GCSE Scheme of Work

The new GCSE will consist of 3 exam papers, each 1½ hours long. There will be one Non-Calculator Paper and two Calculator Papers

Higher Tier
The higher tier covers all grades from 1-9. It specifically tests grades 4-9, but assumes knowledge of grades 1-3.
Work at grades 4-5 is likely to be tested as straight questions. Work at grade 6-9 is likely to have a bigger emphasis on problem solving

Foundation Tier
The foundation tier covers all grades from 1-5
Work at grades 4-5 is likely to be tested as straight questions. Work at grades 1-3 is likely to have a bigger emphasis on problem solving

Assessment Objectives

Assessment Objective	Criteria	Higher Tier	Foundation Tier
AO1: Use and Apply Standard Techniques	• Accurately recall facts, terminology and definitions (10%) • Use and interpret notation correctly (10%) • Accurately carry out routine procedures or set tasks requiring multistep solutions	40%	30%
AO2: Reason, Interpret and Communicate Mathematically	• 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	30%	25%
AO3: Solve Problems with Mathematics and in Other Contexts	• 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	30%	25%

In the pre-2015 GCSE whole questions were assigned as either AO1, AO2 or AO3. In the new GCSE marks are assigned individually to each assessment objective, therefore a single question may have marks allocated to all three assessment objectives
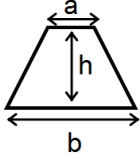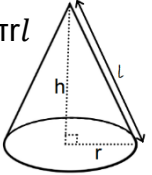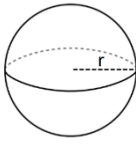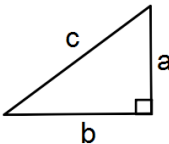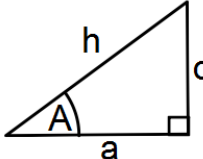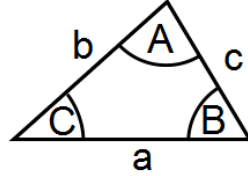
Note: QWC (*) will not be flagged up on questions but will be tested through AO2 across the whole paper

Overview of New Content

Higher Tier	Foundation Tier
- Product rule for counting - Estimate powers and roots of any given positive number - Expanding three or more linear brackets - Composite and inverse functions - Gradients and areas under curves - Equations of tangents to a circle at a given point - Find solutions to equations using iteration - Work with iterative processes - Solve quadratic inequalities - Solve linear inequalities in two variables using set notation and graphs - Nth term of a quadratic sequence - Proof of circle theorems - Geometric sequences with common ratios that are surds - Identify turning points of quadratics by completing the square	- Calculate with and interpret standard form - Use inequality symbols to specify errors due to rounding or truncating - Simplify and manipulate algebraic expressions involving surds - Multiple two brackets - Factorise and solve quadratics - Use $y = mx + c$ to identify parallel lines - Identify gradients and y-intercepts - Find equations of lines from points and gradients - Recognise, sketch and interpret graphs of linear, quadratic, cubic and the reciprocal function - Use graphs to solve problems involving acceleration - Linear simultaneous equations - Recognise Fibonacci type, quadratic and geometric sequences - Calculate compound measures including pressure - Understand direct and inverse proportion - Reverse percentages - Compound growth and decay problems - Similarity - Congruence of triangles - Enlargement with fractional scale factors - Volume and surface area of spheres, pyramids, cones and composite solids - Area and perimeter of composite shapes involving circles - Arc length and area of sectors - Calculate with exact multiple of π - Trigonometry in right angled triangles - Exact values for sin, cos and tan - Add, subtract and multiply with vectors - Tree diagrams - Basic sampling - Venn diagrams - Consider outliers when calculating the range

The Formula Page

There will be no formula page on the exam paper.

Formula to be Learnt These will not be given in the exam paper		Formula given on the Exam Paper Will be given in question
The Quadratic Formula $ax^2 + bx + c = 0$ where $a \neq 0$ $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$	**Perimeter, Area, Surface Area, Volume** Area of Trapezium $= \frac{1}{2}(a+b)h$ Volume of Prism $=$ Area of cross-section x length	**Perimeter, Area, Surface Area, Volume** Curved Surface Area of Cone $= \pi r l$ Volume of Cone $= \frac{1}{3}\pi r^2 h$
Circles Circumference $= 2\pi r = \pi d$ Area $= \pi r^2$	**Probability** P(A or B) = P(A) + P(B) − P(A and B) P(A and B) = P(A given B)P(B)	Surface Area of a Sphere $= 4\pi r^2$ Volume of Sphere $= \frac{4}{3}\pi r^3$
Right Angled Triangles Pythagoras Theorem $a^2 + b^2 = c^2$ Trigonometry Sin A $= \frac{o}{h}$ Cos A $= \frac{a}{h}$ Tan A $= \frac{o}{a}$	**Non-Right Angled Triangles** Sine Rule $$\frac{a}{SinA} = \frac{b}{SinB} = \frac{c}{SinC}$$ Cosine Rule $$a^2 = b^2 + c^2 - 2bcCosA$$ Area $= \frac{1}{2}abSinC$	**Kinematics** a is constant acceleration, u is initial velocity, v is final velocity, s is displacement t is time taken v = u + at s = ut + ½at² v² = u² + 2as

Overview Page

Topic Number	Topic	Notes	Completed
1	Integers and Place Value	Topics 1-4 to be taught in Year 9 Summer term 2 when they start the KS4 Scheme of Work	
2	Angles and Bearings		
3	Coordinates and Linear Graphs		
4	Number Properties		
5	Powers, Roots and Surds		
6	Expressions and Brackets		
7	Statistics: Drawing Graphs		
8	Decimals		
9	2D Shapes		
10	Fractions		
11	Solving Equations		
12	Ratio and Proportion	Yellow = Both higher and Foundation	
13	Triangles	Green = Higher	
14	Solving Quadratic Equations	Red = Foundation	
15	Statistics: Averages		
16	Sequences		
17	Substitution and Formulae		
18	Percentages	Blue = if time is restricted in the lead up to mocks, these	
19	3D Shapes	topics are to be left, with a focus on the other	
20	Fractions, Decimals, Percentages	highlighted topics. The blue topics can then be picked up after the Year 11 mocks.	
21	Construction		
22	Probability		
23	Measures		
24	Transformations		
25	Quadratic and Curved Graphs		
26	Inequalities		
27	Proof		

1		Integers and Place Value	
F	1-3	Understand and use place value Order positive and negative integers Find half way values between numbers Add and subtract integers using both mental and formal written methods Multiply and divide integers using both mental and formal written methods Add, subtract, multiply and divide with negative numbers Understand relationships between operations including inverse operations Multiply and divide by powers of 10 Round to the nearest 10, 100 *etc.*	
F/H	4-5		
H	6-7		
	8-9		

AO2: Reasoning
- Phil states 3.44 x 10 = 34.4, Chris states 3.44 x 10 = 34.40. Who is correct? (Grades 1-3)

AO3: Problem Solving
- Negative numbers in real life contexts (Grades1-3)
- I have the numbers 1, 5 and 7, list all the two digit numbers I can make (Grades 1-3)
- Show me another number with 3,4,5,6,7 where the 6 has the same place value as the 6 in the number 36754 (Grades 1-3)

2		Angles and Bearings	
F	1-3	Name the types of angles (acute, obtuse, reflex and right) Apply the rules of angles at a point, angles on a straight line and vertically opposite angles Apply the rule of angles in a triangle Apply the rules of angles in polygons Apply the rules of angles on parallel lines (corresponding, alternate and interior) Use bearings and scale drawings including maps	
F/H	4-5	Know the language of tangent, arc, sector and segment	
H	6-7	Know and apply the Arrow Theorem Know and apply Angles from a diameter Know and apply Angles from a chord Know and apply Cyclic Quadrilateral Theorem Know and apply the Alternate Segment Theorem Know and apply a tangent and radius meet at right angles Know and apply two external tangents to a circle are equal in length Know and apply a line draw from the centre to the midpoint of a chord meets the chord at 90º Prove the standard circle theorems	
	8-9		
Key Words: points, lines, parallel, perpendicular, acute, obtuse, reflex, right, vertically opposite, corresponding, alternate			

AO2: Reasoning	AO3: Problem Solving
• Pupils need to be able to solve multi-step angle problem in which they explain which angle rules they are applying at each stage. Use of correct vocabulary is important. (Grades 1-9)	• Given an interior or exterior angle, find the number of sides of a polygon (Grades 1-3)

3		Coordinates and Linear Graphs	
F	1-3	Work with coordinates in all four quadrants Solve geometric problems on coordinate axes Plot graphs of linear equations Identify gradients and y-intercepts from both graphs and equations Use distance tables and timetables	
F/H	4-5	Find midpoints between coordinates Use the form y = mx + c to identify parallel lines Find the equation of a line from two points on the line, or from one point and a gradient Plot and interpret linear graphs in the context of real life functions, *e.g*: speed, distance and time graphs Plot and use conversion graphs	
H	6-7		
	8-9	Use the form y = mx + c to identify perpendicular lines Interpret gradients of and areas under linear graphs in real life contexts, including distance-time graphs, velocity-time graphs and in financial contexts	

AO2: Reasoning	AO3: Problem Solving
	• Using a conversion graph to compare the price of an item in two different countries (Grades 4-5) • Pupils need to be able to draw their own axis and decide upon suitable scaling (Grades 1-9)

4		Number Properties	
F	1-3	Understand prime number Work out factors and multiples of a given number Calculate prime factorisation for a given number Find the highest common factor and lowest common multiple using lists Find the highest common factors and lowest common multiple using prime factorisation	
F/H	4-5		
H	6-7		
	8-9		

AO2: Reasoning
- Convince me 8 is not a prime number (Grade 1-3)
- Kate say 108 is prime. Is she correct? (Grade 1-3)

AO3: Problem Solving
- Problems such as: Sausages are sold in packs of 16, buns are sold in packs of 24. A hot dog requires one sausage and one bun. How many packets of each should I buy so I have nothing left over? (Grade 1-3)
- Pam write down a multiple of 9 and two different factors of 40. She adds them together and makes a numbers more than 20 but less than 30. What could the 3 numbers be? (Grades 1-3)

5		Powers, Roots and Surds	
F	1-3	Understand and apply BODMAS (including with brackets, powers, roots and reciprocals) Use positive integer powers and associated real roots (square, cube and higher) Recognise powers of 2,3,4 and 5 Know what a reciprocal is Writing using indices (*e.g*: a x a x a = a^3) Know and apply the laws of indices: multiplying, dividing and powers of powers Convert between standard and ordinary form Calculate with standard form with and without a calculator	
F/H	4-5	Know how to use the power buttons on a calculator Calculate with BODMAS on a calculator Calculate with roots and integer indices Calculate negative indices	
H	6-7	Calculate fractional indices	
	8-9	Estimate powers and roots of any given positive number Simplify surds Add and subtract surds Rationalise denominators	

AO2: Reasoning	AO3: Problem Solving
• Prove that the square root of 45 lies between 6 and 7 (Grades 8-9)	• Carry out standard form calculations in real life contexts (*e.g*: using speed of light) (Grades 1-3)

6		Expressions and Brackets	
F	1-3	Introduce algebraic notation (*e.g*: a x b = ab, a x a = a^2, a ÷ b = $\frac{a}{b}$) Simplify expressions involving sums, products, division and powers Multiply a single number term over a bracket Multiply a single letter or letter and number term over a bracket Factorise single brackets	
F/H	4-5	Find the product of two linear brackets Factorise quadratics of the form x^2 ± bx ± c, including the difference of two squares	
H	6-7	Find the product of more than two linear brackets Factorise quadratics of the form ax^2 ± bx ± c	
	8-9	Simplify algebraic fractions Add and subtract algebraic fractions	

Key Vocabulary: expression, equation, formulae, identities, inequalities, terms, factors

AO2: Reasoning	AO3: Problem Solving
	• Calculating the perimeters of shapes using algebraic expressions (Grade 1-3)

7		Statistics: Drawing Graphs	
F	1-3	Know the difference between discrete and continuous data Interpret and construct frequency tables Interpret and construct pictograms Interpret, construct and compare bar charts Interpret, construct and compare pie charts Interpret and construct vertical line charts Interpret and construct scattergraphs Recognise correlation	
F/H	4-5	Understand basic sampling techniques and analyse bias Interpret and construct tables and line graphs for time series data Understand correlation does not indicate causation Draw lines of best fit Interpolate and extrapolate using lines of best fit and know the limitations of this	
H	6-7	Carry out a stratified sample	
	8-9	Interpret and construct histograms	

AO2: Reasoning
- Consider misleading graphs and critically evaluate the way information is presented (Grades 1-9)
- Justify why a sample may or may not be a representation of a population (Grades 4-5)
- Evaluate the truth of statements related to a particular graph or chart (Grades 4-9)
- Choose which type of graph to use for a given set of data and justify the choice (Grades 4-9)

AO3: Problem Solving
- Be able to set up axes and choose appropriate scaling (Grades 1-9)

8		Decimals	
F	1-3	Order decimals Understand and use place value within the context of decimals Add, subtract, multiply and divide with decimals Using a given calculation to derive other calculations (*e.g*: 23 x 14 = 322, so 2.3 x 1.4 = 3.22) Round numbers to a given number of decimal places Round numbers to a given number of significant figures Use estimation to check answers and approximate the answers to calculations	
F/H	4-5	Use inequality notation to specify simple error intervals due to truncation or rounding Introduction to upper and lower bounds	
H	6-7		
	8-9	Carry out calculations involving upper and lower bounds	

AO2: Reasoning	AO3: Problem Solving
• Justifying whether an answer is an underestimate or overestimate when estimating calculations (Grade 1-3)	• Solving money problems, both with and without a calculator (Grades 1-3) • Shopping problems (Grades 1-3)

9		2D Shapes	

F	1-3	Derive and apply the properties and definitions of special types of triangles, including scalene, right angle, isosceles and equilateral Derive and apply the properties and definitions of special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus Calculate the perimeter of 2D shapes Calculate the area of triangles Calculate the area of parallelograms Calculate the area of trapeziums Calculate the circumference of a circle Calculate the area of a circle Calculate the area of composite shapes	
F/H	4-5	Give answers to circle problems in terms of π and understand this is more accurate than rounding Calculate arc lengths, angles and areas of sectors of circles Reverse area or circumference problems involving circles, semicircles and quarter circles	
H	6-7		
	8-9		

Key Words: edges, polygons, regular, centre, radius, chord, diameter, circumference

AO2: Reasoning	AO3: Problem Solving
- Writing down what is the same and what is different between two polygons (Grades 1-3) - Andy says "Diameter = 2 x radius". Ben says "Radius = 2 x diameter". Who is correct? (Grades 1-3)	- Given two shapes with the same area, find the missing dimension on one shape (Grades 1-3) - Real life area problems, (*e.g.* working out the area of a wall for painting, the area of a floor for tiling, grass for grass seed, extending to money calculations to buy the paint, tiles or grass seed) (Grades 1-3)

10		Fractions		
F	1-3	Compare and order fractions Work out equivalent fractions Convert between proper fractions and mixed numbers Simplify fractions Express one number as a fraction of another Add, subtract, multiply and divide proper fractions Add, subtract, multiply and divide improper fraction and mixed numbers Find fractions of a given quantity		
F/H	4-5			
H	6-7			
	8-9			

AO2: Reasoning	AO3: Problem Solving
• Justify when two fractions are equivalent (Grade 1-3)	

11		Solving Equations	
F	1-3	Use function machines Solve equations using flow charts Solve linear equations with the unknown on one side of the equation	
F/H	4-5	Solve linear equations with one unknown on both sides of the equation Solve linear simultaneous equations algebraically Solve linear simultaneous equations graphically Find approximate solutions to linear equations graphically	
H	6-7	Find approximate solutions to equations numerically using trial and improvement	
	8-9	Find approximate solutions to equations numerically using iteration	

AO2: Reasoning	AO3: Problem Solving
	• Set up and solve linear equations from word or geometric problems and interpret the solution in context (Grades 4-5) • Set up and solve linear simultaneous equations from word or geometric problems and interpret the solution in context (Grades 6-7)

12		Ratio and Proportion	
F	1-3	Use ratio notation Simplify ratio Divide a quantity into a give ratio Express the division of a quantity into two parts as a ratio Use proportion to solve problems Write ratios in unitary form Relate fractions and ratios	
F/H	4-5	Understand the basic concept of direct and inverse proportion Express ratios as linear functions (*e.g*: there are twice as many girls as boys can be expressed as 2:1 or y = 2x, where y is the number of girls and x is the number of boys)	
H	6-7	Interpret equations which describe direct and inverse proportion Recognise and interpret graphs that illustrate direct and inverse proportion Construct and solve problems involving direct and inverse proportion, Construct and solve direct and inverse proportion problems involving squares, cube and roots	
	8-9		

AO2: Reasoning	AO3: Problem Solving
• Decide whether a pair of sets of numbers show direct proportion (Grades 4-5)	• Exchange rate problems (Grades 1-3) • Mixing Problems (Grades 1-3) • Recipe Problems (Grades 1-3) • Best Buy Comparisons (Grades 1-3) • Problems involving ratio which use percentages (*e.g*: In a youth club boys to girls are in a ratio of 3:2. 30% of boys are under the age of 14, 60% of the girls are under the age of 14. What percentage of the youth club is under 14? (Grades 1-3)

13		Triangles	
F	1-3		
F/H	4-5	Know and use the formula for Pythagoras' Theorem Know and use the formula for trigonometric ratios (sin, cos, tan) Apply Pythagoras and trigonometry in right angle triangles and other shapes containing right angles triangles to find missing lengths and angles Angles of depression and elevation Know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0°, 30°, 45°, 60°$ and $90°$ Know the exact values for $\tan\theta$ for $\theta = 0°, 30°, 45°$ and $60°$	
H	6-7	Know and apply the sine rule Know and apply the cosine rule Know and apply the formula for area of triangles using ½abSinC	
	8-9	Apply Pythagoras and trigonometry in 3D shapes containing right angles triangles to find missing lengths and angles	

AO2: Reasoning	AO3: Problem Solving
	• Use Pythagoras to find distances between two coordinates (Grades 4-5) • Trigonometry and Pythagoras problem solving from word problems or real life situations (Grades 4-5) • Multi-stage problems, involving both Pythagoras and trigonometry (Grades 4-5) • Multi-stage problems, involving sine rule, cosine rule and area of a triangle or combinations of these (Grades 6-7)

14		Solving Quadratic Equations	
F	1-3		
F/H	4-5	Solve quadratic equations by factorisation	
H	6-7	Solve quadratics using the quadratic formula	
	8-9	Solve quadratic equations by completing the square Use the completed square to find turning points on graphs Solve quadratic equations that require rearrangement first Solve simultaneous equations where one or both equations are quadratic Solve equations involving algebraic fractions, which may lead to quadratics	

AO2: Reasoning	AO3: Problem Solving
	• Geometric or word problems leading to quadratics (Grades 6-9)

15		Statistics: Averages	
F	1-3	Calculate the mean, median, mode and range Compare data using the mean, median, mode and range Calculate the mean, median, mode and range from a frequency table	
F/H	4-5	Calculate the estimated mean, median and modal group from a grouped frequency table Consider outliers	
	6-7		
H	8-9	Interpret and construct cumulative frequency graphs Interpret and construct box plots Compare data using box plots Calculate quartiles and the interquartile range	

AO2: Reasoning
- 12, 13, 14, 15, 16, 17. Susan states the median is 15. She is wrong. Explain why. (Grades 1-3)
- Justify the use of a particular average to support an argument. (Grades 4-5)

AO3: Problem Solving
- Given the mean, median or mode of a set of data work out part of the original data set (Grades 1-3)
- Given the mean, median and mode of a set of data, find the entire original set of data (Grades 1-3)
- Given the size of a sample and a box plot, calculate the number of people represented in a given section of the box plot (Grades 8-9)

16		Sequences	
F	1-3	Generate terms of a sequence from a term-to-term rule Generate terms of a sequence from a position-to-term rule Recognise and use sequences of triangule, square and cube numbers Recognise and use sequences with simple arithmetic progressions Calculate the nth term of a linear sequence	
F/H	4-5	Recognise and use Fibonacci type sequences Recognise and use quadratic sequences Recognise and use simple geometric progressions (r^n, where n is an integer and r is a positive rational number)	
H	6-7	Understand the notation of iterative sequences (U_{n+1}, U_n *etc*) Use iterative sequences	
	8-9	Recognise and use geometric progressions (r^n, where n is an integer and r is a surd) Recognise more complex sequences Calculate the nth term of a quadratic sequence	

AO2: Reasoning	AO3: Problem Solving
• Justify whether a given number is in a particular sequence (Grade 1-3)	• Given a sequence, what is the first term greater than 50? (Grades 1-3) • Solve problems involving sequences from real life problems (*e.g*: a grain of rice on the first square of a chess board, 2 on the second *etc*, a person saves £10 in the first week, £20 in the next *etc*, what is the height of a tree which grows 6m per year) (Grades 1-5)

17		Substitution and Formulae	
F	1-3	Substitute numerical values into expressions and formulae (including SUVAT equations) Understand and use standard mathematical formulae Rearrange formulae to change the subject using flowcharts	
F/H	4-5	Form formulae from word problems Rearrange simple formulae	
H	6-7	Rearrange complex formulae, where the subject appears more than once	
	8-9	Use function notation, f(x), g(x), f^{-1}(x) Calculate inverse functions, f^{-1}(x) Calculate composite functions fg(x)	

AO2: Reasoning	AO3: Problem Solving
• Kate and John use the formula y = 8n + 4, when n=2. Kate says y = 86. John says y = 20. Who is correct? (Grade 1-3)	

18		Percentages	
F	1-3	Introduce the language of percentages Express one quantity as a percentage of another (both non-calculator and calculator methods) Finding percentages of amounts (both non-calculator and calculator methods) Calculate percentage increase and decrease Interpret fractions, decimals and percentages as operators in percentage change problems Calculate percentage change Calculate original quantities after a percentage change Calculate simple interest	
F/H	4-5	Calculate compound interest Solve compound percentage increase problems Solve compound percentages decrease problems	
H	6-7		
	8-9		

AO2: Reasoning	AO3: Problem Solving
	• Compare two quantities using percentages, for example the cost of two items with different percentage discounts (Grades 1-3) • Comparing bank accounts with different interest rates, for example simple versus compound (Grades 4-5) • Consecutive reductions, such as a sale price of 10% off the previous days price. If the item is £90 on Monday, what is its cost on Wednesday? (Grades 1-3)

19		3D Shapes	
F	1-3	Identify properties of the faces surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres Draw nets of 3D shapes Interpret and construct plans and elevations of 3D shapes Calculate the volume of a cuboid Calculate the volume of a prism Calculate the surface area of a cuboid Calculate the surface area of a prism	
F/H	4-5	Calculate the volume and surface area of a cylinder Calculate the volume and surface area of pyramids, cones, spheres and frustums Calculate volume and surface area of composite solids Solve reverse volume problems, leading to finding the radius or height from a given volume	
H	6-7		
	8-9		

Key Words: vertices, edges, faces, planes

AO2: Reasoning	AO3: Problem Solving
	- Painting problems involving surface area of objects (Grades 1-3) - Volume problems involving packing (*e.g.* How many cylinder cans can fit into a given cuboid, how many smaller cuboids can fit into a larger cuboid) (Grades 1-5)

20		Fractions, Decimal, Percentages	
F	1-3	Know common fractions, percentage and decimal conversions Convert between percentages and decimals Convert between percentages and fractions Convert between fractions and terminating decimals	
F/H	4-5	Compare and order fractions, decimals and percentages	
H	6-7	Convert between fractions and recurring decimals	
	8-9		

AO2: Reasoning
- Use algebraic proof to show recurring decimals is a given fraction (Grades 6-7)
- Convince me that 0.125 is 1/8 (Grades 4-5)

AO3: Problem Solving
- Problems involving fractions, decimals and percentages (*e.g*: There are 200 pupils in year 10. They can choose either swimming, football or tennis. 30% choose tennis, 7/10 choose football. How many people choose swimming?) (Grades 1-3)

21		Construction	
F	1-3	Use standard conventions for labelling and referring to the sides and angles of a triangle Draw diagrams from written descriptions Measure line segments and angles in geometric figures Measure and draw angles Construct triangles using a protractor (SAS and ASA)	
F/H	4-5	Construct triangles using a compass (SSS) Construct a perpendicular bisector of a line Construct a perpendicular to a given line from a point away from the line Construct a perpendicular to a given line from a point on the line Construct an angle bisector Use these to construct other figures Solve loci problem Know that the perpendicular distance from a point to a line is the shortest distance to the line	
H	6-7		
	8-9		

AO2: Reasoning	AO3: Problem Solving
	• Loci problems (Grades 4-5)

22		Probability	
F	1-3	Use the probability scale List outcomes of events and combined events (*e.g*: listing possible combinations from a menu) Calculate basic theoretical probabilities Calculate missing probabilities for mutually exclusive events Complete two ways tables and calculate probabilities from them Calculate experimental probabilities Complete sample space diagrams and use them to calculate probabilities Sort data into venn diagrams Draw and use frequency trees (like a probability tree but with frequencies on the braches rather than probabilities)	
F/H	4-5	Use simple tree diagrams where all branches are the same Use more complex trees diagrams where branches represent different situations Use set notation for venn diagrams to describe a set of numbers or objects	
H	6-7	Construct venn diagrams to solve more complex probability problems Calculate probabilities using venn diagrams Carry out '&' and 'or' probability questions Calculate combinations and permutations	
	8-9	Calculate conditional probabilities including with the use of tree diagrams	

AO2: Reasoning	AO3: Problem Solving
	• Mutually exclusive events with probabilities given in algebra (*e.g*: probabilities of x, 2x, 3x and 4x. Need to find x) (Grades 1-3)

23		Measures	
F	1-3	Read scales Use standard units of mass, length, time, money Convert between related standard metric units (time, length, area, capacity, mass, volume)	
F/H	4-5	Use standard units of speed Convert between units of speed Use standard units of density and pressure Convert between standard units of density and pressure	
H	6-7		
	8-9	Use of the formula for kinematics relating displacement, initial and final velocity, acceleration and time $v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$	

AO2: Reasoning	AO3: Problem Solving
	• Speed comparison problems (Grades 4-5) • Deciding whether someone is speeding (Grades 4-5)

24		Transformations	
F	1-3	Understand reflection symmetry Understand rotational symmetry Carry out and describe rotations on and off the coordinate axis Carry out and describe reflections on and off the coordinate axis Carry out and describe translations on and off the coordinate axis Describe translations as 2D vectors Recognise congruent shapes Draw tessellations	
F/H	4-5	Carry out enlargements with integer scale factors on and off the coordinate axis and with and without a centre of enlargement Carry out enlargements with fractional scale factors on and off the coordinate axis and with and without a centre of enlargement Use basic congruence criteria for triangles (SSS, SAS, ASA, RHS) Apply the concepts of congruence and similarity with regards to length in similar shapes Use diagrammatic and column representations of vectors Apply addition and subtraction of vectors and multiplication of vectors by a scalar	
H	6-7	Carry out enlargements with negative scale factors on the coordinate axis and with a centre of enlargement Describe the changes and invariance achieved by combinations of rotations, reflections and translations Apply ratios between areas and volumes in similar shapes problems	
	8-9	Solve problems involving vectors	

AO2: Reasoning • Proving similarity or congruence between two shapes (Grades 4-5) • Use vectors to construct geometric arguments and proofs (Grades 8-9)	AO3: Problem Solving • Find the area of a parallelogram produced by given vectors (Grades 8-9)

25		Quadratic and Curved Graphs	
F	1-3	Plot graphs of quadratic functions	
F/H	4-5	Identify roots, intercepts and turning points of quadratic functions from their graph Sketch linear, quadratic, cubic and reciprocal graphs	
H	6-7	Recognise, sketch and interpret graphs of exponential functions Plot and interpret exponential graphs in real contexts Recognise and use the equations of the circle with centre at the origin Recognise, sketch and interpret graphs of trigonometric functions (sin, cos and tan) Sketch translations, reflections and stretches of given functions	
	8-9	Calculate gradients of curved graphs Calculate or estimate the area under graphs Interpret gradients of and areas under curved graphs in the context of distance-time graphs, velocity-time graphs and in financial contexts Find the equations of a tangent to a circle at a given point Interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rates of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts	

AO2: Reasoning
- Matching graphs to their functions (Grades 4-9)
- Justify whether a straight line graph would pass through a circle draw on the coordinate grid (Grades 8-9)

AO3: Problem Solving
- Pupils need to be able to draw their own axis and decide upon suitable scaling (Grades 1-9)

26		Inequalities	
F	1-3	Use the symbols =, ≠, <, >, ≤ and ≥	
F/H	4-5	Solve linear inequalities in one variable Represent inequalities on number lines	
H	6-7		
	8-9	Solve linear inequalities in two variables Solve quadratic inequalities in one variable Represent inequalities using set notation Represent inequalities on a graph	

AO2: Reasoning	AO3: Problem Solving
	• Solve word problems leading to inequalities. (Grade 4-5)

27		Proof	
F	1-3		F	
F/H	4-5	Argue mathematically to show algebraic expressions are equivalent Use algebra to support and construct arguments	
H	6-7	Carry out algebraic proofs	
	8-9		
AO2: Reasoning		AO3: Problem Solving	