

YEAR 9 SCHEME OF WORK - EXTENSION

Autumn Term 1	Powers and roots	Spring Term 1	Multiplicative reasoning	Summer Term 1	Graphical solutions
	Quadratics		Non-linear graphs		Trigonometry
Half Term: Assessment		Half Term: Assessment		Half Term: Assessment	
Autumn Term 2	Inequalities, equations and formulae	Spring Term 2	Accuracy and measures	Summer Term 2	Mathematical reasoning
	Collecting and analysing data				End of Term Assessment
End of Term: Assessment		End of Term: Assessment		End of Year: Assessment	

Year 9 Extension Term: Autumn 1	Unit Title: Powers and roots	Duration: 11 hrs.
<p>Objectives:</p> <ul style="list-style-type: none"> distinguish between exact representations of roots and their decimal approximations interpret numbers in standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or zero compare numbers in standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or zero substitute numerical values into formulae and expressions, including scientific formulae 	<p>Notes:</p> <ul style="list-style-type: none"> Find the reciprocal of simple numbers /fractions mentally, e.g. 10 and 1/10, 1/3 and 3 etc. Know that a number multiplied by its reciprocal is 1 Know that the reciprocal of a reciprocal is the original number Use the index laws to include negative power answers and understand that these answers are smaller than 1 Evaluate powers of fractions Write numbers greater than 10 in standard form Write number less than 10 in standard form Order numbers written in standard form Complete calculations using numbers written in standard form Use fractional indices and write a fractional power as a root Work out negative fractional powers of numbers Simplify expressions which include surds Present a concise and reasoned argument using surds Understand / use rational / irrational numbers Distinguish between exact representations of roots and their decimal approximations 	

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Year 9 Extension Term: Autumn 1	Unit Title: Quadratics	Duration: 10 hrs.
<p>Objectives:</p> <ul style="list-style-type: none"> • simplify and manipulate algebraic expressions to maintain equivalence: expanding products of two or more binomials • generate terms of a sequence from a term-to-term rule • generate terms of a sequence from a position-to-term • recognise arithmetic sequences • find the nth term • recognise geometric sequences and appreciate other sequences that arise 	<p>Notes/Common misconceptions:</p> <ul style="list-style-type: none"> • Generate any term of a sequence when the nth term is given. • Generate the next term in a quadratic sequence • Find a term of a quadratic sequence with $T(n) = an^2$ for a given value of n • Find the nth term of a quadratic sequence of the term with $T(n) = an^2 + b$ • Find the nth term of a quadratic sequence of the term with $T(n) = an^2 + bn + c$ • Generate the sequence of triangle numbers by considering the arrangement of dots and deduce that $T(n) = 1 + 2 + 3 + \dots + n$, the sum of the series • By looking at the spatial patterns of triangular numbers, deduce that the nth term is $n(n + 1)/2$ • Multiply out brackets involving positive terms such as $(a + b)(c + d)$ and collect like terms • Multiply out brackets involving positive and negative terms such as $(a + b)(c - d)$ or $(a - b)(c - d)$ and collect like terms • Square a linear expression and collect like terms • Derive and use identities for the product of two linear expressions of the form $(a + b)(a - b) = a^2 - b^2$ and $(x + 2)(x - 2) = x^2 - 4$ • Factorise a quadratic expression • Factorise a perfect square • Derive and use the difference of two squares • Solve quadratics with first term x squared (no multiples of x squared) 	

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Year 9 Extension Term: Autumn 2	Unit Title: Inequalities, equations and formulae	Duration: 11 hrs.
Objectives: <ul style="list-style-type: none"> understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors rearrange formulae to change the subject use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement) 	Notes/Common misconceptions: <ul style="list-style-type: none"> Solve linear inequalities and represent the solution on a number line Multiply both sides of an inequality by a negative number Know that $a^0 = 1$ Use the index laws to include negative power answers and establish that these answers are smaller than 1 Explain the distinction between equations, formulae and functions Solve equations of the form $(ax +/- b)/c = (dx +/- e)/f$ {One of c or f should be 1} Construct and solve equations of the form $(ax +/- b)/c = (dx +/- e)/f$ {c and f are bigger than 1} Change the subject of a formula Use factorisation to make a given letter the subject of a formula Change algebraic fractions to equivalent fractions Change the subject of a complex formula that involves fractions, e.g. make u or v the subject of the formula $1/v + 1/u = 1/f$ Solve problems by finding a variable that is not the subject of a formula Simplify complex algebraic expressions 	

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Year 9 Extension Term: Autumn 2	Unit Title: Collecting and analysing data	Duration: 12 hrs.
<p>Objectives:</p> <ul style="list-style-type: none"> • use a calculator and other technologies to calculate results accurately and then interpret them appropriately • describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete data • describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving continuous and grouped data • describe, interpret and compare observed distributions of a single variable through: appropriate measures of spread (range, consideration of outliers) 	<p>Notes/Common misconceptions:</p> <ul style="list-style-type: none"> • Select appropriate level of accuracy of data • Select the range of possible methods that could be used to collect this data as primary data • Select and discuss the range of possible sources that could be used to collect this data as secondary data • From a range of sample sizes identify the most sensible answer • Determine the sample size and degree of accuracy needed • From a small choice of options identify ways to reduce bias in a sample or questionnaire • Identify a random sample • Use stem and leaf diagrams to find mode, median, mean, range • Construct stem and leaf diagrams • Use back to back stem and leaf diagrams to compare sets of data • Construct a frequency diagram from a grouped frequency table, and use it to draw a frequency polygon. • Compare two distributions using the shape of the distributions – frequency polygons. • Construct and use frequency polygons to compare sets of data • Estimate the range of a large set of grouped data • Calculate an estimate of the mean of a large set of grouped data • Estimate the mean from a frequency polygon • Identify the class that contains the median of a set of grouped data from a table • Calculate possible values of the set of data given summary statistics • Find quartiles from raw data and present data in a box plot • Find the lower and upper quartiles of a set of grouped data using a cumulative frequency chart and box and whisker diagram • Draw a grouped frequency graph • Estimate the median of a set of grouped data using a cumulative frequency chart • Find the interquartile range of a large set of grouped data using a cumulative frequency chart • Interpret / construct histograms 	

Year 9 Extension Term: Spring 1	Unit Title: Multiplicative reasoning	Duration: 10 hrs.
Objectives: <ul style="list-style-type: none"> • solve problems involving direct proportion • solve problems involving inverse proportion • calculate and solve problems involving perimeters of circles • calculate and solve problems involving areas of circles 	Notes: <ul style="list-style-type: none"> • Given a relationship (as proportion) graphically or in words, extend beyond known values (e.g. off lines of chart, or above pairs of values given) • Check by drawing graphs whether two variables are in direct proportion • Set up equations to show direct proportion • Recognise sets of data that are proportional • Understand direct proportion as equality of ratio • Use algebraic methods to solve problems involving variables in direct proportion • Use expressions of the form y is proportional to x • Use expressions of the form y is proportional to x^2 • Identify data that is proportional to the inverse of a variable • Understand / use inverse proportion • Recognise the formulae for length of arcs in a circle • Recognise the formulae for area of sectors in a circle • Use the formulae for length of arcs and area of sectors of circles to solve problems 	

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Year 9 Extension Term: Spring 1	Unit Title: Non-linear graphs	Duration: 10 hrs.
<p>Objectives:</p> <ul style="list-style-type: none"> recognise, sketch and produce graphs of quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane find approximate solutions to contextual problems from given graphs of a variety of functions: reciprocal graphs 	<p>Notes/Common misconceptions:</p> <ul style="list-style-type: none"> Construct a table of values, including negative values of x for a quadratic function such as $y = ax^2$ Recognise the graph of a quadratic function Construct a table of values, including negative values of x for a function such as $y = ax^2 + b$ Find the line of symmetry and write down the turning point of a quadratic graph Explain the effect on a quadratic graph of changing the parameter Solve simple quadratic equations graphically, e.g. $x^2 - 10 = 0$, $2x^2 - 15 = 0$ Construct a table of values, including negative values of x for a function such as $y = ax^2 + bx$ and $y = ax^2 + bx + c$ Solve quadratic equations such as $ax^2 + bx = 0$ graphically and relate the solutions to quadratic factorisation Solve quadratic equations such as $x^2 + bx + c = 0$ graphically and relate the solutions to quadratic factorisation Construct a table of values, including negative values of x for a function such as $y = ax^3$ Recognise the graphs of $y = x^2$, $y = 3x^2 + 4$, $y = x^3$ Recognise graphs of functions of the form $y = ax^2 + b$ and $y = ax^3$ Identify maxima, minima and lines of symmetry on quadratic and cubic graphs Construct models of real-life situations by drawing graphs and constructing algebraic equations Sketch / interpret graphs of reciprocal functions Recognise and use reciprocal graphs and graphs for inverse proportion 	

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Year 9 Extension Term: Spring 2	Unit Title: Accuracy and measures	Duration: 9 hrs.
Objectives: <ul style="list-style-type: none"> • use compound units such as speed, unit pricing and density to solve problems • round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures] • use approximation through rounding to estimate answers • calculate possible errors resulting from estimating, expressed using inequality notation $a < x \leq b$ 	Notes/Common misconceptions: <ul style="list-style-type: none"> • Solve problems using constant rates and related formulae. • Extend to simple conversions of compound measures (e.g. convert 2 m/s to km/hr) • Solve problems using average rate of change and related formulae • Identify the upper and lower bounds of a measurement by calculating \pm half of the unit used for rounding • Identify upper and lower bounds for rounding of discrete and continuous data • Calculate simple error intervals using inequality notation $a < x \leq b$ • Calculate the lower and upper bounds of area measurement • Calculate the upper and lower bounds of compound measures • Determine upper and lower bounds in complex problems • Solve problems by understanding upper and lower bounds 	Levels: <ul style="list-style-type: none"> • 7a • 7a • 8c • 7c • 7b • 7b • 8b • 8a • 8a • 8a

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Year 9 Extension Term: Summer 1	Unit Title: Graphical solutions	Duration: 11 hrs.
<p>Objectives:</p> <ul style="list-style-type: none"> • understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors use linear graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations • use quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations • understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors 	<p>Notes/Common misconceptions:</p> <ul style="list-style-type: none"> • Understand the steps required to solve a pair of simultaneous equations of the form $ax + y = b, y = ax$ • Understand the steps required to solve a pair of simultaneous equations, when they are solved by addition. Equations are of the form $ax + y = b, x - y = c$ • Understand the steps required to solve a pair of simultaneous, when they are solved by subtraction. Equations are of the form $ax + y = b, x + y = c$ • Rearrange equations of the form $ax + by = c$ to compare gradients and y-intercept • Recognise that linear functions can be rearranged to give y explicitly in terms of x, e.g. rearrange $y + 3x - 2 = 0$ in the form $y = 2 - 3x$ • Find the equation of the line between two points • Understand the steps required to solve a pair of simultaneous equations, when they are solved by multiplication. Equations are of the form $ax + y = b, x +/- cy = d$ • Identify the solution of simultaneous equations on a graph • Solve inequalities in two variables by using linear graphs • Solve more complex inequalities in two variables by using linear and quadratic graphs • Construct models of real-life situations by drawing graphs and constructing algebraic equations 	

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Year 9 Extension Term: Summer 1	Unit Title: Trigonometry	Duration: 12 hrs.
<p>Objectives:</p> <ul style="list-style-type: none"> • use trigonometric ratios in similar triangles to solve problems involving right-angled triangles • use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders and pyramids to solve problems in 3D 	<p>Notes/Common misconceptions:</p> <ul style="list-style-type: none"> • Understand that the ratio of any two sides is constant in similar right-angles triangles • Use the sine, cosine and tangent ratios to find the lengths of unknown sides in a right-angled triangle, using straight-forward algebraic manipulation, e.g. calculate the adjacent (using cosine), or the opposite (using sine or tangent ratios) • Use the sine, cosine and tangent ratios to find the lengths of unknown sides in a right-angled triangle, using more complex algebraic manipulation, e.g. the hypotenuse (using cosine or sine), or adjacent (using the tangent ratio) • Begin to use the trigonometric ratios to find the size of an angle in a right-angled triangle • Use the appropriate ratio to find a length, or angle, and hence solve a two-dimensional problem • Use sine / cosine / tangent of any size of angle and Pythagoras' theorem when solving problems in 3D • Sketch graphs of sine / cosine / tangent functions for any angle, generating/interpreting them 	

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Year 9 Extension Term: Summer 2	Unit Title: Mathematical reasoning	Duration: 9 hrs.
Objectives: <ul style="list-style-type: none"> • use known results to obtain simple proofs 	Notes/Common misconceptions: <ul style="list-style-type: none"> • Justify solutions to problems set in an unfamiliar context • Generate fuller solutions using reasoned argument • Construct models of real-life situations by drawing graphs and constructing algebraic equations • Identify exceptional cases or counter-examples and explain why • Use counter example to show why a statement is false • Explore the effects of varying values and make convincing arguments to justify generalisations • Justify generalisations, arguments or solutions and investigate whether particular cases can be generalised further • Present a reasoned argument using algebra • Use algebra to investigate an extension to a problem 	

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