



HALEWOOD
ACADEMY



KEY STAGE 3 Y7 - Y9



ASSESSMENT STEPS



Mathematics

'We Seek the Best'

Key Stage 3 Descriptors	Key Knowledge Skills and Understanding for Key Stage 3 What do students know and what can they do?				
	Number	Ratio and Proportion	Algebra	Shape, space and measure	Data Handling
+ Excelling + (Projected Grade 9 at GCSE)	- Index laws - Working in standard form - Calculating using mixed number - Percentage change - Reverse percentages - Compound interest and depreciation - Recurring and terminating decimals to fractions		- Expand double brackets - Algebraic direct and inverse proportion - Simultaneous equations - Draw graphs in the $ax + by = c$ - Draw and interpret non-linear graphs	- Enlargement with fractional and negative scale factors - Problem solving using loci - Congruence and similarity - Similar triangles - Right angled trigonometry	- Averages from a grouped frequency table - Representing grouped data - Venn diagrams
+ Mastering + (Projected Grades 6 - 8 at GCSE)	- Using prime factors to find the HCF and LCM - Multiply and divide decimals - Understand higher powers and roots - Percentage multipliers - Calculating percentage increase and decrease	- Ratio and proportion problems using decimals - Understand the link between ratio and fractions - Ratio in the form 1:n - Direct and inverse proportion - Best buys	- Write and use formula - Change the subject of a formula - Use the order of operations with algebraic expressions - Solve equations with fractions - Use $y=mx+c$ - Draw quadratic functions - Non-linear sequences - Representing inequalities	- Volumes of prisms and cylinders - Pythagoras theorem - Angles in parallel lines - Solving geometric angle problems - Perpendicular and angle bisectors - Constructing triangles and angles - Errors and bounds - Compound measures - Convert imperial to metric measures	- Understand types of data - Averages from an ungrouped frequency table - Representing ungrouped data - Stem and leaf diagrams - Experimental and theoretical - Sample space diagrams

Key Stage 3 Descriptors	Descriptors of Key Knowledge Skills and Understanding for Key Stage 3 What do students know and what can they do?				
	Number	Ratio and Proportion	Algebra	Shape, space and measure	Data Handling
+ Securing + (Projected Grades 3 - 5 at GCSE)	- Prime factor decomposition - Understand squares and their roots - Calculations with decimals including place value calculations - Multiply and divide by 10, 100 and 1000 - Equivalence between fractions, decimals and percentages - Converting between improper fractions and mixed number - Four operations with fractions - Order of operations including fractions, decimals, negatives	Use a ratio to find one quantity when the other is known	- Expand and factorise single brackets - Solve 2 step equations - Solve equations with unknowns on both sides - Draw straight line graphs - Find the midpoint of a line - Write the equation of a line in the form $y = mx + c$ - Find the gradient of a line - Find the nth term of an arithmetic sequence - Real-life graphs	- Area of a trapezium - Circles - Surface area of cubes and cuboids - Accurately draw triangles using a protractor - Interior and exterior angles in polygons - Translate, reflect and rotate a shape - Enlarge a shape given a positive scale factor - Using scales	- Compare data using the averages and the range - Compare data using charts and averages - Two way tables - Scatter Graphs - Construct pie charts - Know that probabilities add up to 1
+ Developing + (Projected Grades 1 – 2 at GCSE)	- Recognise prime, square and cube numbers - Find common factors and multiples - Order decimal numbers and round decimal numbers - Calculate with negative numbers, money and time - Simplify and compare fractions - Add and subtract fractions - Calculate simple percentages and fractions of amounts	- Write ratio - Understand simple direct proportion - Read and construct scale drawings - Use and interpret maps and scale drawings, using a variety of scales and units	- Use a function machine for 2 step problems - Understand algebraic notation - Simplify by collecting like terms - Multiply and divide terms - Write simple expressions and formulae - Substitute positive integers into a simple expression - Term to term rule for arithmetic sequences - Plot co-ordinates in all four quadrants	- Convert metric units of measure - Calculate the area of rectangles and parallelograms - Volume of cubes and cuboids 2D representations of 3D solids - Measure and draw angles - Angle facts including in a triangle and quadrilateral	- Calculate the median and mean - Construct frequency tables for grouped data - Draw and interpret line graphs and multiple bar charts. - Interpret simple pie charts - Use the language of probability - Probability scale - Calculate simple probabilities
+ Emerging + (Below GCSE Grading)	- Place value up to 10,000,000 - Round to the nearest 10, 100, 1000 - Recognise and use negative numbers in context - Know multiplication facts to 12x12 and associated division facts - Know multiples and factors - Multiply by 4 digits by 1 or 2 digits - Divide up to 4 digits by 2 digit - Solve problems using the four operations - Write equivalent fractions	- Convert a percentage to a number of hundredths or tenths - Write equivalent fractions - Use fraction notation to describe parts of shapes	- Use simple formula written in words - Continue an arithmetic sequence - Continue a pattern - Plot co-ordinates in the first quadrant	- Identify 3D and 2D shapes - Know the difference between regular and irregular polygons - Perimeter of rectangles and shapes made up of rectangles - Area of shapes by counting squares - Estimate volume and capacity by counting cubes - Units of measure - Units of time - Reflection and translation	- Read and interpret information from tables - Read and draw pictograms - Read and draw a bar chart - Find the mode and range from a set of data



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KEY STAGE 4 Y10 - Y11

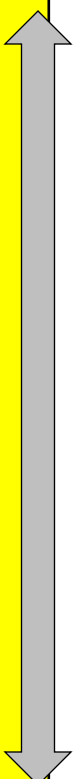


ASSESSMENT STEPS



Mathematics

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Key Stage 4 Descriptors	Descriptors of Key Knowledge Skills and Understanding for Key Stage 4				
	Number	Ratio and Proportion	Algebra	Shape, space and measure	Data Handling
9 			- Solve quadratic inequalities in one variable - Represent the solution set of inequalities on a number line, using set notation and on a graph - Sketch translations and reflections of a given function - Find the equation of a tangent to a circle at a given point Interpret the succession of two functions as a 'composite function' (the use of formal function notation is expected) - Apply the concepts of average and instantaneous rate of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts (this does not include calculus) - Finding the nth term of a quadratic sequence	- Use circle theorems them to prove related results 3D Trigonometry 3D Pythagoras	

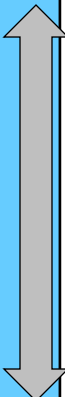
Key Stage 4 Descriptors	Grade Descriptors for Key Stage 4				
	Number	Ratio and Proportion	Algebra	Shape, space and measure	Data Handling
8	Rationalise denominators		- Solve quadratic equations by completing the square - Solve two simultaneous equations in two variables inc quadratic - Find approximate solutions to equations using iteration - Recognise, sketch and interpret exponential functions $y=kx$ for positive values of k - Recognise, sketch and interpret the trigonometric functions - Plot and interpret graphs (including reciprocal graphs and exponential graphs) - Calculate or estimate gradients of graphs and areas under graphs and interpret these in practical examples - Recognise and use the equation of a circle with centre at the origin - Argue mathematically to show algebraic proofs		

Key Stage 4 Descriptors	Grade Descriptors for Key Stage 4				
	Number	Ratio and Proportion	Algebra	Shape, space and measure	Data Handling
7	- Simplify surd expressions involving squares (e.g. $\sqrt{12}=\sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$) - Calculate upper and lower bounds		- Algebraic proof - Solving quadratics using the formula - Trigonometric graphs - Factorising quadratic expressions - Solve quadratic equations by using the quadratic formula Identify and interpret roots, intercepts, turning points of quadratic functions graphically and deduce turning points by completing the square Interpret the gradient at a point on a curve as the instantaneous rate of change	- Use vectors to construct geometric arguments and proofs 3D Pythagoras - Know and apply the sine rule and cosine rule to find unknown lengths and angles Know how to calculate the area, sides or angles of any triangle	- Construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use - Construct and interpret histograms

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6	- Change recurring decimals into their corresponding fractions and vice versa - Estimate powers and roots of any given positive number - Calculate with fractional indices - Calculate exactly with surds - Use the product rule for counting (i.e. if there are m ways of doing one task and for each of these, there are n ways of doing another task, then the total number of ways the two tasks can be done is m x n ways)	Construct and interpret equations that describe direct and inverse proportion	- Expanding products of three or more binomials - Simplifying expressions involving sums, products and powers, including the laws of indices - Solve quadratic equations (including those that require rearrangement) - Find approximate solutions using a graph use the form $y=mx+c$ to identify perpendicular lines - Recognise and use simple geometric progressions (where n is an integer, and is a rational number or a surd) and other sequences - Deduce expressions to calculate the nth term of a quadratic sequence - Work with general iterative processes	- Apply the standard circle theorems concerning angles, radii, tangents and chords Identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including negative scale factors) - Apply the concepts of congruence and similarity, including the relationships between areas and volumes in similar figures - Describe the changes and invariance achieved by combinations of rotation, reflections and translations	- Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams - Find inter-quartile range from cumulative frequency graphs. - Draw and interpret box plots.

Key Stage 4 Descriptors	Grade Descriptors for Key Stage 4				
	Number	Ratio and Proportion	Algebra	Shape, space and measure	Data Handling
5	• Use inequality notation to specify simple error intervals due to truncation or rounding • Apply and interpret limits of accuracy • Interpret fractions and percentages as operators • Calculate exactly with multiples of π • Calculate with and interpret standard form	• Express a multiplicative relationship between two quantities as a ratio or a fraction solve original value problems • Solve problem involving direct and inverse proportion including graphical and algebraic representations • Make links to similarity (including trigonometric ratios) and scale factors • Understand that x is inversely proportional to y is equivalent to x is proportional to $1/y$ • Interpret equations that describe direct and inverse proportion • Recognise and interpret graphs for direct and inverse proportion	• Factorising quadratic expressions • Solve linear equations • Solve quadratic equations by factorising • Find approximate solutions using a graph • Solve simultaneous eqs • Derive an equation • Solve linear inequalities • Identify and interpret roots, intercepts, turning points of quadratic functions graphically, deduce roots algebraically • Recognise, sketch and interpret quadratic functions, simple cubic functions and the reciprocal function • Plot and interpret graphs of non-standard functions • Rearrange formulae • Difference between an equation and an identity • Change freely between compound units in algebraic contexts	• Construct given figures and solve loci problems • Use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS) Know the formulae for the trigonometric ratios • Find angles and lengths in right-angled triangles Know the exact values of certain trig ratios • Calculate: surface area and volume of spheres, pyramids, cones and composite solids • Calculate arc lengths, angles and areas of sectors of circles Identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional) • Apply the concepts of congruence and similarity	• Enumerate sets and combinations of sets systematically, using tree diagrams • Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions • Find median from cumulative frequency graphs Infer properties of populations or distributions from a sample, while knowing the limitations of sampling

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4	- Use the concepts and vocabulary of prime factorisation, including using product notation and the unique factorisation theorem - Estimate answers - Check calculations using approximations and estimation, including answers obtained using technology - Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of significant figures) - Identify and work with fractions in ratio problems - Calculate with integer indices - Calculate exactly with fractions	- Change freely between compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical contexts - Divide a quantity into two parts in a given part:part or part:whole ratio - Express the division of a quantity into two parts as a ratio - Apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) - Solve problems involving simple interest including in financial mathematics - Use compound units such as speed, rates of pay, unit pricing, density and pressure - Compare lengths, areas and volumes using ratio notation	- Expanding products of two binomials - Solve linear equations in one unknown algebraically - Find approximate solutions using a graph - Translate simple situations or procedures into algebraic expressions or formulae - Solve linear inequalities in one variable - Recognise, sketch and interpret graphs of linear functions use the form $y=mx+c$ to identify parallel lines - Understand and use standard mathematical formulae - Where appropriate, interpret simple expressions as functions with inputs and outputs - Deduce expressions to calculate the nth term of a linear sequence	- Apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representation of vectors - Do standard ruler and compass constructions - Know that the perpendicular distance from a point to a line is the shortest distance to the line - Derive and use the sum of angles in a polygon - Know and apply the formulae for Pythagoras' theorem - Know parts of a circle - Calculate: perimeters and areas of 2D shapes - Use isosceles triangle facts - Identify, describe and construct congruent and similar shapes,	- Apply the property that the probabilities of an exhaustive set of outcomes sum to one - Understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size - Enumerate sets and combinations of sets systematically, using Venn diagrams - Construct theoretical possibility spaces - Find mean and median from grouped data - Explain the use of different averages - Draw cumulative frequency graphs - Recognise correlation and - Draw lines of best fit and interpret them - Interpolate and extrapolate apparent trends while knowing the dangers of this

Key Stage 4 Descriptors	Grade Descriptors for Key Stage 4				
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3 	• Apply the four operations, including formal written methods, to simple fractions (proper and improper), and mixed numbers – both positive and negative • Use the concepts and vocabulary of highest common factor, lowest common multiple • Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places) • Use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 • Calculate with roots	• Use scale factors, scale diagrams and maps Express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1 • Use ratio notation, including reduction to simplest form Interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively • Work with percentages greater than 100% Solve problems involving percentage change, including percentage increase/decrease	• Substitute numerical values into formulae and expressions • Understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors • Multiplying a single term over a bracket • Taking out common factors • Plot graphs of equations that correspond to straight-line graphs in the coordinate plane • Generate terms of a sequence from either a term-to-term or a position-to-term rule • Recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci sequences, quadratic sequences, and simple geometric progressions	• Describe translations as 2D vectors understand and use alternate and corresponding angles on parallel lines • Construct and interpret plans and elevations of 3D shapes • Use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.) • Interpret maps and scale drawings and use bearings • Know and apply formulae to calculate: volume of right prisms (including cylinders) • Know the formulae for circumference and area of a circle • Apply triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides	• Record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees • Apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments • Relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale • Enumerate sets and combinations of sets systematically, using tables and grids • Find the mean and modal class from grouped data • Compare distributions using averages and range • Use and interpret scatter graphs of bivariate data

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2	- Order decimals and fractions - Use the symbols =, $\neq$, $<$, $>$, $\leq$, $\geq$ - Apply the four operations - Apply the four operations, including formal written methods, to decimals –both positive and negative Recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions) - Use conventional notation for priority of operations, including brackets, powers, roots and reciprocals - Use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples	- Change freely between related standard units (e.g. time, length, area, volume/capacity, mass) - Understand and use proportion as equality of ratios - Relate ratios to fractions and to linear functions - Express one quantity as a percentage of another - Compare two quantities using percentages	- Collecting like terms - Work with coordinates in all four quadrants	- Use conventional terms - Use the standard conventions for labelling and referring to the sides and angles of triangles - Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles - Derive and apply the properties of special types of quadrilaterals; and triangles and other plane figures using appropriate language Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres - Measure angles - Know and apply formulae to calculate: area of parallelograms, trapezia; volume of cuboids - Apply angle facts	- Find the mean from a list of data - Compare distributions using bar charts and pictograms - Construct and interpret pie charts - Compare distributions using bar charts, vertical line charts and pictograms - Construct and interpret pie charts
	- Order positive and negative integers - Understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)	Define percentage as ‘number of parts per hundred’	Collect like terms that are positive	- Measure line segments in geometric figures - Know and apply formulae to calculate area of triangles	- Find median and mode from list of data - Draw and interpret line graphs, bar charts and pictograms - Make tables, lists and tally charts from discrete data - Draw and interpret line graphs, bar charts and pictograms - Make tables, lists and tally charts from discrete data