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Mathematics Progress Grid

Mathematics Assessment Grid Summary

Grade	Description
9	**Problem Solving- Extensive ability to solve problems within mathematics and in other contexts** Grade 9 Students for **all GCSE maths** should be able to: • translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes • make and use connections between different parts of mathematics • interpret results in the context of the given problem • evaluate methods used and results obtained • evaluate solutions to identify how they may have been affected by assumptions made
8	**Problem Solving- Extensive ability to solve problems within mathematics and in other contexts** To achieve grade 8, candidates will be able to: • perform procedures accurately • interpret and communicate complex information accurately • make deductions and inferences and draw conclusions • construct substantial chains of reasoning, including convincing arguments and formal proofs • generate efficient strategies to solve complex mathematical and non-mathematical problems by translating them into a series of mathematical processes • make and use connections, which may not be immediately obvious, between different parts of mathematics • interpret results in the context of the given problem • critically evaluate methods, arguments, results and the assumptions made
7	**Decision making- Extensive ability to reason, interpret and communicate mathematically** Grade 7 Students should, for most topics, be able to:

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	• make deductions, inferences and draw conclusions from mathematical information • construct chains of reasoning to achieve a given result • interpret and communicate information accurately • present arguments and proofs • assess the validity of an argument and critically evaluate a given way of presenting information
6	**<u>Fluency - Extensive ability to use and apply standard techniques</u>** Grade 6 Students should, for Grade 5 maths, be able to: • accurately recall facts, terminology and definitions • use and interpret notation correctly • accurately carry out routine procedures or set tasks requiring multi-step solutions
5	**<u>Students should be able to demonstrate fluency in lower grade mathematics and a developing ability to decision make and solve problems</u>** To achieve grade 5, candidates will be able to: • perform routine single & multi-step procedures by recalling, applying & interpreting notation, terminology, facts, definitions & formulae • interpret and communicate information effectively • make deductions, inferences and draw conclusions • construct chains of reasoning, including arguments • generate strategies to solve mathematical & non-mathematical problems by translating them into mathematical processes, realising connections between different parts of mathematics • interpret results in the context of the given problem • evaluate methods and results
4	**Problem Solving- Increasing independence when solving problems within mathematics and in other contexts** Grade 4 Students should, for most Grade 3 content and some Grade 4 maths, be able to: • translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes • make and use connections between different parts of mathematics

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	• interpret results in the context of the given problem • evaluate methods used and results obtained • evaluate solutions to identify how they may have been affected by assumptions made
3	**Decision making- Increasing confidence to reason, interpret and communicate mathematically** Grade 3 Students should, for some Grade 3 topics and most lower Grade maths, be able to: • make deductions, inferences and draw conclusions from mathematical information • construct chains of reasoning to achieve a given result • interpret and communicate information accurately • present arguments and proofs • assess the validity of an argument and critically evaluate a given way of presenting information
2	**Fluency - Increasing ability to use and apply standard techniques** To achieve grade 2, candidates will be able to: • recall and use notation, terminology, facts and definitions; perform routine procedures, including some multi-step procedures • interpret and communicate basic information; make deductions and use reasoning to obtain results • solve problems by translating simple mathematical and non-mathematical problems into mathematical processes • provide basic evaluation of methods or results • interpret results in the context of the given problem •
1	**Students should be able to demonstrate fluency in functional mathematics and a developing ability to decision make and solve problems**

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Assessment Criteria 1 - Number

Grade	Numbers, Powers and Decimals	Fractions and Decimals
1-	▯ Read, write and order integers up to 4 digits ▯ Order, add and subtract positive and negative numbers (integers) in context. ▯ recognise odd and even numbers ▯ recall multiplications facts up to 10 x 10 and derive the corresponding division facts	▯ use fraction notation and the vocabulary numerator and denominator ▯ use unit fractions such as 1⁄2, 1⁄3, 1⁄4, 1⁄5, 1⁄10, … to describe parts of shapes ▯ Write fractions to describe shaded parts of diagrams ▯ recognise simple fractions that are several parts of a whole, such as 2⁄3 or 3⁄4 ▯ Use diagrams to find equivalent fractions or compare fractions
1 (G +)	▯ Partition and round whole numbers up to the nearest 1000 ▯ use the symbols <, > and understand the ≠ symbol ▯ use mental methods to: find remainders after division ▯ use efficient written methods to add and subtract whole numbers ▯ use efficient written methods to multiply & divide 2o r 3-digit numbers by a single-digit ▯ multiply and divide whole numbers by powers of ten ▯ begin to use the order of operations ▯ understand and use inverse operations ▯ Compare and order decimals with up to two places using the symbols < and >	▯ use decimal notation for tenths and hundredths including use of money ▯ recognise simple equivalent fractions ▯ express 1/2, 1/4, 3/4, and tenths and hundredths, as fractions and decimals. ▯ find simple equivalent fractions, decimals ▯ calculate simple fractions of numbers and quantities. ▯ use efficient written methods to add and subtract decimals ▯ interpret a calculator display in contexts such as money or measures. ▯ use decimal notation to record measurements (e.g. 1.25 m or 0.6 kg)
1+	▯ identify squares of numbers to 10 x 10 ▯ list the first 10 prime numbers ▯ recognise multiples and use simple tests of divisibility ▯ recognise multiples and factors, and identify factors of 2-digit numbers.	▯ begin to convert metric units of measurement to related units ▯ interpret with appropriate accuracy numbers on a range of measuring instruments ▯ express a quotient as a decimal or fraction ▯ calculate with simple fractions ▯ multiply decimals
	Numbers, Powers and Decimals	**Fractions and Decimals**
2-	▯ understand negative numbers as positions on a number line ▯ order, add and subtract positive and negative integers in context ▯ use the symbols <, > and understand the ≠ symbol in the context of integers & decimals ▯ round numbers to the nearest 10, 100 or 1000 & decimals to the nearest	▯ multiply and divide decimals with up to two places by single-digit whole numbers ▯ understand and use decimal notation and place value ▯ use the memory of a calculator and interpret the display in different contexts.

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	whole or 1 dp	
2(E-)	▯ multiply and divide 3-digit by 2-digit whole numbers ▯ use the order of operations, including brackets. ▯ use inverse operations in the context of integers ▯ consolidate recall of multiplication to 10 × 10 and quickly derive division facts ▯ multiply any integer or decimal by powers of ten ▯ understand and use decimal notation and place value ▯ compare and order decimals in different contexts ▯ use efficient written methods to: add and subtract whole numbers ▯ recognise square numbers to at least 12 ▯ 12, and corresponding roots, and use the square and square root keys of a calculator ▯ recognise and use multiples, factors, primes (less than 100), common factors, highest common factors and lowest common multiples in simple cases	▯ add and subtract simple fractions and those with common denominators ▯ Express a given number as a fraction of another, using very simple numbers, some cancelling, and where the fraction is both < 1 and > 1 ▯ Write a fraction in its simplest form and find equivalent fractions ▯ multiply a fraction by an integer ▯ calculate simple fractions of quantities and measurements. ▯ convert one metric unit to another (e.g. grams to kilograms) ▯ add and subtract whole numbers and decimals ▯ use mental methods to multiply and divide simple decimals by one-digit whole numbers, e.g. 0.8 × 6, 2.4 ÷ 3, using jottings as appropriate ▯ use fractions to describe parts of shapes
2+	▯ use simple tests of divisibility ▯ use the bracket, square, square root and sign change keys of a calculator. ▯ use the memory of a calculator and interpret the display in different contexts.	▯ use diagrams to compare two or more simple fractions ▯ simplify fractions by cancelling and identify equivalent fractions ▯ recognise equivalent fractions and decimals
	Numbers, Powers and Decimals	**Fractions and Decimals**
3-	▯ add, subtract, multiply and divide positive and negative integers ▯ round positive numbers to any given power of 10 & decimals to the nearest whole number of one or two decimal places ▯ use efficient written methods to :add and subtract integers of any size	▯ find equivalent fractions, and equivalent fractions and decimals ▯ add & subtract integers & decimals of any size, including numbers with differing numbers of decimal places ▯ add and subtract fractions by writing them with a common denominator
3(E +)	▯ multiply and divide 3-digit by 2-digit whole numbers ▯ use the order of operations, including brackets, with more complex calculations ▯ multiply and divide integers and decimals by 0.1 or 0.01, and derive products such as 6 × 0.7, 8 × 0.03 ▯ read and write positive integer powers of 10	▯ Convert between mixed numbers and improper fractions; ▯ Add fractions and write the answer as a mixed number ▯ Multiply and divide an integer by a fraction ▯ Order fractions, by using a common denominator ▯ Compare fractions, use inequality signs, compare unit fractions ▯ Add and subtract mixed number fractions

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	▯ use squares, positive and negative square roots, cubes and cube roots, and index notation for small positive integer powers ▯ use multiples, factors, common factors, highest common factor, lowest common multiple and primes	▯ calculate fractions of quantities ▯ use a calculator to carry out more difficult calculations, including fractions and using the memory ▯ Recall the fraction-to-decimal conversion ▯ multiply and divide integers and decimals ▯ use division to convert a fraction to a decimal and recognise that a recurring decimal is a fraction
3+	▯ find the prime factorisation of a number (e.g. 8000 = 2^6 x 5^3) ▯ use the function keys of a calculator for sign change, brackets, powers and roots, and interpret the display in context. ▯ use a calculator to carry out more difficult calculations, entering numbers, including fractions, using the memory, and interpreting the display in context	▯ order fractions by writing them with a common denominator or by converting them to decimals multiply and divide decimals, understanding where to position the decimal point by considering equivalent calculations ▯ multiply and divide fractions by integers ▯ Compare and order fractions, decimals and integers, using inequality signs
	Numbers, Powers and Decimals	**Fractions and Decimals**
4-	▯ use positive and negative numbers of any size, the laws of arithmetic and inverse operations ▯ understand the order of operations, including powers ▯ use rounding to make estimates and to give solutions to an appropriate degree of accuracy ▯ round decimals to any given number of decimal places or a given number of significant figures	▯ use efficient written methods to add and subtract decimals of any size, to multiply by decimals, and to divide by decimals by transforming to division by an integer ▯ Add and subtract mixed number fractions ▯ Multiply mixed number fractions ▯ Divide a fraction by a whole number ▯ Convert between fractions and decimals
4 **(D to C-)**	▯ understand the effects of multiplying or dividing by numbers between 0 and 1 ▯ understand and use equivalences between 0.1, 1⁄10 and 10–1, ▯multiply and divide by any integer power of 10 ▯ understand positive & negative square roots & recall cubes of 1, 2, 3, 4, 5 & 10 ▯ use index notation for integer powers ▯ know and use the index laws for multiplication and division of positive integer powers ▯ Use the power and root keys of a calculator ▯ use the prime factor decomposition of a number and write the product	▯ Find the reciprocal of an integer, decimal or fraction ▯ Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is 1 (and that zero has no reciprocal because division by zero is not defined) ▯ Multiply and divide a fraction by an integer, including finding fractions of quantities or measurements, and apply this by finding the size of each category from a pie chart using fractions ▯ Multiply fractions: simplify calculations by cancelling first ▯ Divide fractions by fractions ▯ Recognise recurring decimals and convert fractions such as , and into recurring decimals ▯ use a calculator efficiently and appropriately for complex calculations, knowing not to round during intermediate steps

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	using index notation Find the LCM and HCF of two numbers using Venn diagrams and prime factors Convert large & small numbers into standard form & vice versa	
4+	Add and subtract numbers in standard form Multiply and divide numbers in standard form Interpret a calculator display using standard form & know how to enter numbers in standard form	know that a recurring decimal is an exact fraction. use efficient written methods to add and subtract fractions, and to multiply or divide fractions, interpreting division as a multiplicative inverse, and cancelling common factors before multiplying
	Numbers, Powers and Decimals	**Fractions and Decimals**
5-	Use index notation for integer powers of 10, including negative powers; Recognise powers of 2, 3, 4, 5; Use the square, cube and power keys on a calculator and estimate powers and roots of any given positive number, by considering the values it must lie between	Add, subtract, multiply & divide decimals, whole numbers including any number between 0 & 1 Express a given number as a fraction of another; Find equivalent fractions and compare the size of fractions;
5 **(C+ to B-)**	Use index laws to simplify & calculate the value of numerical expressions involving multiplication & division of integer powers, fractional & negative powers, & powers of a power; 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 & roots Find prime factor decomposition of positive integers & write as a product using index notation Find common factors and common multiples of two numbers; 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;	Calculate the upper and lowers bounds of numbers given to varying degrees of accuracy; 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; 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. Write a fraction in its simplest form, including using it to simplify a calculation Find a fraction of a quantity or measurement, including within a context; Convert between mixed numbers and improper fractions;
5+	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; Convert large and small numbers into standard form and vice versa;	Add and subtract fractions, including mixed numbers; Multiply and divide fractions, including mixed numbers and whole numbers and vice versa; Understand and use unit fractions as multiplicative inverses;

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	▯ Add, subtract, multiply and divide numbers in standard form; ▯ Interpret a calculator display using standard form & know how to enter numbers in standard form	
	Powers, Decimals, Indices and Surds	**Fractions and Decimals**
6-	▯ Recall that $n^0 = 1$ and $n^{-1} = 1/n$ for positive integers n as well as, $= \sqrt{n}$ and $= 3*\sqrt{n}$ for any positive number	▯ Calculate the upper and lower bounds of an expression involving the four operations;
6 (B)	▯ Understand that the inverse operation of raising a positive number to a power *n* is raising the result of this operation to the power ▯ Solve problems using HCF and LCM, and prime numbers; ▯ Understand surd notation	▯ Find the upper and lower bounds in real-life situations using measurements given to appropriate degrees of accuracy;
6+	▯ Simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$).	▯ Use inequality notation to specify an error bound.
	Powers, Decimals, Indices and Surds	**Fractions and Decimals**
7-	▯ Solve problems using index laws;	
7(A)	▯ Find the value of calculations using indices including positive, fractional and negative indices;	▯ Find the upper and lower bounds of calculations involving perimeters, areas and volumes of 2D and 3D shapes;
7+		
	Powers, Decimals, Indices and Surds	**Fractions and Decimals**
8 (A*)	▯ understand and use rational and irrational numbers	
9(A)**	▯ use surds and Pi in exact calculations, without a calculator, and rationalise a denominator	

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Assessment Criteria 2 – Ratio & Proportion

Grade	Ratio & Proportion	Compound Measures	Percentages
1-	▯ recognise proportions of a whole and use simple fractions and percentages to describe these	▯ read values in km/h and mph from a speedometer	▯ recognise proportions of a whole and use simple fractions and percentages to describe these
1 (G +)	▯ find equivalent fractions, decimals and percentages ▯ calculate simple fractions & percentages of quantities ▯solve simple problems involving ideas of direct proportion by scaling numbers up or down.	▯ calculate average speed, distance, time – in miles per hour as well as metric measures	▯ understand percentage as 'the number of parts in every 100', and find simple equivalent fractions, decimals and percentages ▯ calculate simple fractions & percentages of quantities. ▯ Understand that a percentage is a fraction in hundredths
1+	▯ Write ratios in their simplest form ▯ Write a ratio as a fraction	▯ Convert between currencies	
Grade	**Ratio & Proportion**	**Compound Measures**	**Percentages**
2-	▯ Understand and express the division of a quantity into a ratio ▯ Work out which product is the better buy		▯ use fractions and percentages to describe parts of shapes
2(E-)	▯ calculate simple fractions and percentages of quantities ▯ Solve proportion problems using the unitary method ▯ simplify ratios & divide a quantity into 2 parts in a given ratio ▯ solve simple problems involving ratio and direct proportion using informal strategies.	▯ Understand and use compound measures ▯ Density ▯ Pressure ▯ Speed	▯ calculate simple fractions and percentage of quantities ▯ Find a percentage of a quantity without a calculator: 50%, 25% and multiples of 10% and 5% ▯ Find a percentage of a quantity or measurement (use measurements they should know from Key Stage 3 only)
2+	▯ Compare ratios ▯ Express a multiplicative relationship between two quantities as a ratio or a fraction		
Grade	**Ratio & Proportion**	**Compound Measures**	**Percentages**
3-	▯ Solve word problems involving direct proportion	▯ convert between metric speed measures	▯ express one given number as a percentage of another

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	▯ simplify ratios, including ratios in different units, recognising links with fraction notation	▯ Express a given number as a percentage of another number in more complex situations	▯ calculate percentages & find the outcome of a given percentage increase or decrease
3(E +)	▯divide a quantity into two or more parts in a given ratio ▯Recognise when values are in direct proportion using a graph ▯use equivalent fraction, decimals & % to compare proportions ▯Write ratios in form 1 : m or m : 1 ▯Share a quantity in a given ratio including three-part ratios ▯use a ratio to find one quantity when the other is known	▯ Calculate percentage profit or loss ▯ Make calculations involving repeated percentage change, not using the formula ▯ Use a variety of measures in ratio and proportion problems: ▯ currency conversion; ▯ rates of pay;	▯ Calculate amount of increase/decrease ▯ Convert between fractions, decimals and percentages ▯ Use percentages to solve problems, including comparisons of two quantities using percentages ▯ Percentages over 100% ▯ Find a percentage of a quantity, including using a multiplier
3+	▯use a ratio to compare a scale model to a real-life object ▯use a ratio to convert between measures		
Grade	**Ratio & Proportion**	**Compound Measures**	**Percentages**
4-	▯ recognise when fractions or percentages are needed to compare proportions ▯ use proportional reasoning to solve problems, choosing the correct numbers to take as 100%, or as a whole	▯ use kinematics formulae from the formulae sheet to calculate speed, acceleration (with variables defined in the question)	▯ Use percentages in real-life situations, including percentages greater than 100%
4 (D to C-)	▯ compare two ratios & calculate ratios in a range of contexts. ▯ Write a ratio as a linear function ▯ Write lengths, areas and volumes of two shapes as ratios in simplest form ▯ Write ratios in form 1 : m or m : 1 ▯ Solve word problems involving direct and indirect proportion	▯ change d/t in m/s to a formula in km/h, i.e. d/t × (60 × 60)/1000 – with support ▯ Find the original amount given the final amount after a percentage increase or decrease ▯ Use compound interest ▯ Set up & interpret the answers in growth & decay problems	▯ Price after VAT (not price before VAT) ▯ Simple interest ▯ Income tax calculations ▯ Use decimals to find quantities ▯ Use a multiplier to increase or decrease by a percentage in any scenario where percentages are used
4+	▯ Understand inverse proportion: as x increases, y	▯ Understand that X is inversely proportional to Y is	▯ Understand the multiplicative nature of percentages as

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	decreases (inverse graphs done in later unit) ▯ Understand direct proportion ---> relationship y = kx	equivalent to X is proportional to ▯ Interpret equations that describe direct and inverse proportion	operators
Grade	**Ratio & Proportion & Rates of Change**	**Compound Measures**	**Percentages**
5-	▯ Express the division of a quantity into a number parts as a ratio ▯ Write ratios in their simplest form, including three-part ratios	▯ Understand and use compound measures:	▯ Convert between fractions, decimals and percentages; ▯ Express one quantity as a percentage of another where the percentage is greater than 100% ▯ Find a percentage of a quantity;
5 **(C+ to B-)**	▯ Write a ratio as a fraction and as a linear function; ▯ Identify direct proportion from a table of values, by comparing ratios of values; ▯ Use a ratio to compare a scale model to real-life object; ▯ Work out best value of products & consider rates of pay; ▯ Calculate an unknown quantity from quantities that vary in direct or inverse proportion; ▯ 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.	▯ convert between metric speed measures; ▯ convert between density measures; ▯ convert between pressure measures; ▯ Use a ratio to convert between measures and currencies, e.g. £1.00 = €1.36;	▯ 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, including a range of calculations and contexts ▯ Find a percentage of a quantity using a multiplier and use a multiplier to increase or decrease by a percentage ▯ Find the original amount given the final amount after a percentage increase or decrease (reverse percentages) ▯ Use percentages in real-life situations, including percentages greater than 100%; ▯ Work out the multiplier for repeated proportional change as a single decimal number;
5+	▯ Recognise & interpret graphs showing direct & indirect proportion ▯ Estimate lengths using a scale diagram;	▯ Use and interpret maps and scale drawings, using a variety of scales and units; ▯ Read and construct scale drawings, drawing lines and shapes to scale;	▯ Represent repeated proportional change using a multiplier raised to a power, use this to solve problems involving compound interest and depreciation;
Grade	**Ratio, Proportion & Rates of Change**	**Compound Measures**	**Percentages**

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6-	Use $y = kx$ to solve direct proportion problems, including questions where students find k, and then use k to find another value;		Understand that fractions are more accurate than rounded percentage or decimal equivalents, & choose fractions, decimals or percentages appropriately for calculations.
6 (B)	Set up and use equations to solve word and other problems involving direct proportion; Identify direct proportion from a table, by comparing ratios of values, for x squared & x cubed relationships; Recognise when values are in direct proportion by reference to the graph form, & use a graph to find the value of k in $y=kx$;	Use kinematics formulae from the formulae sheet to calculate speed, acceleration, etc (with variables defined in the question);	Describe percentage increase/decrease with fractions, e.g. 150% increase means times as big; 1 22
6+	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; 35 74b		Use calculators for reverse percentage calculations by doing an appropriate division;
Grade	**Ratio, Proportion & Rates of Change**	**Compound Measures**	**Percentages**
7-	Write statements of proportionality for quantities proportional to the square, cube or other power of another quantity;		
7(A)	Solve problems involving inverse proportion using graphs by plotting and reading values from graphs; Solve problems involving inverse proportionality; Set up and use equations to solve word and other problems involving direct proportion or inverse proportion.		
7+	Understand the effect of enlargement on angles, perimeter, area and volume of shapes and solids; Recognise, sketch and interpret graphs of exponential functions $y = kx$ for positive values of k and integer		

	values of *x*;		
Grade	**Ratio, Proportion & Rates of Change**	**Compound Measures**	**Percentages**
8	⍰ Use calculators to explore exponential growth and decay;		
9	⍰ Set up, solve and interpret the answers in growth and decay problems		

Assessment Criteria 3 - Algebra

Grade	Expressions, Equations & Formulae	Sequences	Inequalities
1-	♣ Begin to use letters and symbols to represent numbers ♣ Write simple expressions	♣ recognise, describe and extend simple number sequences	
1 (G +)	♣ simplify simple linear expressions by collecting like terms ♣ use simple formulae expressed in words & then symbols ♣ substitute numbers into word formulae	♣ recognise sequences of odd & even numbers and other sequences including Fibonacci ♣ use function machines to find terms of a sequence	♣ Show inequalities on number lines;

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		♣ write term-to-term definition of a sequence in words	
1+	♣ substitute positive values into simple linear expressions ♣ solve simple linear equations using an appropriate method.	♣ Recognise such sequences from diagrams and draw the next term in a pattern sequence	♣ Write down whole number values that satisfy an inequality
Grade	**Expressions, Equations & Formulae**	**Sequences**	**Inequalities**
2-	♣ use notation and symbols correctly ♣ write an expression ♣ understand the difference in expression, equation & formula	♣describe integer sequences using the term to term rule ♣ find a term in a sequence using the term to term rule	
2(E-)	♣ simplify linear algebraic expressions by collecting like terms ♣ multiply together simple expressions ♣ multiply a constant over a bracket ♣ substitute positive integers into linear expressions	♣ generate the terms of a simple sequence ♣ generate sequences from patterns or practical contexts and describe the general term in simple cases.	♣ Show inequalities on number lines; ♣ Write down whole number values that satisfy an inequality
2+	♣ use simple formulae from mathematics and other subjects. ♣ derive a formula ♣ construct and solve simple linear equations with integer coefficients (unknown on one side only)	♣ represent simple functions using words, symbols & mappings ♣ recognise the first few triangular, square and cube numbers ♣ find the nth term of a pattern sequence	
Grade	**Expressions, Equations & Formulae**	**Sequences**	**Inequalities**
3-	♣ select an expression, equation, formula or identity from a list ♣ use index laws in algebra	♣ generate terms of a linear sequence using term-to-term and position-to term rules	
3(E +)	♣ simplify expressions involving brackets ♣ recognise factors of algebraic terms involving single brackets ♣ construct and solve linear equations with integer coefficients (unknown on one or both sides, without and with brackets	♣ find the nth term of arithmetic and linear sequences ♣ find a specific term in the sequence using the nth term ♣ use linear expressions to describe the nth term of a simple arithmetic sequence, justifying its form by referring to the context from which it was generated.	♣Solve an inequality such as $-3 < 2x + 1 < 7$ and show solution on a number line ♣Use correct notation to show inclusive & exclusive inequalities ♣ Construct inequalities to represent a set shown on a number line;

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	♣ substitute positive and negative numbers into expressions ♣ derive & substitute integers into simple formulae & expressions, including examples that lead to equations to solve		
3+	♣ Rearrange simple equations ♣ Solve angle or perimeter problems using algebra	♣ Use the nth term to decide if a given number is a term in the sequence	♣ Solve two inequalities in x, find the solution sets and compare them to see which value of x satisfies both;
Grade	**Expressions, Equations & Formulae**	**Sequences**	**Inequalities**
4-	♣ represent & interpret problems in algebraic or graphical form ♣ use index laws in algebra	♣ generate terms of a sequence using term-to-term and position-to-term rules	♣ Use the correct notation to show inclusive and exclusive inequalities;
4 (D to C-)	♣ argue mathematically to show expressions are equivalent ♣ factorise algebraic expressions by taking out single-term common factors ♣ construct and solve linear equations with integer coefficients (including brackets & negative signs in the equation) ♣ Solve linear equations in one unknown, with integer or fractional coefficients; ♣ Solve angle or perimeter problems using algebra	♣ generate sequences from practical contexts and write and justify an expression for 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 over a certain number ♣ Use the nth term of an arithmetic sequence to find the first term greater/less than a certain number	♣ Construct inequalities to represent a set shown on a number line; ♣ Solve simple linear inequalities in one variable, and represent the solution set on a number line; ♣ Round answers to a given degree of accuracy
4+	♣ find the inverse of a linear function ♣ use algebraic methods to solve problems involving direct proportion, relating solutions to graphs of the equations, using ICT as appropriate	♣ Continue a geometric progression and find the term-to-term rule, including negatives, fraction and decimal terms; ♣ Continue a quadratic sequence and use the nth term to generate terms	
Grade	**Functions & Graphs**	**Other Graphs**	**Quadratic & Simultaneous Eqns**
5-	•Identify and plot points in all four quadrants;	• Generate points and plot graphs of simple quadratic	• Find approximate solutions to quadratic equations

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	• Draw & interpret straight-line graphs for real-life situations, inc conversion graphs, fuel bills, fixed charge & cost per item	functions, then more general quadratic functions;	using a graph;
5 (C+ to B-)	• Draw distance–time and velocity– time graphs; • Find the coordinates of the midpoint of a line segment with a diagram given or coordinates; • Find the equation of the line through two given points. • Plot and draw graphs of y = a, x = a, y = x and y = –x, drawing and recognising lines parallel to axes, • Recognise that equations of the form y = mx + c correspond to straight-line graphs in the coordinate plane; • Identify and interpret the gradient and y-intercept of a linear graph given by equations of the form y = mx + c; • 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;	• 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;	• solve quadratic equations of the form x 2 + b x + c = 0 by factorisation. • Find the exact solutions of two simultaneous equations in two unknowns; • Use elimination or substitution to solve simultaneous equations;
5+	• Find the equation of the line through one point with a given gradient; • find approximate solutions to a linear equation from a graph; • identify direct proportion from a graph;	• Draw graphs of the reciprocal function with x ≠ 0 using tables of values; • Recognise a linear, quadratic, cubic, reciprocal and circle graph from its shape;	• Solve simultaneous equations graphically:
Grade	**Functions & Graphs**	**Other Graphs**	**Quadratic & Simultaneous Equations**
6-	• Calculate the length of a line segment given the coordinates	• Interpret the rate of change of graphs of containers filling and emptying;	• Factorise quadratic expression in the form ax^2 + bx + c;
6 (B)	• Identify and interpret gradient from an equation ax + by = c; • Find the equation of a line from a graph in the form ax + by=c	• Interpret graphs of quadratic functions from real-life problems; • Interpret the rate of change of unit price in price graphs.	•Solve quadratic inequalities in one variable, by factorising and sketching the graph to find critical values;

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	• Plot and draw graphs of straight lines in the form ax + by = c; • use gradients to interpret how one variable changes in relation to another;		• Set up and solve quadratic equations; • Solve quadratic equations by factorisation & completing the square
6+	• 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 -1/m	• Interpret the gradient of a linear or non-linear graph in financial contexts;	• Solve quadratic equations by using the quadratic formula; • solve simultaneous equations representing a real -life situation graphically, and interpret the solution in the context of the problem;
Grade	**Functions & Graphs**	**Other Graphs**	**Quadratic & Simultaneous Eqns**
7-	• find the equation of a line of best fit (scatter graphs) to model the relationship between quantities; • Explore the gradients of parallel lines and lines perpendicular	•Draw circles, centre the origin, equation x^2 + y ^2 = r ^2 .	• solve quadratic equations & inequalities by factorisation, completing the square & using the quadratic formula
7(A)	• Interpret and analyse a straight-line graph and generate equations of lines parallel and perpendicular to the given line; • Use graphs to calculate various measures, including: unit price (gradient), average speed, distance, time, acceleration; including using enclosed areas by counting squares or using areas of trapezia, rectangles and triangles;	•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) for linear, quadratic, cubic functions;	• Use iteration with simple converging sequences. • Solve quadratic equations that need rearranging; Solve exactly, by elimination of an unknown, two simultaneous equations in two unknowns: linear / linear, including where both need multiplying; linear / quadratic; linear / x 2 + y 2 = r2 ;
7+	• 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 and use f –1 (x) • For two functions f(x) and g(x), find gf(x)	• apply to the graph of y = f(x) the transformations y = f(x) + a, y = f(x + a) for linear, quadratic, cubic functions;	• find graphically the intersection points of a given straight line with a circle;
Grade	**Functions & Graphs**	**Other Graphs**	**Quadratic & Simultaneous Eqns**
8 (A*)	• 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;	• Estimate area under a graph by dividing it into trapezia; • Interpret the gradient of linear or non-linear graphs, and estimate the gradient at a given point by sketching the tangent • Interpret the gradient of non-linear graph in curved distance–time and velocity–time graphs:	• 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;

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9(A)**	• using the given point; Recognise and construct the graph of a circle using x^2 + y^2 = r^2 for radius r centred at the origin of coordinates.	• for a non-linear velocity–time graph, estimate the acceleration at one point in time, from the tangent, & the average acceleration over several seconds by finding the gradient of the chord; • Interpret the area under any graph in real-life contexts;	• consider cases of simultaneous linear equations that have no solution or an infinite number of solutions.

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Assessment Criteria 4 – Geometry

Grade	Angles and Construction	Transformations and vectors	Properties of 2D & 3D shapes	Length, Perimeter, Area & Volume	Geometric Reasoning
1-	▯ estimate and measure length ▯ measure & draw lines to nearest mmm ▯ describe angles as turns & use degrees	▯ Understand clockwise & anticlockwise ▯recognise shapes with no symmetry. ▯identify lines of symmetry in 2Dshape	▯ identify lines of symmetry in 2D shapes ▯ Know the terms face, edge & vertex ▯ Identify parallel lines	▯ Indicate given values on a scale, including decimal value	
1 (G +)	▯ interpret with appropriate accuracy numbers on a range of measuring instruments ▯ Know degrees in a full, half and quarter turn ▯ Mark perpendicular lines on a diagram and use their properties ▯ Identify parallel lines ▯ estimate, measure & draw acute & obtuse angles ▯ find angles on a straight line or a point	▯visualise and draw where a shape will be after reflection in a mirror line ▯Understand that reflections are specified by a mirror line ▯Identify correct reflections from a choice of diagrams ▯make and describe turns	▯ Identify a line perpendicular to a given line ▯ identify, visualise and describe properties of rectangles, triangles, regular polygons and 3D solids, ▯ List the properties of each special type of quadrilateral, ▯ Draw sketches of shapes ▯ Identify and name common solids:	▯ Know that measurements using real numbers depend upon the choice of unit ▯ Convert between units of measure within one system ▯ measure and calculate the perimeter of rectangles and triangles ▯ estimate areas by counting squares	
1+	▯ Draw circles & arcs to a given radius or diameter ▯ Draw sketches of shapes ▯ Know and use compass directions	▯Draw the position of a shape after rotation about a centre ▯Identify correct rotations from a choice of diagrams	▯ visualise and make 3D mathematical models by linking faces or edges ▯ identify and draw nets of simple 3D shapes	▯ derive and use the formula for the area of a rectangle ▯ Recall the definition of a circle	
Grade	**Angles and Construction**	**Transformations and Vectors**	**Properties of 2D and 3D shapes**	**Length, Perimeter, Area & Volume**	**Geometrical Reasoning**
2-	▯ draw accurate diagrams ▯ use correctly the vocabulary, notation & labelling conventions	▯ recognise and visualise the symmetries of a 2D shape ▯Transform 2D shapes using single	▯ Recall the properties and definitions of special types of quadrilaterals	▯ Convert metric units to metric units ▯ Make sensible estimates of a range of measures in everyday settings	

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	for lines, angles & shapes	reflections with vertical, horizontal and diagonal mirror lines	visualise 3D shapes and deduce some of their properties		
2(E-)	estimate & measure acute, obtuse & reflex angles know and calculate the sum of angles at a point, on a straight line & vertically opposite angles Distinguish between scalene, equilateral, isosceles and right-angled triangles	Understand that rotations are specified by a centre, an angle and a direction of rotation Rotate a shape about the origin or any other point on a coordinate grid Understand that translations are specified by a distance and direction using a vector Translate a given shape by a vector	Mark perpendicular lines on a diagram and use their properties use coordinates in the first quadrant to draw, locate and complete shapes with given properties Mark parallel lines on a diagram and use their properties Name all quadrilaterals that have a specific property	Find the perimeter of parallelograms and trapezia Recall and use the formulae for the area of a triangle and rectangle Find the area of a rectangle and triangle calculate perimeters and areas of shapes made from rectangles visualise 3D shapes and deduce some of their properties	
2+	construct a triangle given two sides & the included angle (SAS) or two angles and the included side (ASA) draw simple nets of 3D shapes Understand & draw plans and elevations of 3D shapes	Describe reflections on a coordinate grid Describe and transform 2D shapes using single translations on a coordinate grid	Classify quadrilaterals by their geometric properties Distinguish between scalene, equilateral, isosceles and right-angled triangles	calculate the surface areas of cubes and cuboids Identify, name and draw parts of a circle including tangent, chord and segment	
Grade	**Angles, Bearings and Construction**	**Transformation and Vectors**	**Properties of 2D and 3D shapes**	**Length, Perimeter, Area and Volume**	**Geometrical Reasoning**
3-	identify alternate & corresponding angles Use properties of angles at a point, on a straight line & vertically opposite	Scale a shape on a grid (without a centre specified)	Recognise and name pentagons, hexagons, heptagons, octagons and decagons	Find the area of a parallelogram Calculate areas and perimeters of compound shapes made from triangles and rectangles	Identify shapes which are similar; including all circles or all regular polygons with equal number of sides
3(E +)	understand a proof the angle sum of a triangle is 180° & quadrilateral is 360° Understand and use the angle	Identify the equation of a line of symmetry Find the centre of rotation, angle and direction of rotation	classify quadrilaterals by their geometrical properties identify all the symmetries of 2D shapes	derive and use formulae for the area of a triangle, parallelogram and trapezium and the volume of a cuboid	solve geometrical problems using side and angle properties of triangles and special

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	properties of triangles, including isosceles and equilateral triangles ▯ the exterior angle of a triangle is equal to the sum of 2 interior opposite angles. ▯ use compasses to construct line and angle bisectors ▯ use compasses to construct a triangle, given the lengths of the three sides (SSS)	▯transform 2D shapes by rotation, reflection and translation ▯enlarge 2D shapes given a centre of enlargement. ▯Use column vectors to describe translations	▯ Understand 'regular' and 'irregular' as applied to polygons ▯ Identify shapes which are congruent (by eye)	▯ calculate areas of compound shapes and volumes and surface areas of cuboids and shapes made from cuboids ▯Find the area of a trapezium and recall the formula ▯Find surface area using rectangles and triangles	quadrilaterals, explaining reasoning with diagrams and text ▯ Use the basic congruence criteria for triangles (SSS, SAS, ASA and RHS)
3+	▯ Draw and construct diagrams from given instructions, (LOCI) ▯ Mark on a diagram the position of point B given its bearing from point A	▯Describe a rotation fully using the angle, direction of turn, and centre ▯Describe & transform enlargements by a positive integer scale factor		▯Recall and use formulae for the circumference & area enclosed by a circle C = 2πr = πd, A = πr^2	
Grade	**Angles, Bearings and Construction**	**Transformation and Vectors**	**Pythagoras & Trigonometry**	**Length, Perimeter, Area & Volume**	**Geometrical Reasoning**
4-	▯ Use the fact that angle sum of a quadrilateral is 360° ▯ Understand and use the angle properties of parallel lines ▯ find & use the sum of interior & exterior angles of regular polygons	▯ identify reflection symmetry in 3D shapes ▯use a coordinate grid to solve problems involving translations, rotations, reflections & enlargements	▯ Understand, recall and use Pythagoras' Theorem in 2D, including leaving answers in surd form ▯ Given 3 sides of a triangle, justify if it is right-angled or not	▯ know and use the formulae for the circumference and area of a circle ▯ Find the volume of a cylinder ▯ Find the volume of a prism, including a triangular prism, cube and cuboid	▯ represent problems in geometric form, making accurate mathematical diagrams on paper and on screen
4 **(D to C-)**	▯ Use the sum of the interior angles of an n-sided polygon; Use the sum of the exterior angles of any polygon is 360°; ▯ use compasses to construct the perpendicular from a point to a line, the perpendicular to a line from a point on the line -triangles, given right angle, hypotenuse &	▯ recognise that translations, rotations and reflections preserve length and angle, & map onto congruent images ▯ compare combinations of translations, reflections & rotations ▯enlarge 2D shapes, given a centre of enlargement & a positive scale factor ▯Find the centre of enlargement	▯ Calculate the length of the hypotenuse in a right-angled triangle ▯ Find the length of a shorter side in a right-angled triangle ▯ Apply Pythagoras' Theorem with a triangle drawn on a coordinate grid ▯ Understand, use and recall the trigonometric ratios sine, cosine and tan, and apply them to find angles	▯ Give an answer involving the a circle in terms of π ▯ Find radius or diameter, given area or perimeter of a circles ▯ Calculate perimeters & areas of composite shapes made from circles ▯ Calculate arc lengths, angles and areas of sectors of circles ▯ Find the surface area of a cylinder	▯ Solve angle problems involving congruence ▯ Understand similarity of triangles and of other plane shapes, use this to make geometric inferences, and solve angle problems using similarity ▯ Identify the scale factor

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	side (RHS) Use accurate drawing to solve bearings problems Give a bearing between the points on a map or scaled plan	Understand that similar shapes are enlargements & angles are preserved Describe & transform 2D shapes using combined transformations	and lengths in general triangles in 2D figures	Find the surface area and volume of prims, spheres, pyramids, cones and composite solids	of an enlargement of a shape as the ratio of the lengths of two corresponding sides Solve problems to find missing lengths in similar shapes
4+	Solve locus problems including bearings. Find and describe regions satisfying a combination of loci Use constructions to solve loci problems (2D only)	Identify two column vectors which are parallel Calculate using column vectors, and represent graphically, the sum of two vectors, the difference of two vectors and a scalar multiple of a vector	Use the trigonometric ratios to solve 2D problems Find angles of elevation & depression Know exact values of sinθ & cosθ for θ = 0°, 30°, 45°, 60° & 90°; know exact value of tan θ for θ = 0°, 30°, 45° & 60°.	Convert between metric area measures Convert between metric volume measures Convert between metric measures of volume and capacity e.g. 1ml = 1cm3	
Grade	**Angles, Loci and Trigonometry**	**Transformation and Vectors**	**Pythagoras and Trigonometry**	**Length, Perimeter, Area & Volume**	**Geometrical Reasoning**
5-	Classify quadrilaterals by their geometric properties & between scalene, isosceles & equilateral triangles; Understand 'regular' & 'irregular' as applied to polygons; Understand the proof that the angle sum of a triangle is 180°;	Distinguish properties that are preserved under particular transformations (invariant points) Recognise and describe rotations Rotate 2D shapes using the origin or any other point	Understand, recall and use Pythagoras' Theorem in 2D; Calculate the length of the hypotenuse in a right-angled triangle (including decimal lengths and a range of units);	convert & calculate using metric &, where appropriate, imperial measures Find the volume and surface area of a cylinder; Draw 3D shapes using isometric grids;	Understand & use SSS, SAS, ASA & RHS conditions to prove the congruence of triangles using formal arguments Understand similarity of triangles and of other plane shapes, and use this to make geometric inferences;
5 (C+ to B-)	Understand and use the angle properties of parallel lines and find missing angles using the properties of corresponding and alternate	Recognise and describe reflections on a coordinate grid eg $x = a$, $y = a$, $y = x$, $y = -x$ & lines not parallel to axes; Reflect 2D shapes using specified	Find the length of a shorter side in a right-angled triangle; Calculate the length of a line segment AB given pairs of points;	solve problems involving surface areas and volumes of cylinders, spheres, cones and composite solids. solve problems involving lengths of	Prove that two shapes are similar by showing that all corresponding angles are equal in size and/or

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	angles, giving reasons; 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°; 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; Understand, draw & measure bearings Calculate bearings and solve bearings problems, including on scaled maps, and find/mark and measure bearings construct angles of 90°, 45°;	mirror lines including lines parallel to the axes and also $y = x$ and $y = -x$; Translate a given shape by a vector; Understand the effect of one translation followed by another, in terms of column vectors (to introduce vectors in a concrete way); Know that an enlargement on a grid is specified by a centre and a scale factor (include fractional) Identify the scale factor of an enlargement of a shape; Describe and transform 2D shapes using combined rotations, reflections, translations, or enlargements;	Give an answer to the use of Pythagoras' Theorem in surd form; Use the trigonometric ratios to solve 2D problems; Know the exact values of sin ϑ and cos ϑ for $\vartheta = 0°, 30°, 45°, 60°$ and 90°; know the exact value of tan ϑ for $\vartheta = 0°, 30°, 45°$ and 60°.	circular arcs and areas of sectors Use the formulae for volume and surface area of spheres and cones; Calculate arc lengths, angles and areas of sectors of circles; Find the area & perimeter of 2d shapes using a variety of metric measures; Calculate the perimeter of compound shapes made from triangles and rectangles; Recall the definition of a circle and name and draw parts of a circle; Find radius or diameter, given area or circumference of circles in a variety of metric measures;	lengths of sides are in the same ratio/one is an enlargement of the other, giving the scale factor; 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; Find missing lengths, areas and volumes in similar 3D solids; Use the relationship between enlargement and areas and volumes of simple shapes and solids;
5+	• Construct a region bounded by a circle and an intersecting line; • Construct a given distance from a point and a given distance from a line; • Construct equal distances from two points or two line segments;	Understand that 2**a** 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	Know the exact values of sin ϑ and cos ϑ for $\vartheta = 0°, 30°, 45°$, 60° and 90° and exact value of tan ϑ for $\vartheta = 0°, 30°, 45°$ and 60° and find them from graphs.	Convert between metric measures of volume and capacity, e.g. 1 ml = 1 cm3; Estimating surface area, perimeter and volume by rounding measurements to 1 significant figure to check reasonableness of answers;	

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		column vectors (including algebraic terms).			
Grade	**Angles, Loci and Trigonometry**	**Transformation and Vectors**	**Pythagoras and Trigonometry**	**Length, Perimeter, Area & Volume**	**Geometrical Reasoning**
6-	Calculate the angles of regular polygons and use these to solve problems;	Describe the changes and invariance achieved by combinations of rotations, reflections and translations	understand and use trigonometric relationships in right-angled triangles, and use these to solve problems, including those involving bearings	Recall and use the formula for volume of pyramid; Find the surface area of a pyramid;	Find areas after enlargement and compare with before enlargement, to deduce multiplicative relationship (area scale factor);
6 (B)	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; Use angle facts to demonstrate how shapes would 'fit together', & work out interior angles of shapes in a pattern.	Describe and transform 2D shapes using enlargements by a integer, fractional, & negative scale factor; Understand and use vector notation, including column notation, and understand and interpret vectors as displacement in the plane Find the length of a vector using Pythagoras' Theorem.	Understand the language of planes, and recognise the diagonals of a cuboid. Find angles of elevation and depression;	Find the surface area and volumes of compound solids constructed from cubes, cuboids, cones, pyramids, spheres, hemispheres, cylinders; Give answers in terms of π;	Know the relationships between linear, area and volume scale factors of mathematically similar shapes and solids; Understand the effect of enlargement on angles, perimeter, area and volume of shapes and solids;
6+	Use constructions to solve loci problems including with bearings; Know that the perpendicular distance from a point to a line is the shortest distance to the line	Calculate the resultant of 2 vectors. Solve geometric problems in 2D where vectors are divided in a given ratio	Use & recall the trig ratios sin, cos & tan, & apply them to find angles & lengths in general triangles in 2D Given three sides of a triangle, justify if it is right-angled or not;	Calculate perimeters and areas of shapes made from circles and parts of circles (incl semi, quarter-circles, combinations of these & also incorporating other polygons);	Use congruence to show that translations, rotations & reflections preserve length & angle, so that any figure is congruent to its image Solve problem by proving congruence

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Grade	Angles, Loci and Trigonometry	Transformation and Vectors	Pythagoras and Trigonometry	Length, Perimeter, Area & Volume	Geometrical Reasoning
7-			Solve geometrical problems on coordinate axes.		Solve problems involving frustums of cones where you have to find missing lengths first using similar triangles. Use formal geometric proof for the similarity of two given triangles;
7(A)	Find and describe regions satisfying a combination of loci, including in 3D;	Produce geometrical proofs to prove points are collinear and vectors/lines are parallel.	Understand, recall and use trigonometry & Pythagoras' Theorem in right-angled triangles, & use these to solve problems in 3D configurations. Calculate the length of a diagonal of a cuboid. Find the angle between a line & a plane. 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).	Form equations involving more complex shapes and solve these equations. Solve problems involving more complex shapes and solids, including segments of circles and frustums of cones;	Prove and use the facts tha the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference; angle in a semicircle is right angle; the perpendicular from the centre of a circle to a chord bisects the chord; angles in same segment are equal; alternate segment theorem; opposite angles of a cyclic quadrilateral sum to 180°; Understand & use the fact the tangent at any point on a circle is perpendicular to radius at that point
7+			Use the sin & cos rules to solve 3D problems.		Find & give reasons for missing angles on diagrams

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			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.		using circle theorems; isosceles triangles angle amid tangent & radius is 90° the fact that tangents from an external point are equal in length
Grade	**Angles, Loci and Trigonometry**	**Transformation and Vectors**	**Pythagoras and Trigonometry**	**Length, Perimeter, Area Volume**	**Geometrical Reasoning**
8 (A*)	Select and apply construction techniques and understanding of loci to draw graphs based on circles and perpendiculars of lines;		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 $f(x)$.		
9(A)**					

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Assessment Criteria 5a – Data

Grade	Presenting Data	Averages
1-	♣ represent data in: -tally charts -pictograms (symbol representing 1 or 2 units)	
1 (G +)	♣ represent data in Venn and Carroll diagrams, pictograms, bar charts and simple line graphs ♣ collect discrete data and record them using a frequency table, where appropriate using equal class intervals ♣ Plot coordinates in first quadrant and read graph scales in multiples ♣ Calculate total population from a bar chart or table	♣ use the mode and range to describe sets of data
1+	♣ construct simple pie charts ♣ Find greatest and least values from a bar chart or table	
Grade	**Presenting Data**	**Averages**
2-	♣ construct frequency tables for gathering discrete data, grouped where appropriate in equal class intervals	
2(E-)	♣ construct graphs and diagrams to represent data, including: -bar-line graphs -frequency diagrams for grouped discrete data ♣ construct, on paper and using ICT, graphs and diagrams to represent data, including: -composite bar charts -dual/comparative bar charts for categorical and ungrouped discrete data -vertical line charts -line graphs -frequency diagrams for grouped discrete data -simple pie charts.	♣ find the mode, mean, median and range for a set of discrete data, and the modal class for grouped discrete data
2+	♣ construct bar-line graphs and frequency diagrams for grouped discrete data, on paper & using ICT ♣ Interpret simple pie charts using simple fractions and percentages;	
Grade	**Presenting Data**	**Averages**

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3-	♣ plan, construct and use two-way tables for recording discrete data	♣ mode and range from a bar chart;
3(E +)	♣ construct: -bar charts and frequency diagrams for grouped discrete data -pie charts for categorical data -simple scatter diagrams ♣ construct stem-and-leaf diagrams plan, construct and use frequency tables with equal class intervals for gathering continuous data ♣ construct: -bar charts and frequency diagrams for continuous data -simple line graphs for time series -stem and leaf (including back-to-back) -histograms with equal class intervals	♣ median, mean and range from a (discrete) frequency table ♣ median, mode and range from stem and leaf diagrams
3+	♣ Know which charts to use for different types of data sets ♣ Construct pie charts for categorical data and discrete/continuous numerical data	♣ construct and interpret stem-and-leaf diagrams, and compare two simple distributions using the range and one of the mode, median or mean
Grade	**Presenting Data**	**Averages**
4-	♣ construct frequency tables for gathering discrete or continuous data, choosing suitable class intervals	♣ range, modal class, interval containing the median, and estimate of the mean from a grouped data frequency table
4 (D to C-)	♣ select, construct and modify, on paper and using ICT, suitable graphs and diagrams to progress an enquiry, e.g. frequency diagrams, pie charts ♣ collect and represent discrete and continuous data, using ICT where appropriate ♣ use statistical measures, tables and diagrams, for discrete and continuous data, ♣ Understand that the frequency represented by corresponding sectors in two pie charts is dependent upon the total populations represented by each of the pie charts	♣ mean from a bar chart ♣ Understand that the expression 'estimate' will be used where appropriate, when finding the mean of grouped data using mid-interval values ♣ Compare the mean, median, mode and range (as appropriate) of two distributions using bar charts, dual bar charts, pictograms and back-to-back stem and leaf
4+	♣ select, construct and modify, on paper and using ICT, suitable graphs and charts to progress an enquiry, including: -line graphs for time series -scatter graphs to develop further understanding of correlation	♣ Recognise the advantages and disadvantages between measures of average
Grade	**Presenting Data**	**Averages**
5-	• Know which charts to use for different types of data sets; • Produce composite bar charts; • Produce comparative and dual bar charts;	• Design and use two-way tables for discrete and grouped data; • Use information provided to complete a two-way table;
5 (C+ to B-)	• Produce pie chart; • Produce frequency polygons for grouped data;	• Sort, classify and tabulate data and discrete or continuous quantitative data; • Construct and interpret stem and leaf diagrams (including back-toback diagrams):

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	• Produce frequency diagrams for grouped discrete data; • Produce line graphs; • Draw scatter graphs in terms of the relationship between two variables; • Draw lines of best fit by eye;	
5+	• Identify outliers and ignore them on scatter graphs; • Distinguish between positive, negative and zero correlation using lines of best fit, and interpret correlation in terms of the problem;	• 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 leaf diagrams (mode, median, range);
Grade	**Presenting Data**	**Averages**
6-	• Construct time–series graphs;	• Construct and interpret grouped frequency tables for continuous data:
6 (B)	• Know the appropriate uses of cumulative frequency diagrams; • Construct cumulative frequency tables, cumulative frequency graphs/diagrams;	• for grouped data, find the interval which contains the median and the modal class; • estimate the mean with grouped data;
6+	• Produce box plots from raw data and when given quartiles, median and identify any outliers;	• understand that the expression 'estimate' will be used where appropriate, when finding the mean of grouped data using mid-interval values.
Grade	**Presenting Data**	**Averages**
7-	• Produce histograms with equal class intervals:	
7(A)	• Know the appropriate uses of histograms; • Construct histograms from class intervals with unequal width;	♣ use a moving average to identify seasonality and trends in time series data, using them to make predictions
7+	• Use and understand frequency density; • From histograms: complete a grouped frequency table;	
Grade	**Presenting Data**	**Averages**
8 (A*)		♣ Apply the concepts of instantaneous and average rates of change by looking at the gradients of tangents and chords to a curve
9(A)**		

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Assessment Criteria 5b – Probability

Grade	Basic Probability	Probability and Venn Diagrams
1-	discuss events using words such as 'likely', 'unlikely', 'certain', 'impossible'.	
1 (G +)	place the probability of events on a scale from impossible to certain. use the language of chance or likelihood find probabilities based on equally likely outcomes in simple contexts.	
1+	List all outcomes for single events systematically	
Grade	**Basic Probability**	**Probability and Venn Diagrams**
2-	use the vocabulary and ideas of probability, drawing on experience understand and use the probability scale from 0 to 1	estimate probabilities by collecting data from a simple experiment and recording in a frequency table
2(E-)	find and justify probabilities based on equally likely outcomes in simple contexts identify all the possible mutually exclusive outcomes of a single event. Find the probability of an event happening using theoretical probability Use theoretical models to include outcomes using dice, spinners, coins Write probabilities in words or fractions, decimals and percentages	compare experimental and theoretical probabilities in simple contexts. Find the probability of an event happening using relative frequency List all outcomes for combined events systematically
2+	Work out probabilities from frequency tables Identify different mutually exclusive outcomes & know the probability sum of all outcomes is 1	Estimate the number of times an event will occur, given the probability and the number of trials – for both experimental and theoretical probabilities
Grade	**Basic Probability**	**Probability and Venn Diagrams**
3-	interpret results of an experiment using the language of probability and appreciate that random processes are unpredictable	compare estimated experimental probabilities with theoretical probabilities, recognising that if an experiment is repeated, the outcome may and usually will be different
3(E +)	know if the probability of an event is p, then the probability of it not occurring is $1 - p$ use diagrams and tables to record all possible mutually exclusive outcomes for single or 2 events Work out probabilities from two-way tables	Recognise increasing the number of trials generally leads to better estimates of probability Work out probabilities from Venn diagrams to represent real-life situations and also 'abstract' sets of numbers/values

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3+	▯ Use and draw sample space diagrams ▯ Add simple probabilities ▯ List all outcomes for combined events systematically	▯ Compare experimental data and theoretical probabilities ▯ Use tree diagrams to calculate the probability of two independent events
Grade	**Basic Probability**	**Probability and Venn Diagrams**
4-	▯ identify all the mutually exclusive outcomes of an experiment	▯ use a numerical scale from 0 to 1 to express and compare experimental and theoretical probabilities in a range of contexts.
4 (D to C-)	▯ know the sum of probabilities of all mutually exclusive outcomes is 1 & use when solving problems ▯ use a numerical scale from 0 to 1 to express and compare experimental and theoretical probabilities in a range of contexts.	▯ appreciate the difference between mathematical explanation and experimental evidence. ▯ Use union and intersection notation ▯ Compare relative frequencies from samples of different sizes
4+	▯ Find a missing probability from a list or table including algebraic terms	▯ Find the probability of successive events, such as several throws of a single dice ▯ Use tree diagrams to calculate the probability of two dependent events
Grade	**Basic Probability**	**Probability and Venn Diagrams**
5-	▯ Understand and use experimental and theoretical measures of probability, including relative frequency to include outcomes using dice, spinners, coins, etc; ▯ Estimate the number of times an event will occur, given the probability and the number of trials;	
5 (C+ to B-)	▯ 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 sample space diagrams and use them for adding simple probabilities; ▯ Know that the sum of the probabilities of all outcomes is 1; ▯ 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;
5+	▯ Draw a probability tree diagram based on given information, and use this to find probability and expected number of outcome;	

HAYDOCK HIGH SCHOOL

Mathematics Progress Grid

Grade	**Basic Probability**	**Probability and Venn Diagrams**
6-	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* × *n* ways);	
6 (B)	Find a missing probability from a list or two-way table, including algebraic terms; Understand conditional probabilities and decide if two events are independent; Use a two-way table to calculate conditional probability; Compare experimental data and theoretical probabilities;	
6+	Compare relative frequencies from samples of different sizes.	
Grade	**Basic Probability**	**Probability and Venn Diagrams**
7-	Understand selection with or without replacement;	
7(A)	Use a tree diagram to calculate conditional probability;	
7+	Calculate the probability of independent and dependent combined events;	
Grade	**Basic Probability**	**Probability and Venn Diagrams**
8 (A*)		Use a Venn diagram to calculate conditional probability;
9(A)**		