a positive power • Apply the index laws for multiplication and division of positive integer powers • Show that any number to the power of zero is 1 • Understand that each of the headings in the place value system, to the right of the tens column, can be written as a power of ten • Know the prefixes associated with 10^9, 10^6, 10^3 (giga, mega and kilo) • Understand the effect of multiplying or dividing by any integer power of 10 • Understand the order in which to calculate expressions that contain powers and brackets in both the numerator and denominator of a fraction • Round numbers to a given number of significant figures • Use numbers of any size rounded to 1 significant figure to make standardized estimates for calculations with 1 step.	

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Year 8 Extension Term: Autumn 1	Unit Title: Working with powers	Duration: 10 hrs.
Objectives: • use and interpret algebraic notation: coefficients written as fractions rather than as decimals • use and interpret algebraic notation: brackets • understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors • simplify and manipulate algebraic expressions to maintain equivalence: collecting like terms • simplify and manipulate algebraic expressions to maintain equivalence: multiplying a single term over a bracket • use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)	**Notes/Common misconceptions:** • Simplify simple expressions involving powers, but not brackets, by collecting like terms • Simplify simple expressions involving index notation, i.e. $x^2 + 2x^2$, $p \times p^2$, $r^5 \div r^2$ • Know and understand the meaning of an identity and use the identity sign • Simplify expressions involving brackets and powers e.g. $x(x^2 + x + 4)$, $3(a + 2b) - 2(a + b)$ • Establish index laws for positive powers of variables where the answer is a positive power	

	• Apply the index laws for multiplication and division of small integer powers, e.g. $a^3 \times a^2$, $x^3 \div x^2$ • Know and use the general forms of the index laws for multiplication and division of positive integer powers. (e.g. $pa \times pb$, $pa \div pb$, $(pa)b$) • Multiply a single term over a bracket e.g. $x(x + 4)$, $3x(2x – 3)$ • Use the distributive law to take out single term algebraic factors, e.g. $x^3 + x^2 + x = x(x^2 + x + 1)$ • Substitute positive and negative integers into linear expressions and expressions involving powers • Construct and solve equations that involve multiplying out brackets by a negative number and collecting like terms (e.g. $4(2a – 1) = 32 – 3(2a – 2)$)

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Year 8 Extension Term: Autumn 2	Unit Title: 2D shapes and 3D solids	Duration: 12 hrs.
Objectives: • understand and use standard mathematical formulae • derive and apply formulae to calculate and solve problems involving volume of prisms (including cylinders) • calculate and solve problems involving perimeters of circles • calculate and solve problems involving areas of circles • use Pythagoras' Theorem to solve problems involving right-angled triangles	**Notes/Common misconceptions:** • Begin to use plans and elevations • Visualise and use a wide range of 2D representations of 3D objects • Analyse 3D shapes informally and through cross-sections, plans and elevations • Calculate the volume and surface area of right prisms • Calculate the lengths, areas and volumes in cylinders • Convert between larger volume measures to smaller ones (e.g. m^3 to cm^3) • Calculate the lengths and areas given the volumes in right prisms • Use the formula for the circumference of a circle • Know the names of parts of a circle • Use the formulae to find area of a circle, given the radius or diameter • Use the formulae for the area of a circle, given area, to calculate the radius or diameter • Be able to correctly identify the hypotenuse • Know the formula for Pythagoras' theorem and how to substitute in values from a diagram • Use and apply Pythagoras' theorem to solve problems • Given the coordinates of points A and B, calculate the length of AB	

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Year 8 Extension Term: Autumn 2	Unit Title: Real-life graphs	Duration: 10 hrs.
Objectives: • understand and use standard mathematical formulae • rearrange formulae to change the subject • model situations or procedures by translating them into algebraic expressions or formulae • find approximate solutions to contextual problems from given graphs of a variety of functions: including piece-wise linear graphs • solve problems involving direct proportion • solve proportion problems including graphical and algebraic representations • use compound units such as speed, unit pricing and density to solve problems	**Notes/Common misconceptions:** • Extend a proportion or relationship beyond known values (given proportion graphically or in words) • Recognise graphs that show direct proportion • Solve problems involving direct proportion with a graph • Discuss and interpret real-life graphs • Interpret information from a complex real life graph, read values and discuss trends • Plot the graphs of a function derived from a real life problem • Discuss and interpret linear and non linear graphs from a range of sources • Recognise graphs showing constant rates of change, average rates of change and variable rates of change • Plot a simple straight line graph (distance-time) • Draw and use graphs to solve distance-time problems • Identify misleading graphs and statistics – choosing the appropriate reasons from a small choice of options • Identify misleading graphs and statistics – choosing the appropriate reasons from a wide choice of options, or writing their own reasons	

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Year 8 Extension Term: Spring 1	Unit Title: Transformations	Duration: 11 hrs.
Objectives: • identify properties of, and describe the results of: translations • identify properties of, and describe the results of: rotations • identify properties of, and describe the results of: reflections • construct similar shapes by enlargement without coordinate grids • construct similar shapes by enlargement coordinate grids • apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides	**Notes:** • Describe a reflection, giving the equation of the line of reflection • Show reflection on a coordinate grid in $y = x$, $y = -x$ • Describe and carry out translations using column vectors • Describe a rotation on a coordinate grid • Know that translations, rotations and reflections preserve length and angle • Know that translations, rotations and reflections map objects on to congruent images • Enlarge 2D shapes, given a centre of enlargement and a positive whole number scale factor • Describe 2D enlargements • Enlarge 2D shapes, given a centre of enlargement outside the shape and a negative whole-number scale factor • Enlarge 2D shapes, given a fractional scale factor • Recognise that enlargements preserve angle but not length • Enlarge 2D shapes and recognise the similarity of resulting shapes • Transform 2D shapes by simple combinations of rotations, reflections and translations, using ICT • Transform 2D shapes by more complex combinations of rotations, reflections and translations • Identify reflection symmetry in 3D shapes • Understand the implications of enlargement for perimeter • Identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments • Calculate areas and volumes of shapes after enlargement	

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Year 8 Extension Term: Spring 1	Unit Title: Fractions, decimals and percentages	Duration: 9 hrs.
Objectives: • interpret percentages and percentage changes as a fraction or a decimal • interpret percentages multiplicatively • express one quantity as a percentage of another • compare two quantities using percentages • work with percentages greater than 100%	**Notes/Common misconceptions:** • Know fractional equivalents to key recurring decimals e.g. 0.333333..., 0.66666666..., 0.11111… • Know the denominators of simple fractions that produce recurring decimals, and those that do not • Convert a recurring decimal to a fraction • Use an inverse operation • Use the unitary method for an inverse operation • Calculate percentage change, using the formula 'actual change/original amount × 100' – where formula is given • Calculate percentage change, using the formula 'actual change/original amount × 100' – where formula is recalled • Calculate compound interest and repeated percentage change	

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Year 8 Extension Term: Spring 2	Unit Title: Constructions and loci	Duration: 11 hrs.
Objectives: • draw and measure line segments and angles in geometric figures • derive and use the standard ruler and compass constructions: perpendicular bisector of a line segment • derive and use the standard ruler and compass constructions: constructing a perpendicular to a given line from/at a given point • derive and use the standard ruler and compass constructions: bisecting a given angle • recognise and use the perpendicular distance from a point to a line as the shortest distance to the line • describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric • use the standard conventions for labelling the sides and angles of triangle ABC	**Notes/Common misconceptions:** • Construct a triangle given two sides and included angle (SAS) • Construct a triangle given two angles and the included side (ASA) • Use straight edge and compass to construct a triangle, given three sides (SSS) • Use ruler and protractor to draw accurate nets of 3-D shapes, using squares, rectangles and triangles e.g. regular tetrahedron, square-based pyramid, triangular prism • Use straight edge and compass to construct the mid-point and perpendicular bisector of a line segment • Use straight edge and compass to construct the bisector of an angle • Use straight edge and compass to construct the perpendicular from a point on a line segment • Use straight edge and compass to construct a triangle, given right angle, hypotenuse and side (RHS) • Use straight edge and compass to construct the perpendicular from a point to a line segment • recognise and use the perpendicular distance from a point to a line as the shortest distance to the line • Draw the locus equidistant between 2 points or from a point • Draw the locus equidistant between 2 lines • know that all the points equidistant from a single point in space form the surface of a sphere • Draw the locus equidistant from a line and around a rectangle • Produce shapes and paths by using descriptions of loci • Use construction to find the locus of a point that moves according to a rule	

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Year 8 Extension Term: Summer 1	Unit Title: Probability	Duration: 11 hrs.
Objectives: • record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes • use appropriate language of probability • use the 0–1 probability scale • understand that probabilities of all possible outcomes sum to 1 • generate theoretical sample spaces for single and combined events with equally likely and mutually exclusive outcomes • use sample spaces for single and combined events to calculate theoretical probabilities.	**Notes/Common misconceptions:** • Understand and use the probability scale from 0 to 1 • Identify all possible mutually exclusive outcomes of a single event • Find and justify probabilities based on equally likely outcomes in simple contexts • Calculate the probability of a combination of events or single missing events of a set of mutually exclusive events using 'sum of outcomes = 1' • Calculate the probability of the final event of a set of mutually exclusive events • Know that if probability of event is p, probability of not occurring is $1 - p$ • Understand relative frequency as an estimate of probability and know when to add or multiply probabilities • Know how to calculate relative frequency • Use relative frequency to make estimates • Apply estimated probabilities to future data • Estimate probabilities based on these data (collected from a simple experiment) • Plot and use relative frequency diagrams, and recognise that with repeated trials experimental probability tends to a limit • Use experimentation to complete a data collection sheet, e.g. throwing a die or data-logging • Identify all mutually exclusive outcomes for two successive events with two or three outcomes in each event • Use the vocabulary of probability to assign probability to events. • Identify conditions for a fair game • Draw and use tree diagrams to represent outcomes of two independent events and calculate probabilities • Calculate the probability of independent and dependent events	

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Year 8 Extension Term: Summer 1	Unit Title: Scale drawings and measures	Duration: 10 hrs.
Objectives: • use scale factors • use scale diagrams • use maps • interpret scale drawings • know and use the criteria for congruence of triangles • identify and construct congruent triangles	**Notes/Common misconceptions:** • Use scales in maps and plans • Use and interpret maps, using proper map scales (1:25 000) • Draw diagrams to scale • Use and interpret scale drawings, where scales use mixed units, and drawings aren't done on squared paper, but have measurements marked on them. • Solve simple geometrical problems showing reasoning • Distinguish between conventions, definitions and derived properties • Solve geometric problems using side and angle properties of equilateral, isosceles and right-angled triangles and special quadrilaterals • Solve problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons • Make simple drawings, demonstrating accurate measurement of length and angle • Use bearings to specify direction • Solve angle problems involving bearings • Begin to use congruency to solve simple problems in triangles and quadrilaterals • Know and use the criteria for congruence of triangles • Identify 2D shapes that are congruent or similar by reference to sides and angles • Use the information given about the length of sides and size of angles to determine whether triangles are congruent, or similar • Know that triangles given SSS, SAS, ASA or RHS are unique, but that triangles given SSA or AAA are not. • Find points that divide a line in a given ratio, using the properties of similar triangles • Use similarity to solve problems in 2-D shapes	

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Year 8 Extension Term: Summer 2	Unit Title: Graphs	Duration: 12 hrs.
Objectives: • recognise and use relationships between operations including inverse operations • model situations or procedures by using graphs • work with coordinates in all four quadrants • recognise, sketch and produce graphs of linear functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane • interpret mathematical relationships both algebraically and graphically • reduce a given linear equation in two variables to the standard form y = mx + c • calculate and interpret gradients and intercepts of graphs of such linear equations numerically • calculate and interpret gradients and intercepts of graphs of such linear equations graphically • calculate and interpret gradients and intercepts of graphs of such linear equations algebraically	**Notes/Common misconceptions:** • Plot the graphs of linear functions in the form $y = mx + c$ and recognise and compare their features • Recognise that linear functions can be rearranged to give y explicitly in terms if x e.g. rearrange $y + 3x – 2 = 0$ in the form $y = 2 – 3x$ • Recognise that straight line graphs can be written in the form $y = mx + c$ • Be able to work out when a point is on a line • Begin to consider the features of graphs of simple linear functions, where y is given explicitly in terms of x • Without drawing the graphs, compare and contrast features of graphs such as $y = 4x$, $y = 4x + 6$, $y = x + 6$, $y = –4x$, $y= x – 6$ • Know and use $y = mx + c$ for any straight line • Know for a straight line $y = mx + c$, m is the gradient and m = (change in y)/(change in x) • Recognise that any line parallel to a given line will have the same gradient. • Know that a line perpendicular to the line $y = mx + c$, will have a gradient of $–1/m$ • Recognise when lines are parallel or perpendicular from their equations • Recognise when lines are parallel and where a line crosses the y-axis from the equation of the line • Find the inverse of a linear function such as $x \rightarrow 2x + 5$, $x \rightarrow 2(x – 3)$, $x \rightarrow (x + 2)/4$, $x \rightarrow 5x – 4$ • Recognise the graph of the inverse of simple linear functions • Recognise that when the linear and inverse of a linear function such as $y = 2x$, $y = 3x$ are plotted, they are a reflection in the line $y = x$ • Recognise geometric sequences and appreciate other sequences that arise • Find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear , exponential and reciprocal graphs • Solve problems involving direct and inverse proportion, including graphical and algebraic representations	

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