Liverpool Girls' High School
Innovation Excellence Learning

Mathematics ~ Stage 5 Course Outlines

INTRODUCTION TO MATHEMATICS

Mathematics provides students with knowledge, skills and understanding in Number and Algebra, Measurement and Geometry, and Statistics and Probability. It focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, communication, logical reasoning, analytical thought and problem-solving skills. These capabilities enable students to respond to familiar and unfamiliar situations by employing strategies to make informed decisions and solve problems relevant to their further education and everyday lives.

COURSE OBJECTIVES AND OUTCOMES

Working Mathematically

Students develop understanding and fluency in mathematics through inquiry, exploring and connecting mathematical concepts, choosing and applying problem-solving skills and mathematical techniques, communication and reasoning;

	5.1	5.2	5.3
Communicating	MA5.1-1WM uses appropriate terminology, diagrams and symbols in mathematical contexts	MA5.2-1WM Selects appropriate notations and conventions to communicate mathematical ideas and solutions	MA5.3-1WM uses and interprets formal definitions and generalisations when explaining solutions and/or conjectures
Problem Solving	MA5.1-2WM selects and uses appropriate strategies to solve problems	MA5.2-2WM interprets mathematical or real-life situations, systematically applying appropriate strategies to solve problems	MA5.3-2WM Generalises mathematical ideas and techniques to analyse and solve problems efficiently
Reasoning	MA5.1-3WM Provides reasoning to support conclusions that are appropriate to the context	MA5.2-3WM Constructs arguments to prove and justify results	MA5.3-3WM uses deductive reasoning in presenting arguments and formal proofs

Number and Algebra

Students develop efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation;

	5.1	5.2	5.3
Financial Mathematics	MA5.1-4NA solves financial problems involving earning, spending and investing money	MA5.2-4NA solves financial problems involving compound interest	
Ratios and Rates		MA5.2-5NA recognises direct indirect proportion, and solves problems involving direct proportion	MA5.3-4NA draws, interprets and analyses graphs of physical phenomena
Algebraic Techniques		MA5.2-6NA Simplifies algebraic fractions, and expands and factorises quadratic expressions	MA5.3-5NA selects and applies appropriate algebraic techniques to operate with algebraic expressions
Indices	MA5.1-5NA operates with algebraic expressions involving positive-integer and zero indices, and establishes the meaning of negative indices for numerical bases	MA5.2-7NA applies index laws to operate with algebraic expressions involving integer indices	MA5.3-6NA Performs operations with surds and indices

	5.1	5.2	5.3
Equation		MA5.2-8NA solves linear and simple quadratic equations, linear inequalities and linear simultaneous equations, using analytical and graphical techniques	MA5.3-7NA solves complex linear, quadratic, simple cubic and simultaneous equations, and rearranges literal equations
Linear Relationships	MA5.1-6NA determines the midpoint, gradient and length of an interval, and graphs linear relationships	MA5.2-9NA uses the gradient-intercept form t interpret and graph linear relationships	MA5.3-8NA uses formulas to find midpoint, gradient and distance on the Cartesian plane, and applies standard orms of the equation of a straight line
Non-Linear Relationships	MA5.1-7NA graphs simplenon-linear relationships	MA5.2-10NA Connects algebraic and graphical representations of simple non-linear relationships	MA5.3-9NA sketches and interprets a variety of nonlinear relationships
Polynomials			MA5.3-10NA recognises, describes and sketches polynomials, and applies the factor and remainder theorems to solve problems
Logarithms #			MA5.3-11NA uses the definition of a logarithm to establish and apply the lawsof logarithms
Functions and Other Graphs #			MA5.3-12NA uses function notation to describe and sketch functions

Measurement and Geometry

Students identify, visualise and quantify measures and the attributes of shapes and objects, and explore measurement concepts and geometric relationships, applying formulas, strategies and geometric reasoning in the solution of problems

	5.1	5.2	5.3
Area and Surface Area	MA5.1-8MG calculates the areas of composite shapes, and the surface areas of rectangular and triangular prisms	MA5.2-11MG calculates the surface areas of right prisms, cylinders and related composite solids	MA5.3-13MG Applies formulas to find the surface areas of right pyramids, right cones, spheres and related composite solids
Volume		MA5.2-12MG applies formulas to calculate the volumes of composite solids composed of right prisms and cylinders	MA5.3-14MG applies formulas to find the volumes of right pyramids, right cones, spheres and related composite solids
Numbers of Any Magnitude	MA5.1-9MG interprets very small and very large units of measurement, uses scientific notation, and rounds to significant figures		
Right-Angled Triangles (Trigonometry)	MA5.1-10MG applies trigonometry, given diagrams, to solve problems, including problems involving angles of elevation and depression	MA5.2-13MG Applies trigonometry to solve problems, including problems involving bearings	*Trigonometry and Pythagoras' Theorem* MA5.3-15MG Applies Pythagoras' theorem, trigonometric relationships ,the sine rule, the cosine rule and the area rule to solve problems, including problems involving three dimensions
Properties of Geometrical Figures	MA5.1-11MG describes and applies the properties of similar figures and scale drawings	MA5.2-14MG calculates the angle sum of any polygon and uses minimum conditions to prove triangles are congruent or similar	MA5.3-16MG proves triangles are similar, and uses formal geometric reasoning to establish properties of triangles and quadrilaterals
Circle Geometry #			MA5.3-17MG Applies deductive reasoning to prove circle theorems and to

5.1	5.2	5.3
		solve related problems

Statistics and Probability

Students collect, represent, analyse, interpret and evaluate data, assign and use probabilities, and make sound judgements;

	5.1	5.2	5.3
Single Variable Data Analysi	MA5.1-12SP uses statistical displays to compare sets of data, and evaluates statistical claims made in the media	MA5.2-15SP uses quartiles and box plots to compare sets of data, and evaluates sources of data	MA5.3-18SP uses standard deviation to analyse data
Bivariate Data Analysis		MA5.2-16SP Investigates relationships between two statistical variables, including their relationship over time	MA5.3-19SP investigates the relationship between numerical variables using lines of best fit, and explores how data is used to inform decision-making processes
Probability	MA5.1-13SP Calculates relative frequencies to estimate probabilities of simple and compound events	MA5.2-17SP describes and calculates probabilities in multi-step chance experiments	

Stage 5 Mathematics (5.1/5.2/5.3) ~ Year 9

Term 1 - 10 weeks   ***** = Stage 5.3 content***

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
1. Pythagoras' theorem and surds**			2. Working with numbers			3. Algebra, Products and factors**			
MA5.1-1WM, MA5.1-2WM			MA5.1-1WM,MA5.1-2WM,MA5.2-1WM, MA5.2-2WM			MA5.2-1WM, MA5.2-3WM, MA5.3-1WM**			
MA4-16MG applies Pythagoras' theorem to find unknown sides and solve related problems MA5.3-6NA** operates with surds and indices			MA5.1-4NA solves financial problems involving earning, spending and investing money interprets			MA5.2-6NA simplifies algebraic fractions, expands and factorises quadratic expressions MA5.3-5NA** operate with algebraic expressions			
Problem solving and open-ended questions			Problem solving: Task Centres			Writing activity: Use of variables and simplifying algebraic expressions			

Term 2 - 10 weeks

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
4. Trigonometry			5. Indices			6. Geometry			
MA5.1-1WM, MA5.1-2WM, MA5.1-3WM, MA5.2-1WM, MA5.2-2WM			MA5.1-1WM, MA5.1-3WM, MA5.2-1WM, MA5.3-1WM**, MA5.3-6NA**			MA5.2-1WM, MA5.2-WM, MA5.2-14MG			
MA5.1-10MG,5.2-13MG, applies trigonometry, to solve problems, including problems involving angles of elevation and depression and bearings			MA5.1-5NA,5.1-9MG, 5.2-7NA applies index laws to operate with algebraic expressions, uses scientific notation, rounds to significant figures			MA5.2-14MG calculates the angle sum of any polygon and uses minimum conditions to prove triangles are congruent or similar			
Formal Assessment Task			Research activity: Use scientific notation to express and rank astronomical distances of planets			Puzzles: 'What shape am I?'			

Term 3 - 10 weeks

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
7. Equations			8. Earning money		9. Investigating data			10. Surface area and volume	
MA5.2-1WM, MA5.2-2WM, MA5.2-8NA, MA5.3-7NA**			MA5.1-1WM, MA5.1-2WM, MA5.1-3WM, MA5.1-4NA		MA5.1-1WM, MA5.1-2WM, MA5.1-3WM, MA5.1-12SP, MA5.2-3WM			MA5.1-1WM, 5.1-8MG, MA5.1-9MG,MA5.3-14MG**	
MA5.2-8NA solves linear and simple quadratic equations, linear inequalities and linear simultaneous equations, using analytical and graphical techniques			MA5.1-4NA solves financial problems involving earning, spending and investing money		MA5.1-12SP, 5.2-3WM uses statistical displays to compare sets of data, and evaluates statistical claims made in the media, constructs arguments to prove and justify results			MA5.2-11MG, 5.2-12MG surface areas and volumes of right prisms, cylinders and of composite solids	
Writing activity: Comparing and evaluating the different methods of solving an equation			Practical assignment: Earning Money		Open-ended questions involving sets of data			Problem solving: Task Centres	

Term 4 - 10 weeks

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
11. Coordinate geometry and graphs			12. Probability			13. Congruent and similar figures			
MA5.1-1WM, MA5.1-3WM, MA5.2-1WM, MA5.2-2WM, MA5.2-3WM, MA5.2-5NA, MA5.2-9NA, MA5.2-10NA, MA5.3-2WM, MA5.3-8NA**			MA5.1 1WM, MA5.1 2WM, MA5.1 3WM, MA5.1 13SP, MA5.2 1WM, MA5.2 2WM, MA5.2 3WM, MA5.2 17SP			MA5.1 1WM, MA5.1 2WM, MA5.1 3WM, MA5.1 11MG, MA5.2 1WM, MA5.2 2WM, MA5.3 1WM**, MA5.3 2WM*, MA5.3 16MG**			
MA5.1-6NA find midpoint, gradient and length of an interval, and graphs linear relationships			MA5.2-17SP describes and calculates probabilities in multi-step chance experiments			MA5.2-3WM proves triangles are similar and congruent			
Formal Assessment Task			Investigation: Experimental probability			Writing activity: Proof of similar and congruent triangles			

Stage 5 Mathematics (5.1/5.2/5.3) ~ Year 10

Term 1 - 10 weeks   ** = Stage 5.3 content

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
1. Surds **		2. Interest and Depreciation		3. Coordinate Geometry			4. Surface Area & Volume		
MA5.3-1WM, MA5.3-2WM		MA5.1-2WM, MA5.2-2WM		MA5.2-1WM, MA5.2-3WM, MA5.2-9NA, MA5.3-1WM, MA5.3-2WM, 5.3-3WM, 5.3-8NA			MA5.1-8MG,5.2-1WM,5.2-2WM,5.2-12MG, MA5.3-1WM,5.3-2WM,5.3-3WM,5.3-13MG		
MA5.3-6NA operations with surds and indices		MA5.1-4NA, 5.2-4NA solves financial problems involving earning, spending, investing money compound interest		MA5.1-6NA determines the midpoint, gradient and length of an interval, and graphs linear relationships			MA5.2-11MG MA5.3-14MG, calculates areas, surface areas, volumes of right prisms, cylinders and related composite solids, pyramids, cones and spheres		
Construction activity: Graph surds on the number line		Research: types of savings and investment accounts available.		Practical graphing test			Open-ended and back-to-front questions		

Term 2 - 10 weeks

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
5. Algebra, Products and Factors **			6. Investigating Data			7. Equations and Logarithms**			
MA5.1-5NA, MA5.2-1WM, MA5.2-6NA, MA5.2-7NA, MA5.3-1WM			MA5.2-1WM,5.2-3WM,5.2-15SP,5.2-16SP, MA5.3-1WM, 5.3-2 WM, 5.3-3WM,5.3-19SP			MA5.2-1 WM, MA5.2-2 WM, MA5.2-3 WM)MA5.3-1 WM, MA5.3-2 WM, MA5.3-3 WM			
MA5.2-3WM, 5.3-5NA simplifies, expands, factorises quadratic expressions, operate with algebraic expressions			MA5.1-12SP, MA5.3-18SP uses statistical displays to compare sets of data, uses standard deviation to analyse data			MA5.3-7 NA, MA5.3-11 NA solves linear equations, inequalities, simple cubic and simultaneous equations, quadratic, rearranges literal equations, apply the laws of logarithms			
Formal Assessment Task			Investigation activity: what happens to the range, mean and standard deviation of a data set if a constant is added to each scores?			Group work: Solving word problems			

Term 3 - 10 weeks

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
8. Graphs			9. Trigonometry				10.Quadratic Equations and the Parabola**		
MA5.2-1 WM, MA5.2-2 WM, MA5.2-3 WM, MA5.2-10 NA,5.3-1 WM,5.3-2 WM,5.3-9 NA			MA5.2-1 WM, MA5.2-2 WM, MA5.3-1 WM, 5.3-2 WM, 5.3-3 WM				MA5.3-1 WM, MA5.3-2 WM)		
MA5.1-7NA,5.2-5 NA,5.3-4NA solves direct proportion problems, draws, interprets and analyses graphs of physical phenomena			MA5.1-10MG, MA5.2-13MG, MA5.3-15MG solve trig. problems involving angles of elevation and depression, bearings, the sine rule, the cosine rule and the area rule				MA5.3-7NA, MA5.3-9NA solves complex linear, quadratic, cubic and simultaneous equations, and rearranges literal equations, sketches and interprets a variety of non-linear relationships		
Matching situations or equations to their graphs			Group work: Problem solving using trigonometry				Match quadratic equations to their graphs		

Term 4 - 10 weeks

Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10
11. Simultaneous Equations		12. Probability		13. Geometry		Option Topics ** 14. Polynomials 15. Circle Geometry 16. Functions			
MA5.2-1 WM, MA5.2-2 WM		MA5.1-13SP,5.2-1 WM,5.2-2WM, 5.2-3WM		MA5.1-11MG,5.2-1WM, 5.2-2,5.2-3,5.3-1,5.3-2,5.3-3 WM,5.3-16 MG		MA5.3-1WM, MA5.3-2WM, MA5.3-3WM			
MA5.2-8NA solves linear, quadratic equations, linear inequalities, linear simultaneous equations, using analytical and graphical techniques		MA5.2-17 SP describes and calculates probabilities in multi-step chance experiments		MA5.2-14 MG calculates the angle sum of any polygon and uses minimum conditions to prove triangles are congruent or similar		MA5.3-10NA describes and sketches polynomials and applies the factor and remainder theorems to solve problems, applies deductive, MA5.3-17 MG reasoning to prove circle theorems and to solve related problems MA5.3-12 NA uses function notation to describe and sketch functions			
Formal Assessment Task		Investigate: Probability of winning games of chance and gambling		Assignment: Setting out geometrical proofs		Matching polynomials to their graphs, Geometry assignment involving circle geometry, Practical Graphing Test			

Mathematics ~ Performance Descriptors

Areas for Assessment

Knowledge, skills and understanding

Students:
Working Mathematically – develop understanding and fluency in mathematics through inquiry, exploring and connecting mathematical concepts, choosing and applying problem-solving skills and mathematical techniques, communication and reasoning

Number and Algebra – develop efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation

Measurement and Geometry – identify, visualise and quantify measures and the attributes of shapes and objects, and explore measurement concepts and geometric relationships, applying formulas, strategies and geometric reasoning in the solution of problems

Statistics and Probability – collect, represent, analyse, interpret and evaluate data, assign and use probabilities, and make sound judgements.

Grade A10

A student performing at this grade uses and interprets formal definitions and generalisations when explaining solutions; generalises mathematical ideas and techniques and selects and uses efficient strategies consistently and accurately to solve unfamiliar multi-step problems; uses deductive reasoning in presenting clear and concise mathematical arguments and formal proofs; synthesises mathematical techniques, results and ideas across the course.

A student at this grade typically:

- uses graphical techniques and a variety of analytical methods to solve problems involving quadratic equations and simultaneous equations; manipulates algebraic expressions and equations with consideration given to restrictions on the values of variables
- solves problems involving surface area and volume of right pyramids, right cones, spheres, and related composite solids, and applies similarity relationships for area and volume; applies deductive reasoning to prove properties of isosceles and equilateral triangles, and special quadrilaterals
- uses and interprets the mean and standard deviation to make comparisons between data sets; critically evaluates the processes of planning, collecting, analysing and reporting studies in the media and elsewhere.

Grade A9

A student performing at this grade uses formal definitions and generalisations when explaining solutions; generalises mathematical ideas and techniques and selects and uses efficient strategies to solve unfamiliar multi-step problems; uses deductive reasoning in presenting mathematical arguments and formal proofs.

A student at this grade typically:

- performs operations with surds and indices in numerical and algebraic contexts; analyses and describes graphs of physical phenomena; uses analytical methods to solve complex linear, quadratic, simple cubic, and simultaneous equations, including simultaneous equations where one equation is non-linear
- uses trigonometry to solve practical problems involving non-right-angled triangles; constructs geometrical arguments and formal proofs of geometrical relationships
- uses the mean and standard deviation to make comparisons between data sets; evaluates the use of data to inform decision-making processes.

Grade B8

A student performing at this grade uses formal definitions when explaining solutions; selects and uses efficient strategies to solve familiar and some unfamiliar multi-step problems; uses some deductive reasoning in presenting mathematical arguments; may require some guidance to determine the most efficient methods.

A student at this grade typically:

- applies special products to expand binomial products and factorises a variety of quadratic expressions; draws and interprets a variety of graphs, and applies coordinate geometry techniques to solve problems
- calculates the surface area and volume of right pyramids, right cones, spheres, and related composite solids; constructs geometrical arguments to prove a general geometrical result, giving reasons
- calculates and uses standard deviation to analyse data; interprets the relationship between numerical variables using lines of best fit.

Grade B7

A student performing at this grade selects and uses appropriate mathematical language, notations and conventions to communicate mathematical ideas and solutions; systematically applies appropriate strategies to solve familiar multi-step problems; constructs appropriate mathematical arguments to prove and justify results; often requires guidance to determine the most efficient methods.

A student at this grade typically:

- applies the compound interest formula to solve financial mathematics problems, including those involving depreciation; solves simultaneous linear equations using an algebraic or graphical method; draws and interprets graphs of simple parabolas, circles and exponentials
- calculates the surface area and volume of simple composite solids; solves trigonometry problems involving bearings, angles of elevation and depression, and angles measured in degrees and minutes
- determines and uses quartiles and the interquartile range to compare sets of data; evaluates sources of data in media reports and elsewhere; evaluates conditional statements in chance situations.

Grade C6

A student performing at this grade uses appropriate mathematical language, notations and diagrams to communicate mathematical ideas and solutions; applies appropriate strategies to solve familiar multi-step problems; constructs some appropriate mathematical arguments to obtain and justify results.

A student at this grade typically:

- expands and factorises simple algebraic expressions and simplifies algebraic expressions involving fractions and positive, negative and zero indices; solves simple quadratic equations
- uses formulae to calculate the surface area and volume of right prisms and cylinders; uses simple deductive reasoning in solving numerical problems in different geometrical contexts, and applies tests for proving that triangles are congruent
- determines the quartiles and interquartile range for a set of data; constructs and interprets displays of bivariate numerical data; calculates probabilities and interprets the results for multi-step chance experiments.

Grade C5

A student performing at this grade uses mathematical language, notations and diagrams to communicate mathematical ideas; applies appropriate strategies, often with the assistance of given diagrams and formulae, to solve simple familiar problems; constructs some mathematical arguments to obtain results.

A student at this grade typically:

- uses conversion graphs to convert from one unit to another and given graphs to solve simple linear simultaneous equations; finds and graphs the equations of straight lines given the gradient and *y*-intercept
- solves simple word problems in trigonometry; applies results related to the angle sum for polygons to solve simple numerical problems

- identifies simple relationships between two statistical variables; calculates probabilities for multi-step chance experiments.

Grade D4

A student performing at this grade uses appropriate mathematical terminology, diagrams and symbols in mathematical contexts; selects and uses appropriate standard strategies to solve simple familiar problems; provides some reasoning to support conclusions that are appropriate to the context.

A student at this grade typically:

- graphs simple linear and non-linear relationships by constructing a table of values; uses diagrams to solve simple coordinate geometry problems
- finds the area of simple composite figures; given diagrams, uses trigonometry to find sides and angles in right-angled triangles
- interprets back-to-back stem-and-leaf plots, and statistical claims made in the media; calculates relative frequencies to estimate probabilities of simple and compound events.

Grade D3

A student performing at this grade uses mathematical terminology, diagrams and symbols in mathematical contexts; uses appropriate standard strategies to solve simple familiar problems; provides some reasoning to support conclusions.

A student at this grade typically:

- solves simple financial mathematics problems involving earning and spending money and, given the formula, calculates simple interest; completes a table of values to graph simple linear relationships
- expresses trigonometric ratios for angles in right-angled triangles in terms of an unknown side; uses the scale factor to find unknown sides in similar triangles
- calculates the mean, median and range to compare two sets of numerical data; uses data from Venn diagrams and two-way tables to calculate simple probabilities.

Grade E2

A student performing at this grade uses some mathematical terminology in mathematical contexts; uses, with guidance, standard strategies to solve simple familiar problems; provides some reasoning in identifying a simple mathematical relationship.

A student at this grade typically:

- solves simple financial mathematics problems involving earning money; simplifies simple algebraic expressions involving positive integral indices
- uses given diagrams and formulae to solve simple problems involving area and surface area; uses a calculator to find approximations of trigonometric ratios of given angles measured in degrees; constructs simple scale drawings
- determines the mean and range for a set of data.