Anthony Gell School

Mathematics Curriculum - Overview

Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
At AGS we aim to get all students off to a secure, positive and confident start in mathematics. This is our primary focus for all of our Year 7 students. Our curriculum builds upon the skills they have gained at primary level and sets out to develop their deeper understanding of mathematics.	In Year 8, students continue to study new concepts throughout the year. Students will also revisit areas of the Year 7 course with a view to further developing their problem-solving skills and deepening their subject knowledge.	During Year 9, students revisit important topics from Key Stage 3 as well as planning for GCSE mathematics. Problem solving and exam technique play an important role during the year. Year 9 students will be better prepared to begin the mathematics course at Key Stage 4.	GCSE mathematics is examined at Foundation or Higher Tier. In Year 10 no decision is made in terms of tier of entry. The curriculum is planned so that students of all levels will have the opportunity to access all of the course content, including that of the Higher Tier.	Course completion and GCSE examination preparation are the main elements of Year 11 mathematics. Students will sit mock exams and then identify key areas to focus on to enable them to achieve their target grade. During the initial part of Year 11, students will have a better understanding of which tier of entry will suit them best.	A level mathematics requires students to be highly skilled, resilient and inquisitive. In Year 12, students not only consolidate parts of the Key Stage 4 curriculum but are also introduced to new concepts that enable a smooth transition to Year 13. The course consists of Pure Mathematics, Statistics and Mechanics. All three are taught during the academic year.	In Year 13, students will deepen their understanding of Pure Mathematics, Statistics and Mechanics by applying their knowledge to real-life situations as well as more advanced problem solving skills.

Anthony Gell School

Curriculum – Topic Sequencing						
Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Half Term 1 **Number** **Embedding the four basic operations to include negative numbers and their uses.** Positive and negative numbers Adding and Subtracting negative numbers **Sequences** **Basic sequences as well as special sequences. Problem solving is a key element of this topic.** Sequences Prime Numbers / Factors Function machines Sequences and rules Generating sequences from nth term	Half Term 1 **Working with numbers** **Students begin Year 8 by revisiting key numeracy skills. The aim is to practice key skills which will allow them to confidently navigate through the course.** Adding and subtracting with negative numbers Multiplying and dividing negative numbers Factors and highest common factor (HCF) Multiples and lowest common multiple (LCM) Powers and roots Prime factors	Half Term 1 **Number 1** **Basic number skills are revisited during this half term to further embed and establish confidence in mathematics at all levels.** Place value and ordering numbers Order of operations and BIDMAS The four rules Multiples of whole numbers Factors of whole numbers Prime numbers Problem solving	Half Term 1 **Algebra 2** **The initial module in Year 10 focuses on developing a firm understanding of linear equations. It is very important that students understand the role that linear equations play in not only solving algebraic problems but also their graphical representation.** Solving linear equations Solving equations with brackets Solving equations with the variable on both sides	Half Term 1 **Algebra 4** **This module brings together many elements of the GCSE course and focuses on their links to algebra. Included in this topic are rates of change, graph transformations as well as equations of circles.** Patterns in number Number sequences Finding the nth term of a linear sequence Special sequences General rules from given patterns Elimination method for simultaneous equations Substitution method for simultaneous equations	**Pure- Algebra 1** Use direct proof, proof by exhaustion and counter examples to prove results Use and manipulate the index laws for all powers Manipulate surds and rationalise a denominator Solving quadratic equations Coordinate geometry of a straight line and circle Linear and non-linear simultaneous equations Linear and quadratic inequalities Assessment	**Pure - Algebra 2** Making logical deductions and prove statements directly Functions, parametric equations and algebraic fractions Partial fractions Assessment **Sequences** Binomial expansion Arithmetic and geometric sequences Assessment **Trigonometric identities** Degrees and radians Reciprocal and inverse trigonometric functions

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Finding the nth term of a sequence Working out missing terms Investigate: Pascals Triangle	Challenge –Blackpool Tower			Balancing coefficients to solve simultaneous equations Using simultaneous equations to solve problems Linear inequalities		Compound and double angles Assessment
Perimeter, area and volume **Studying basic geometry that aims to develop a deeper understanding of dimensions.** Perimeter and area of rectangles Perimeter and area of compound shapes Area of other 2d shapes Area of trapezium Volume of cubes and cuboids Problem solving – Design a bedroom Assessment	• **Geometry** **Exploring geometrical reasoning with concepts learnt in Year 7. This includes areas such as constructions that form a fundamental part of problem solving.** Parallel lines The geometric properties of quadrilaterals Translations Enlargements Constructions Assessment	Solving real-life problems Multiplication and division with decimals Approximation of calculations Multiples, factors, prime numbers, powers and roots Prime factors, LCM and HCF Negative numbers Patterns in number Number sequences Finding the nth term of a linear sequence Special sequences General rules from given patterns The nth term of a quadratic sequence Finding the nth term for quadratic sequences Problem solving	Linear equations Elimination methods for simultaneous equations Substitution method for simultaneous equations Balancing coefficients to solve simultaneous equations Using simultaneous equations to solve problems Linear inequalities Graphical inequalities Trial and improvement Assessment	Distance –time graphs Velocity–time graphs Estimating the area under a curve Rates of change Equation of a circle Other graphs Transformation of the graph y = f(x) Elimination method for simultaneous equations Substitution method for simultaneous equations Balancing coefficients to solve simultaneous equations Using simultaneous equations to solve problems Linear inequalities Assessment	**Polynomials and the binomial theorem** Manipulate, simplify and factorise polynomials The binomial theorem Dividing polynomials The factor theorem Analyse a function and sketch its graph. Assessment **Trigonometry** SOHCAHTOA Using and applying trigonometric identities Sine and cosine rule Assessment	**Differentiation 2** Convex and concave curves Points of inflection Small angle estimations Trigonometric functions Exponentials and natural logarithms Product and quotient rules Chain rule Implicit differentiation Inverse functions Parametric functions Assessment **Integration and differential equations** Standard functions

		Assessment				Area between two curves Integration by substitution Integration by parts Partial fractions Differential equations Assessment
Half Term 2 • **Algebra** **Students will learn about algebra and the fundamental reasons as to why it plays a big part in understanding mathematics.** Introduction to algebra Simplifying expressions Expanding Brackets Expressions and substitution Using formulae	Half Term 2 • **Further probability** **This topic focuses on a systematic approach to problem solving by encouraging students to use diagrams(sample spaces) to support their solutions. Many key statistical terms are also introduced and used on a regular basis.**	Half Term 2 • **Geometry 1** **Extending and building upon Year 7 and 8 geometry, students begin to apply their knowledge to a large range of geometrical concepts that include bearings, polygons and measurement systems.** Systems of measurement Conversion factors Scale drawings Nets	Half Term 2 • **Geometry 2** **Students will explore geometry through a range of 2-d and 3-d shapes to solve practical real-life problems.** Rectangles Compound shapes Area of a triangle Area of a parallelogram Area of a trapezium Circles The area of a circle Answers in terms of π Rotational symmetry Translation	Half Term 2 • **Geometry 4** **The concluding geometry module builds upon prior knowledge and extends this to more abstract problems. Within in this topic students extend the idea of vectors as well as more complex shapes such as arcs and sectors.** Sectors, Pyramids, Cones, Spheres,	**Differentiation and integration** Differentiate from first principles Basic differentiation Find equations, tangents and normals Work out turning points and determine their nature Interpret the second derivative Basic integration Calculate definite integrals Assessment **Exponentials and logarithms**	**Numerical methods** Change of sign method Iteration Newton-Raphson method Trapezium rule Assessment **Mechanics** **Motion in two dimensions** Constant acceleration for motion in two dimensions Using calculus to solve problems Projectiles Motion of an object

• **Working with numbers** **Building upon previous number work, students will begin to work with factors, squares and square roots in more detail. The importance oof rounding and estimating also plays a key role in this unit.** Square numbers and square roots Rounding Order of operations Multiples and Factors Long and short multiplication Long and short division Calculations with measurements Problem solving – What is your carbon footprint? • **Statistics**	Mutually exclusive outcomes and exhaustive outcomes Using a sample space to calculate probabilities Estimates of probability • **Percentages** **Students deepen their understanding of percentages by using multipliers to increase and decrease. A focus here is also on using a calculator to efficiently support their learning.** Calculating percentages Calculating percentage increases and decreases Calculating a percentage change Challenge – Changes in population	Using an isometric grid Angles facts Triangles Angles in a polygon Regular polygons Angles in parallel lines Special quadrilaterals Bearings Angle facts Triangles Angles in a polygon Regular polygons Angles in parallel lines Special quadrilaterals Scale drawings and bearings Congruent triangles Rotational symmetry Transformations Combinations of transformations Bisectors Defining a locus Loci problems Plans and elevations Assessment	Reflections Rotations Enlargements Using more than one transformation Vectors Circumference and area of a circle Area of a parallelogram Area of a trapezium Sectors Volume of a prism Cylinders Volume of a pyramid Cones Spheres Similar triangles Areas and volumes of similar shapes Assessment	Pythagoras' theorem, Calculating the length of a shorter side Applying Pythagoras' theorem in real-life situations, Pythagoras' theorem and isosceles triangles Trigonometric ratios, Calculating lengths using trigonometry, Calculating angles using trigonometry, Trigonometry without a calculator, Solving problems using trigonometry, Trigonometry and bearings, Trigonometry and isosceles triangles Congruent triangles Similarity Further 2D problems, Further 3D problems Trigonometric ratios Use the sine rule and the cosine rule to find sides and angles in any triangle	Convert between powers and logarithms Solve problems involving powers and logarithms Sketching exponential functions Considering limitations of exponential models Assessment	Assessment

Exploring data sets and working towards presenting data. Students will be taught that statistics plays a pivotal role within society. Mode, median and range The mean Collecting and using data Grouped frequency Statistical diagrams Data collection Assessment	• **Further sequences** **Students further their understanding of sequences which is heavily linked to their algebraic skills.** Using flow diagrams to generate sequences The nth term of a sequence Working out the nth term of a sequence The Fibonacci sequence Investigation – Pond borders • **Congruency** **To further establish and embed their geometry skills, students are introduced to congruency. In addition to this topic,**			Using sine to calculate the area of any triangle Properties of vectors Vectors in geometry Assessment		

					Mechanics	Forces 2
students are actively encouraged to offer mathematical reasoning as well as elements of proof work. Congruent shapes Congruent triangles Using congruent triangles to solve problems Problem solving – Using scale diagrams to work out distances Assessment						
Half Term 3 • **Decimals** **Revisiting place vale and calculating with decimal numbers. This includes the four basic operations as well as using decimal numbers in a practical context.**	Half Term 3 • **Surface area and volume** **Building upon work from Year 7 that covered area and volume, students are taught to work out surface area and volume of more complex shapes.**	Half Term 3 • **Ratio and proportion 1** **Problem solving plays a key part in this module where students revisit percentage and ratio. Application is key and work is done to establish the**	Half Term 3 • **Number 3 and Ratio and proportion 2** **Building upon the work at Key Stage 3, students will use their skills to solve problems including compound interest,**	Half Term 3 • **Algebra 5 and Number 4** **In both tiers of entry, students are taught topics that are aimed at supporting them to achieve a higher grade** Powers (indices) Rules for multiplying and dividing powers	**Vectors** Identify vector and scalar quantities Solving tow dimensional problems Displacement, forces and velocity Component form of a vector **Assessment**	Vectors in three dimensions Frictional force Systems Differential equations involving f=ma Moments Assessment

Multiplying and dividing by 10, 100 and 1000 Ordering decimals Estimates Adding and subtracting decimals Multiplying and dividing decimals Financial skills – Shopping for leisure - **Fractions** **Students will work with fractions, developing their skill set to ensure they are competent in working with them. This includes the four basic operations as well as understanding that a fraction is just a number.** Equivalent fractions Comparing fractions Adding and subtracting fractions	Metric units for area and volume Surface area of prisms Volume of prisms Investigation – A cube investigation - **Linear and non-linear graphs** **Basic coordinate skills are essential in this topic as students begin to explore different types of graphs. In this topic students are encouraged to plot and sketch graphs.** Graphs from linear equations Gradient (steepness) of a straight line Graphs from quadratic equations Real-life graphs Challenge – The M25	**importance and relevance of this topic outside of the classroom.** Calculating with decimals Fractions and reciprocals Writing one quantity as a fraction of another Adding and subtracting fractions Multiplying and dividing fractions Fractions on a calculator Ratio Speed, distance and time Direct proportion problems Best buys One quantity as a fraction of another Adding, subtracting and calculating with fractions Multiplying and dividing fractions	**standard form and proportion.** Equivalent percentages, fractions and decimals Calculating a percentage of a quantity Increasing and decreasing quantities by a percentage Expressing one quantity as a percentage of another Compound measures Compound interest and repeated percentage change Reverse percentage (working out the original value) Direct proportion Inverse proportion Powers (indices) Rules for multiplying and dividing powers Standard form	Standard form Distance-time graphs Plotting quadratic graphs Solving quadratic equations by factorisation The significant points of a quadratic curve Cubic and reciprocal graphs Algebraic fractions Changing the subject of a formula Functions Composite functions Iteration Assessment <u>Half Term 4 and 5</u> During these terms, students will focus on areas of weakness that have been identified by the mock examination. In addition to this, students will also	**Units and kinematics** Understand and use SI units Speed and velocity Draw and interpret graphs of displacement and velocity against time SUVAT equations Using calculus to solve problems with variable acceleration Assessment	

Mixed numbers and improper fractions		Fractions on a calculator	Direct proportion	revisit their module		
Adding and subtracting mixed numbers	• **Number**	Increasing and decreasing quantities by a percentage	Inverse proportion	assessments with a view to developing their understanding		
Challenge – Fractional dissection	**Applications of number are explored during this topic as students are introduced to standard form.**	Expressing one quantity as a percentage of another	Assessment	further.		
Assessment		Ratio		Question analysis also plays an important		
	Powers of 10	Direct proportion problems		role during this term. Students will develop		
	Significant figures	Best buys		a deeper understanding of		
	Standard form with large numbers	Compound measures		what they need to do to improve their		
	Multiplying with numbers in standard form	Compound interest and repeated percentage change		grade. In addition to this, students will		
	Challenge – Space – to see where no one has seen before	Reverse percentage (working out the original amount)		become fluent in using mark schemes to critique their work		
	Assessment	Assessment		as well as embedding robust exam techniques.		
				Given the fact that the teaching staff will have taught their class for three years, this level of consistency allows some lessons to be		

			topic focused based on whole class needs. All lessons will continue to revisit a range of topics through retrieval activities that also include mini assessments and exam question practice.			
Half Term 4 • **Angles** **In this unit, students will revisit basic angle facts as well as being introduced to higher level geometric properties.** Measuring and drawing angles Calculating angles Corresponding and alternate angles	Half Term 4 • **Data analysis** **Statistics play a key role in society and students explore a variety of data sets and charts. A key area of this unit is that students can interpret data from a range of charts.** Interpreting graphs and diagrams	Half Term 4 • **Algebra 1** **Basic algebra skills are checked and revisited to enable students to begin the next stage of algebraic manipulation. Within this module, students are introduced to higher level algebraic topics.**	Half Term 4 • **Algebra 3** **In Algebra 2, students were taught the basic principles of linear equations. In this module they build upon that knowledge to not only realise the importance of straight line graphs(applications) but study with an aim to achieve a firm**		**Forces and Newton's laws** Particles in equilibrium Magnitude and direction of a force Understand the connection between weight and mass Resolve forces for connected objects and particles Assessment	**Statistics Probability and continuous random variables** Conditional probability The binomial and Normal distributions Probability models Assessment **Hypothesis testing 2** Testing for correlation PMCC

Angles in a triangle Angles in a quadrilateral Properties of triangles and quadrilaterals Activity – Constructing triangles • **Coordinates** **To support and revisit the earlier algebra and sequences lessons. This topic explores coordinates and the vital role they play developing mathematical understanding.** Coordinates Coordinates from rules Graphs from coordinates Graphs of fixed values of x and y, y=x, y=-x Graphs of the form y=ax	Relative sized pie charts Scatter graphs and correlation Creating scatter graphs Challenge – Football attendances • **Algebra** **Students become more fluent when working with algebra and are encouraged to manipulate and simplify.** Algebraic notation Like terms Expanding brackets Using algebraic expressions Using index notation Mathematical reasoning – Writing in algebra • **Congruence and scaling**	Basic algebra Substitution Expanding brackets Factorisation Quadratic expansion Quadratic factorisation Changing the subject of a formula Factorisation Quadratic expansion Expanding squares More than two binomials Quadratic factorisation Factorising ax2 + bx + c Changing the subject of a formula Assessment	**grasp of gradient and intercept. Non-linear graphs are also introduced at this stage.** Graphs and equations Drawing linear graphs by finding points Gradient of a line y = mx + c Finding the equation of a line from its graph The equation of a parallel line Real-life uses of graphs Solving simultaneous equations using graphs Drawing linear graphs from points Gradient of a line Drawing graphs by gradient-intercept and cover-up methods		**Statistics Collecting, representing and interpreting data** Sampling methods and bias Continuous data and associated graphs Correlation Raw data and measures of spread Assessment	Mean of a Normal distribution Assessment Revision and formal examinations

Graphs form the real world Assessment	**Students were introduced to congruency in the previous term. This part of the course focuses on shape ratio as well as scales that include maps.** Ratio of lengths, areas and volumes Fractional enlargement Map scales Assessment		Finding the equation of a line from its graph Real-life uses of graphs Solving simultaneous equations using graphs Parallel and perpendicular lines Plotting quadratic graphs Solving quadratic equations by factorisation Solving a quadratic equation by using the quadratic formula Solving quadratic equations by completing the square The significant points of a quadratic curve Solving one linear and one non-linear equation using graphs Solving quadratic equations by the method of intersection			

			Solving linear and non-linear simultaneous equations algebraically Quadratic inequalities Assessment			
Half Term 5 • **Percentages** **Given the importance and many practical applications of percentages, students are taught to be fluent in working with them both in and out of context.** Fractions, decimals and percentages Fractions of a quantity Calculating simple percentages	**Half Term 5** • **Fractions and decimals** **Following on from the Year 7 work on fractions, students begin to explore the link between fractions and decimals in more detail. Confidence building is key during this topic as it enables students to apply their skills to a range of questions during the entire mathematical course.**	**Half Term 5** • **Statistics 1** **Although many of the charts and data analysis techniques are not new to the students in this module, there is a strong focus on understanding and application. This module will support the transition from Key Stage 3 to 4.** Frequency tables Statistical diagrams Line graphs Statistical averages Sampling	**Half Term 5** • **Geometry 3** **Geometry 3 is rich in mathematics(some areas will not initially be taught to all students) and covers a range of topics. At this stage, students are introduced to trigonometry, Pythagoras' theorem, volumes of complex shapes as well as loci.** 3D shapes Volume and surface area of a cuboid Volume and surface area of a prism		**Probability and discrete random variables** Understanding key vocabulary in statistics Mutually exclusive and independent events Probability functions and distributions Experiments modelled by the binomial distribution Assessment	

Percentage increase and decrease non calc Percentages with a calculator ● **Probability** **Working with the probability scale and relating key terms such as certainty to the number system. In addition to this, working with experimental and expected probabilities.** Probability scales Combined events Experimental probability (including the horse race simulator) ● **Symmetry** **Explore various transformations with a view to develop a deeper**	Adding and subtracting fractions Multiplying fractions and integers Dividing with integers and fractions Multiplication with large and small numbers Division with large and small numbers Challenge – Guesstimates ● **Proportion** **Linking to the work on graphs, proportionality is explored through graphical analysis.** Direct proportion Graphs and direct proportion Inverse proportion Comparing direct proportion and inverse proportion Challenge – Planning a trip	Pie charts Scatter diagrams Statistical representation Statistical measures Scatter diagrams Experimental probability Mutually exclusive exhaustive outcomes Expectation Probability and two-way tables Probability and Venn diagrams Assessment	Volume and surface area of cylinders Constructing triangles Bisectors Defining a locus Loci problems Pythagoras' theorem Finding the length of the shorter side Applying Pythagoras' theorem in real-life situations Pythagoras' theorem and isosceles triangles Pythagoras' theorem in three dimensions Trigonometric ratios Calculating angles Using the sine and cosine functions Using the tangent function Which ratio to use Solving problems using trigonometry Trigonometry and bearings Trigonometry and isosceles triangles Circle theorems			

understanding of geometry. Line symmetry and Rotational symmetry Reflections Rotations Tessellations Activity – Rangoli Patterns Assessment	Assessment		Cyclic quadrilaterals Tangents and chords Alternate segment theorem Assessment			
Half Term 6 • **Equations** **Using a range of algebraic techniques, students are taught so set up equations and solve them.** Finding unknown numbers Solving equations Two step equations Equations with brackets Writing formulae Setting up and solving equations	Half Term 6 • **Circles** **Exploring the properties of circles, students begin to work with formulae connecting circumference and area. Calculator skills are a key element of this topic.** The circumference of a circle Formula for the circumference of a circle	Half Term 6 • **Number 2** **Students begin to deepen their understanding of numbers in mathematics. This module combines previous number work with new concepts where making links between the two is vital.** Prime factors, LCM and HCF	Half Term 6 • **Statistics 2** **Probability makes up a large part of the Statistics 2 module. One of the main aims behind this unit is to ensure that students grasp the idea of the probability scale and how this can be used in both experimental and theoretical statistics. Students will also be introduced to a range of statistical charts**		**Hypothesis testing 1** Understanding null and alternative hypothesis Critical values and regions to include significance levels Calculating a p-value Concluding a hypothesis test Assessment End of year examination	

Challenge –Number puzzles • **Ratio** **Ratio questions often rely on problem solving skills. This topic revisits basic ratio ideas to ensure that students are confident in their application.** Introduction to ratios Simplifying and equivalent ratios Ratios and sharing Solving problems Problem solving – Smoothie bar • **Additional topics** Drawing Pie Charts Reading Pie Charts Comparing range and averages	Formula for the area of a circle Financial skills – Athletics stadium • **Equations and formulae** **Algebraic skills are essential in solving equations and working with formulae. Students are taught to apply their skills to solve problems.** Equations with brackets Equations with the variable on both sides More complex equations Rearranging formulae Mathematical reasoning – Using graphs to solve equations • **Exploring data**	Square numbers Square roots Basic calculations on a calculator Rounding whole numbers Rounding decimals Approximating calculations Rational numbers, reciprocals, terminating and recurring decimals Estimating powers and roots Negative and fractional powers Index Laws Surds Limits of accuracy Problems involving limits of accuracy Choices and outcomes Assessment	**that were not taught at Key Stage 3.** Calculating probabilities Probability that an outcome will not happen Mutually exclusive and exhaustive outcomes Experimental probability Expectation Choices and outcomes Combined events Two-way tables Probability and Venn diagrams Tree diagrams Collecting data Frequency polygons Cumulative frequency graphs Box plots Histograms Addition rules for outcomes of events Combined events Tree diagrams			

Naming and drawing 3D shapes Using nets to construct 3D shapes Problem solving – Packing boxes Assessment	**Previous work on data analysis is built upon in this topic as students primarily work with raw data and are expected to analyse in greater detail.** Grouped frequency tables Drawing frequency diagrams Comparing sets of data Misleading charts Problem solving – Why do we use so many devices to watch TV? Assessment		Independent events Conditional probability Assessment End of year examination			