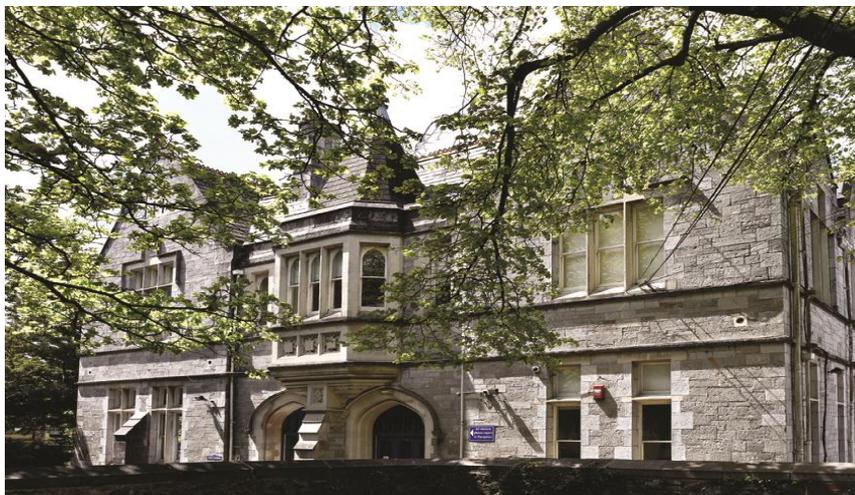


Curriculum and Progression Overview

Maths

Plymouth High School for Girls



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1. The Curriculum

Mathematics provides students with essential mathematical skills and knowledge in number and algebra, measurement and geometry, and statistics and probability.

Introduction

Mathematics is the study of the properties, relationships and patterns in number and shape, and it is the use of this knowledge to analyse, interpret, simplify and solve problems.

Numeracy promotes the development of the number-based skills that are needed regularly by everyone in their lives and is a part of Mathematics.

Mathematics is based on 6 big ideas.

Number	Ratio and Proportion	Algebra
Geometry	Data Analysis	Probability

Our curriculum is an ambitious five to seven year programme, gradually leading to the mastery of these 6 big ideas.

INTENT

Rationale

Learning mathematics develops logical reasoning, analysis, problem-solving skills and the ability to think in abstract ways, as well as offering opportunities for creativity. It is a universal language of numbers and symbols.

Mathematics is important in everyday life, allowing us to make sense of the world around us. It gives us confidence in dealing with number and in understanding shape, position and movement. It enables us to think abstractly, model real-life situations and make generalisations, it equips us with the skills we need to interpret and analyse information, assess risk and make informed decisions.

The curriculum in maths focusses on fluency, reasoning and problem solving. The spiral progression of skills from year 7 to 11 has been carefully thought through and resourced with these three main concepts in mind. We want students to develop mastery in mathematics and believe that this comes from a mixture of:

- Knowledge
Statements of fact, formulae, definitions and theorems
Agreed processes and methods for the efficient solving of problems
Key vocabulary designed to explain and aid the sharing of knowledge.
- Understanding
Recognise previously learnt concepts within unfamiliar problems
Make judgements about the “best” method to use
- Skills
Analysis skills for problem solving
Communication of mathematical ideas

Ambition

From KS3 onwards, we want our students to experience success in mathematics and develop the confidence to take risks, ask questions and explore alternative solutions without fear of being wrong. They will therefore, enjoy exploring and applying mathematical concepts to understand and solve problems, explaining their thinking and presenting their solutions to others in a variety of ways.

It is planned for all students to sit the higher tier papers in mathematics and we hope that many students will opt for mathematics as an A Level choice.

At all stages, the use of collaborative learning encourages students to reason logically and creatively through discussion of mathematical ideas and concepts. Misconceptions and wrong answers are an opportunity to improve and deepen understanding of mathematical concepts, through use of effective questioning and discussion.

- To develop a positive attitude to maths as an interesting and exciting subject in which all students gain success and enjoyment
- To develop mathematical understanding through systematic direct teaching of appropriate learning objectives
- To encourage the effective use of mathematics as a tool in a wide range of activities within and out with school and, subsequently, adult life
- To develop an ability in students to express themselves fluently, to talk about the subject with confidence, using correct mathematical language and vocabulary
- To develop and make connections within maths
- To develop the ability to think clearly and logically with independence of thought and flexibility of mind
- To develop mathematical skills and knowledge and a quick recall of basic facts

IMPLEMENTATION

Active involvement in mathematical experiences, set in real and relevant contexts, is vital to the development of knowledge, understanding, skills and a positive attitude towards numeracy and mathematics.

The curriculum has been designed as a spiral, so that we consciously return to topics and layer the difficulty. For example, in year 7 students study angle facts such as angles in triangles and quadrilaterals, in year 8 this is reviewed and extended into any polygon and angles between parallel lines, in year 9 we take the angle knowledge further by discovering four of the circle theorems whilst also reviewing the knowledge from years 7 and 8. In year 10 we focus on the remaining circle theorems and all the related circle theorem proofs. As this example suggests the curriculum increases with challenge whilst ensuring that the foundation knowledge for each topic is secure, thus ensuring we develop mastery of the topics and skills.

The National Curriculum is taught in Year 7,8 and 9, however if there are overlaps or opportunities to stretch and challenge students by introducing elements from the GCSE specifications, these may be taken.

The Head of Maths encourages all staff to provide a rich and supportive learning environment. Curriculum delivery is equitable for all groups as we regularly share strategies for teaching and learning, ensuring that best practice is drawn upon, so that a skilful mix of approaches are used within the teaching. These include:

- Planned active learning with opportunities to observe, explore, investigate, experiment and play
- Development of problem-solving capabilities, with an increased opportunity for discussion, communication and explanation of thinking
- Plan for both depth and breadth with topics as well as across the curriculum as a whole.
- Use of relevant contexts, familiar to young people's experiences
- Collaborative and independent learning
- Making links across the curriculum where appropriate
- Sharing of resources across the Department to encourage equitable delivery and team planning to take place wherever possible

Curriculum resources include textbooks, collaborative learning activities, interactive online games, practical experiments, as well as "chalk and talk".

Assessments have been designed thoughtfully, and are integrated into the curriculum at the end of each half term. The assessments provide further evidence of where interventions might need to be put into place and, whether interventions are successful.

Enrichment of the curriculum has also been planned for. Close links established over many years with the University of Plymouth allow us to provide further expertise and opportunities for our students. Girls in years 7 and 8 attend the masterclass days, whilst our year 9 students take part in the national masterclasses at the university run by the Royal Institute. Year 10 students often take part in a residential maths masterclass as a follow-up to the year 9 course. Further opportunities such as the Maths Olympiad and inter-city Maths competitions are encouraged as are participation in the Maths Challenge at all levels. Competitions and events within school also support the curriculum such as Pi day, or week long themed maths lessons displays and activities beyond the classroom are also organised.

Curriculum development and pedagogy are supported by teachers' participating in the Further Maths Network group, run by the AMSP in association with the University of Plymouth, as well as Plymouth Maths hub and the SWAT schools network. These networks allow us to meet other teachers and share resources and teaching ideas whilst being kept abreast of the most recent updates from the exam boards.

Development is also supported each year by a one day, city wide Maths Conference, organised by the subject leads for all maths teachers in the area. PHSG Maths Department has played a leading role in organising and hosting this for several years. These conferences enable leading maths professionals to deliver workshops to inspire and to consolidate knowledge and understanding of the maths curriculum and effective ways of its delivery.

IMPACT

In mathematics, as in other curricular areas, assessment forms an integral and ongoing part of learning and teaching. It is the gathering of evidence of both attainment and progression for the purpose of informing future planning, teaching and reporting. In working with students, our teachers continuously evaluate and make use of this assessment in planning future activities.

Assessment for Learning strategies are used on a daily basis.

Formative and summative assessment will be used in the learning & teaching process:

- To share learning objectives and success criteria clearly with students
- To assess understanding through skilful questioning within lessons
- To give students clear and regular feedback in both verbal and written form
- To assist learners and teachers to identify the next steps in the learning process which will ensure progression
- To engage in the process of self and peer assessment

On-going classwork will be the main source of evidence, available through observation of:

- Oral questioning and discussion
- Observations of students who are articulate and can discuss freely mathematical concepts and ideas
- Practical tasks within the lesson, both those completed individually and those completed collaboratively
- Students' written work and assessments

The Department tracks students' progress through the use of a common spreadsheet and interventions are put into place where necessary. Interventions are conducted through classroom practise and seating plans, teachers offering one to one support or use our mentoring scheme with year 12 maths captains.

Over the last few years the impact of the provision we provide has meant that the numbers for A Level have increased steadily and we have been able to maintain a further maths class despite many schools no longer offering this option.

The uptake of STEM degree courses of those students who have studied maths and/or further maths has increased, a further sign that we are engaging and enthusing students in mathematics. Applications to Oxbridge for maths courses have also begun to increase.

To ensure that the curriculum is fit for purpose and being delivered consistently, the Head of Department has in place a rigorous quality assurance program. All teachers are observed formally twice a year and classes are regularly dropped in on by both the Head of maths and the second in maths to ensure quality provision. Work scrutiny is also conducted for each year group in order to provide another indication of quality for all. The Schemes of work and specifications are regularly reviewed by the Department and alterations made as appropriate.

Whole school Quality Assurance monitoring has noted that the maths Department has a consistent focus on developing positive perceptions of maths and that their work in the classroom is informed by the practice of Carol Dweck.

Growth mindset approaches, and strategies for developing resilience in the face of challenge, are consistently used by all members of the Department and strongly support the whole school initiative to develop students' ability to take risks and challenge themselves.

By the end of Year 7 students will know/be able to:

- Perform all numerical calculations with an efficient method that always works.
- Begin to work with algebra to solve simple equations
- Find the perimeter, area and volume of simple shapes
- Analyse data from lists using the averages and simple diagrams to summarise the information
- Begin to understand the probability scale and perform probability calculations for single events
- Solve problems posed in real life contexts that use various mathematical skills from the 6 main areas but with a greater focus on number

By the end of Year 8 students will know/be able to:

- Perform multiple step calculations with ease
- Use algebra more effectively to solve problems and generalise with linear functions
- Find the perimeter, area and volume of increasingly complex shapes
- Learn, use and apply Pythagoras theorem
- Analyse grouped data using the averages and simple diagrams to summarise the information
- Solve problems posed in real life contexts that use various mathematical skills from the 6 main areas but with an increasing focus on the use of algebra and generalisation

By the end of Year 9 students will know/be able to:

- Understand the effects of rounding within calculations on the accuracy of solutions. Extend algebraic knowledge to solve quadratic and simultaneous equations
- Learn, use and apply the trigonometric ratios
- Develop understanding of probability in order to perform probability calculations for multiple events
- Solve problems posed in real life contexts that use various mathematical skills from the 6 main areas

By the end of Year 10 students will know/be able to:

- To understand the ideas of limits within calculations
- Further extend algebraic knowledge to solve polynomial equations
- Deepen understanding of the trigonometric ratios to include non-right angled triangles
- Work with conditional probability
- Solve complex problems posed in real life contexts that use various mathematical skills from the 6 main areas

By the end of Year 11 students will know/be able to:

- Solve increasingly complex problems posed in real life contexts that use various mathematical skills from the 6 main areas

By the end of Year 12 students will know/be able to:

- Develop algebraic knowledge further so that polynomials can be simplified and solved
- Begin to explore differentiation and integration
- Deepen their understanding of trigonometry and its applications
- Learn about discrete probability distributions and the part they play in making predictions for real life scenarios
- Develop mechanics knowledge of Newton's Laws and apply them to real life problems

By the end of Year 13 students will know/be able to:

- Develop their understanding of differentiation and integration
- Deepen their understanding of trigonometry and its applications including the use of radians
- Learn about continuous probability distributions and the part they play in making predictions for real life scenarios
- Deepen mechanics knowledge to include projectiles and the effect of friction

2. Cross Curricular links

Links to other subjects are apparent throughout the delivery of mathematical concepts. This includes:

- Use of scientific formulae when delivering rearranging formulae, substituting into formulae or problem solving in context.
- Use of compound measures in science
- Conversion of units in science and D&T
- Use of technology based problems with regard scale drawings.
- Use of geographical data to analysis for statistics teaching.
- Use of grids and coordinates to read maps.
- Use of symmetry, perspective and ratio in art contexts.
- Use of PE data to look at PB's

On a different scale, the mathematics department have worked with the Hummingbird team on analysis of performance data to develop the car.



3. CURRICULUM & ASSESSMENT OVERVIEW: MATHS

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
KEY STAGE 3						
Year 7	<p>Topic(s): Number-BIDMAS, general calculations, squares, roots and indices.</p> <p>Assessment: Summative</p>	<p>Topic(s): Handling data- introduction to probability. Algebra –simplifying algebraic expressions and substitution. Geometry- coordinates in 2D and 3, recognise linear graphs in the form $y=a$ or $x=b$</p> <p>Assessment: Summative</p>	<p>Topic(s): Algebra – solve linear equations. Geometry- views, nets, shape properties, conversion of units</p> <p>Assessment: Summative</p>	<p>Topic(s): Geometry – area and perimeter of simple shapes, constructions, angle facts, symmetry and shape transformations.</p> <p>Assessment: Summative</p>	<p>Topic(s): Number- fractions, ratio, simple percentages, equivalences of fractions, decimals and percentages.</p> <p>Assessment: End of Year Summative</p>	<p>Topic(s): Handling data – collection and interpretation of data. Conversion graphs</p> <p>Assessment: Basic Skills review and Problem solving.</p>
Year 8	<p>Topic(s): Number - fractions, index laws, standard form. Geometry- angles and bearings.</p>	<p>Topic(s): Algebra- expand brackets, factoring, solving inequalities, sequences. Geometry - recognise linear graphs in the form $y=mx+c$</p>	<p>Topic(s): Algebra – form and solve equations including fractions, brackets and powers. Geometry- solve problems involving speed, distance and time.</p>	<p>Topic(s): Geometry- area and perimeter of circles, complex shape transformations and Pythagoras</p>	<p>Topic(s): Geometry- volume and surface area of prisms, density calculations.</p>	<p>Topic(s): Handling data – further in-depth collection and interpretation of data.</p>

	Assessment: Summative	Assessment: Summative	Assessment: Basic Skills review and Problem solving.	Assessment: Summative	Assessment: End of Year Summative	Assessment: Formative data project
Year 9	Topic(s): Number – significant figures, percentages, compound interest. Algebra – index laws with algebra, trial and improvement methods. Assessment: Summative	Topic(s): Algebra – expand multiple brackets, rearranging formulae, construct and solve simultaneous equations. Geometry – enlargements. Assessment: Summative	Topic(s): Algebra – solving more complex equations, solving two step inequalities, factorise and solve quadratics. Assessment: Basic Skills review and Problem solving.	Topic(s): Handling data -calculating averages from grouped data, displaying data in diagrams and probability. Assessment: Summative	Topic(s): Geometry - constructions, scale diagrams, loci, 3D Pythagoras, trigonometry. Assessment: End of Year Summative	Topic(s): Geometry – circle theorems, surface area and volume of pyramids and cones. Assessment: Formative homework sheets
KEY STAGE 4						
Year 10	Topic(s): Number – limits of calculations, reciprocals, surds, proportionality, recurring fractions to decimals and vice versa. Assessment(s): Summative	Topic(s): Algebra – expand multiple brackets and factorise, solve quadratic equations, work with algebraic fractions. Geometry - plot linear inequalities. Assessment(s): Basic Skills review	Topic(s): Algebra – Sequences, solving simultaneous equations using multiple methods. Geometry - Plot various functions and use graphs to solve equations. Assessment(s): Summative	Topic(s): Geometry – circle theorems, arc length, sectors, similarity Assessment(s): Summative	Topic(s): Geometry – trigonometry using the sine and cosine rules, dimensional analysis. Handling data –moving averages and time series. Assessment(s): Summative	Topic(s): Handling data - study of probability involving tree and Venn diagrams, conditional probability. Assessment(s): End of Year MOCK

		<i>and Problem solving.</i>				EXAM
Year 11	<p><i>Topic(s): Geometry – surface area and volume and vectors.</i></p> <p>Algebra- numerical solutions, SUVAT equations, form and solve equations in context.</p>	<p><i>Topic(s):Revision – preparation for the mock exam, this will include key topics identified from the end of year 10 assessment alongside exam technique and revision strategies.</i></p>	<p><i>Topic(s):Number – rationalise the denominator.</i></p> <p>Geometry – exact values of trigonometric functions, solve trigonometric equation and use the equation of a circle.</p>	<p><i>Topic(s): Mixed</i></p> <p><i>Each class will have their own scheme of learning based on their need following the mocks</i></p>	<p><i>Topic(s): Mixed</i></p> <p><i>Each class will have their own scheme of learning based on their need following the mocks</i></p>	GCSE EXAMS
	<p><i>Assessment(s):</i> Summative</p>	<p><i>Assessment(s):</i> MOCK EXAM</p>	<p><i>Assessment(s):</i> Summative</p>	<p><i>Assessment(s):</i> Summative</p>	<p><i>Assessment(s):</i> Summative</p>	
KEY STAGE 5						
Year 12	<p><i>Topic(s):</i></p> <p>Pure – Indices and surd, trigonometry, quadratics, simultaneous equations and inequalities, polynomials.</p> <p>Stats – The data cycle, summary statistics,</p> <p>Mechanics- Kinematics and vectors</p>	<p><i>Topic(s):</i></p> <p>Pure – binomial expansion</p> <p>Stats – The data cycle, representing data, permutations and combinations</p> <p>Mechanics- Kinematics, vectors and forces and Newton’s Laws</p>	<p><i>Topic(s):</i></p> <p>Pure – calculus: differentiation</p> <p>Stats – Probability, Binomial Distribution, Hypothesis testing</p>	<p><i>Topic(s):</i></p> <p>Pure – integration, coordinate geometry</p> <p>Mechanics – Variable acceleration</p>	<p><i>Topic(s):</i></p> <p>Pure –Graph transformations, sequences and series</p>	<p><i>Topic(s):</i></p> <p>Pure – logarithms, exponentials, further differentiation and integration</p>
			<p><i>Assessment(s):</i></p>	<p><i>Assessment(s):</i></p>		<p><i>Assessment(s):</i> Formative</p>

	Assessment(s): Formative	Assessment(s): Formative	Formative	END of YEAR MOCK	Assessment(s): Formative	
Year 12 Further Maths	Topic(s): Pure – Statistics - <i>Binomial distribution, discrete random variables</i>	Topic(s): Pure - Statistics – Poisson Distribution, Uniform and Geometric Distributions	Topic(s): Pure - Statistics – <i>Bivariate Data analysis, PMCC, LSR, Rank correlation</i>	Topic(s): Pure - Statistics – Chi squared distribution and good ness of fit	Topic(s): Pure - Statistics – <i>Conditional Probability, Bayes theorem, Normal Distribution</i>	Topic(s) Pure - Statistics – <i>Continuous random variables</i>
	Assessment(s): Formative	Assessment(s): Formative	Assessment(s): Formative	Assessment(s): Formative	Assessment(s): Formative	Assessment(s): MOCK EXAM
Year 13	Topic(s): Pure – partial fractions and further binomial expansion, numerical methods	Topic(s): Pure –Further differentiation, functions Stats – probability distributions Mechanics – kinematics and projectiles	Topic(s): Pure – Further integration, trigonometry Stats – hypothesis testing	Topic(s): Pure – differential equations, trigonometric functions Mechanics- forces and motion, friction	Topic(s): Pure – Parametric equations Mechanics – moments Revision	AL EXAMS
	Assessment(s): Formative	Assessment(s): Formative	Assessment(s): MOCK EXAM	Assessment(s): Formative	Assessment(s): Summative	
Year 13 Further Maths	Topic(s): Pure –vectors, matrices, series and induction Statistics - <i>Expectation algebra,</i>	Topic(s): Pure –further calculus, polar coordinates, Maclaurin series Statistics-	Topic(s): Pure –Hyperbolic functions, first order differential equations Decision- <i>algorithms and</i>	Topic(s): Pure – complex numbers, second order differential equations Decision-network	Topic(s): Pure -REVISE Decision- simplex method	AL EXAMS

	<i>confidence intervals, hypothesis testing</i>	<i>simulation</i>	<i>modelling with graphs and networks</i>	<i>algorithms, linear programming</i>		
	<i>Assessment(s): Formative</i>	<i>Assessment(s): Formative</i>	<i>Assessment(s): Formative</i>	<i>Assessment(s): Formative</i>	<i>Assessment(s): Summative</i>	



4. PROGRESSION IN MATHS

	Grade	Number	Algebra	Ratio, proportion, rates of change	Geometry and measures	Probability	Statistics
Mastering	9		Expression, equations and formulas - solve equations that use function notation; understand, interpret and use composite function $fg(x)$ and the inverse $f^{-1}(X)$.	Set up, solve and interpret the answers in growth and decay problems, including compound interest and work with general iterative processes; understand that some iterations may have a limiting value	Vectors- recognise when three or more points are collinear using vectors; use vectors to show three or more points re collinear		Identify outliers from the data set via the use of the mean ± 2 st dev
	9-	Apply and interpret limits of accuracy, including upper and lower bounds, use bounds appropriately to achieve an overall maximum or minimum for a situation	Solve linear inequalities in one or two variable(s), and quadratic inequalities in one variable	Interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rate of change	Know and apply the sine rule and cosine rule, to find unknown lengths and angles, find the area of any triangle		

	8+	Modelling using exponential and trigonometrical functions	Sequences- use suffix notation in recursive formula: find approximate solutions using recursive formulae	Interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion	Transformations applied to any graph and the sine and cosine functions		
	8	Using surds to solve trigonometric problems and other problems leaving answers in exact form.	Solve two simultaneous equations in two variables linear/quadratic algebraically; find approximate solutions using a graph	Understand that X is inversely proportional to Y is equivalent to X is proportional to 1/Y ;	Proofs of key circle theorems	Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams	
	8-	Simplify surd expressions involving squares (e.g. $\sqrt{12} = \sqrt{4 \times 3} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$) and rationalise denominators	Translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s)	Compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors	Trigonometry - use trigonometric ratios in 3D contexts, including finding the angles between a line and a plane, recall Pythagoras in 2D and 3D		

	7+	Calculate with negative integer and negative fractional indices	Solve quadratic equations algebraically by factorising, by completing the square (sketching the graph as well) and by using the quadratic formula; find approximate solutions using a graph	Calculate the area under a graph	Know the shapes of the trigonometric functions; use the graphs to find all values in a given range		
	7	Change recurring decimals into their corresponding fractions and vice versa	Interpret simple expressions as functions with inputs and outputs; interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function'	Solve problems involving direct and inverse proportion, including graphical and algebraic representations	Similarity- compare the areas and volumes of similar shapes or solids, knowing that $a:b$ is the ratio of lengths, then $a^2:b^2$ is the ratio of areas etc.		Find the median from grouped data

3. PROGRESSION IN MATHS

	Grade	Number	Algebra	Ratio, proportion, rates of change	Geometry and measures	Probability	Statistics
Securing	7-	Understand the definition of a rational and irrational number. Simplify surd expressions. Calculate with roots and simplify surds	Sequences - work out the value of the nth term of a quadratic sequence for any given n; work out a formula for the nth term of a sequence; state whether or not a term is in a given sequence.	'number of parts per hundred'; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively	Apply the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results		Construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs
	6+	State limits of accuracy, including upper and lower bounds, estimate answer to one or two step calculations with the use of rounding numbers	Recognise power and exponential graphs from their equations. Interpret these graphs in terms of roots, intercepts and turning points, rates of change in the gradient	Graphs- work out the gradient of lines that are parallel and perpendicular to a given line	x vectors by a scalar, and diagrammatic and column representations of vectors; use vectors to construct geometric arguments and proofs		
	6	Use index laws to simplify expressions with numbers	Use index laws to simplify expressions including algebraic expressions	Use compound units such as speed, rates of pay, unit pricing, density and pressure	Solve simple geometrical problems in 2D using vector methods; using properties of parallel vectors	Understand that samples may or may not be representative of a population; plot and interpret time series graphs	

6-	Use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5; estimate powers and roots of any given positive number		Use calculators to explore exponential growth and decay	Describe the changes and invariance achieved by combinations of rotations, reflections and translations, construct enlargements with negative scale factors	Enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams	Find the mean, mode, median and range of grouped data
5+	Calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer	Sequences - work with Fibonacci type sequences, know how to continue the terms of a quadratic sequence.	Match direct and inverse proportion graphs to their equations and vice versa, draw graphs to present proportional change	Recall/know how to find the exact values of sine, cosine and tan for 0, 30, 45, 60 and 90 degrees.	Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations	Interpret, analyse and compare the distributions of data sets from univariate empirical distributions
5	Understand the term reciprocal and that when a number is multiplied by its reciprocal the answer is 1	Multiply two linear expressions, such as $(2x+3)(3x+4)$. Factorise and solve quadratics of the form $x^2+bx+c=0$	FDP, solve compound interest problems	Construct enlargements with fractional scale factors		
	Calculate - convert mixed numbers to improper fractions and add and subtract mixed numbers	Solve two simultaneous equations in two variables both linear, find approximate solutions using a graph		Work out the area, volume, surface area of spheres, pyramids and cones, and other compound solids		Construct a box plot from a list of data

		Apply systematic listing strategies, including use of 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 $m \times n$ ways)	Recognise quadratic and cubic graphs from their equations. Interpret quadratic graphs in terms of roots, intercepts and turning points, rates of change in the gradient	Relate ratios to fractions and to linear functions	Know the formulae for: Pythagoras' theorem $a^2 + b^2 = c^2$, recall and use it to solve problems	Construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities	Identify outliers from the data set via the use of the $UQ/LQ \pm 1.5 QR$
Emerging	5-	Divide a fraction by another fraction. Multiply a fraction by another fraction	Understand and use standard mathematical formulae; rearrange formulae to change the subject	Understand and use proportion as equality of ratios	Understand congruence and identify shapes that are congruent: work out the side of one shape that is similar to another given the ratio or scale factor; use the conditions of SSS, SAS and ASA and RHS	Understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size	

4+	Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding	Know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments and proofs		Constructions and loci and scale drawings		Use and interpret scatter graphs of bivariate data; recognise correlation, line of best fit to investigate the data further
4	Use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate	Recognise that equations of the form $y=mx+c$ correspond to straight line graphs.		Know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2 , calculate areas of sectors and segments		Use tables and lists or diagrams to find the mean, mode, median and range
4-	Use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem	Simplifying expressions involving sums, products and powers, including the laws of indices	Divide a given quantity into two parts in a given part:part or part:whole ratio	Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines	Apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one	Interpret and construct stem and leaf diagrams

3+	Estimate answers; check calculations using approximation and estimation, including answers obtained using technology, including those estimates of roots, adapt calculations such as $6 \div 0.2$ to $60 \div 2$	Sequences - describe a sequence in words, state the next term in a sequence, work out the value of the nth term of a linear sequence for any given n; work out a formula for the nth term of a sequence; state whether or not a term is in a given sequence.		Area and Perimeter - work out the area and perimeter of a triangles, parallelograms, trapezium or of a compound shape		Interpret and construct pie charts
3	Identify and work with fractions in ratio problems	Factorise algebraic expressions by taking out common factors		Angles and Polygons - work out the size of missing angles in polygons: pentagons, hexagons, octagons and decagons		Interpret and construct multiple and dual bar charts
3-	Recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals.....BIDMAS	Understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors	Use ratio notation, including reduction to simplest form	Know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)	Relate relative expected frequencies to theoretical probability, using appropriate language and the 0–1 probability scale	Interpret and construct tables, charts and diagrams, including frequency tables and bar charts



PROGRESSION IN MATHS

	Grade	Number	Algebra	Ratio, proportion, rates of change	Geometry and measures	Probability	Statistics
Beginning	2+	Calculate percentage increase and decreases	Recognise that equations of the form $y=c$ and $x=c$ correspond to straight lines graphs, parallel to the axes.		Angles and Polygons - work out the size of missing angles at a point and on a straight line; recognise and name regular polygons: pentagons, hexagons, octagons and decagons	Listing outcomes systematically	Statistics - draw bar charts including composite bar charts, dual bar charts and multiple bar charts
	2	Interpret fractions and percentages as operators		Solve best buy problems	Scale drawings and unit conversion (metric to metric)		
	2-	Apply the four operations, including formal written methods, to integers, decimals and simple fractions, and mixed numbers	Substitute numerical values into formulae and expressions, including scientific formulae	Express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1	Use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)	Apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments	Drawing pictograms

1+	Multiply and divide whole numbers	Expand single brackets and solve simple equations		Area and Perimeter - work out the area and perimeter of a rectangle; calculate the area and perimeter of shapes drawn on a grid		Interpreting pictograms
1	Add and subtract whole numbers	Write expressions and collect like terms		3D shapes - identify and name common solids, for example cube, cuboid, prism, cylinder, pyramid, cone and sphere; draw nets and show how they fold to make a 3D solid	Probability - design and use two-way tables; list all the outcomes for a single event in a systematic way	Sorting data into groups...maybe early Venn diagrams
1-	Order positive and negative integers, decimals and fractions; use the symbols =, ≠, , ≤, ≥	Use algebraic manipulation, including: • ab in place of $a \times b$ • $3y$ in place of $y + y + y$ and $3 \times y$ • a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$, $a^2 b$ in place of $a \times a \times b$ • brackets	Change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units	Symmetry - understand line and rotational symmetry	Record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees	Basic tally and frequency table
0	Understand place value in whole numbers Recognise different types of numbers, odd, even, prime etc.	Introducing the use of letters as a variable	Examples of ratios used in everyday life	Name all 2D shapes. Finding lines of symmetry and completing shapes given their lines of symmetry	Comparing real life probabilities.... How likely is it? Number line positions of events	Data collection sheets, tally ticks

5. Feedback and Assessment system

Here is an example of the feedback and assessment forms that we use with students in KS3 and KS4.

Each student receives a sheet with the objectives for that half term, we ask students to highlight the “smiley face” which link to the school's BESM key words, based on how they feel about the upcoming objectives – this helps with ascertaining prior knowledge.

Yr 7 Scheme of Work Term 1

Learning Objectives	Before			
				
Understand place value; multiply and divide numbers by 10, 100, and 1000.				
Round positive numbers to the nearest 10, 100 or 1000, and decimals to the nearest whole number or to a given number of decimal places.				
Understand the terms factors and multiples and use simple tests of divisibility. Know the primes below 30.				
Recognise squares of numbers up to 15, cubes to 5 and the corresponding roots. Recognise the first few triangle numbers.				
Express numbers as the product of their prime factors.				
Find the HCF and LCM of pairs of numbers.				
Understand negative numbers as positions on a number line and be able to use them in calculations.				
To be able to add, subtract, multiply and divide numbers of any size (integers, decimals, negatives)				
Use BIDMAS for the order of operations in calculations.				
Calculations – mixed word problems. Make and justify estimations of calculations.				
Use the index laws – with numbers only				

Once the half term assessment has been completed then we ask students to complete the sheet below.

This allows them to reflect on their performance both in the assessment as well as across the half term. Students reflect on what went well as well as those areas that they need to improve on. As teachers we are looking for progress to have been made in all objectives from before to after.

We set targets for students to work on in their DIRT lessons, they set targets for themselves in order to improve on those areas that they and we have identified.

Yr 7 Scheme of Work Term 1

On my end of half term test I scored%

My thoughts on my result;

WWW

EBI/Areas for development

Learning Objectives	After			
				
Understand place value; multiply and divide numbers by 10, 100, and 1000.				
Round positive numbers to the nearest 10, 100 or 1000, and decimals to the nearest whole number or to a given number of decimal places.				
Understand the terms factors and multiples and use simple tests of divisibility. Know the primes below 30.				
Recognise squares of numbers up to 15, cubes to 5 and the corresponding roots. Recognise the first few triangle numbers.				
Express numbers as the product of their prime factors.				
Find the HCF and LCM of pairs of numbers.				
Understand negative numbers as positions on a number line and be able to use them in calculations.				

To be able to add, subtract, multiply and divide numbers of any size (integers, decimals, negatives)				
Use BIDMAS for the order of operations in calculations.				
Calculations – mixed word problems. Make and justify estimations of calculations.				
Use the index laws – with numbers only				

Teachers Comments

My Targets for improvement are;

Parents comment/signature

<p><u>SMART</u></p> <p>S = Specific</p> <p>M = Measurable</p> <p>A = Attainable</p> <p>R = Relevant, Rigorous, Realistic, and Results Focused</p> <p>T = Timely and Trackable</p>	<ul style="list-style-type: none"> • Use mymaths to review..... • Use the lunchtime drops in sessions in room 1 to work with a maths captain on the topic of • To ask my teacher for a worksheet on • If I finish the test before the time is up, CHECK my work more thoroughly • To change the way I revise, make sure I do questions when I am revising rather than simply reading through my exercise book
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Yr 10 Scheme of Work Term 5

Prior knowledge:

Calculate averages from lists of data. Draw and interpret line graphs and bar charts.

Draw and measure bearings accurately.

Use Pythagoras' theorem in 3-D problems. Use trigonometry ratios in right angled triangles.

Learning Objectives	Before			
Apply trigonometric ratios including the sine and cosine rules to find missing lengths and angles.				
Derive and apply area = $\frac{1}{2} ab \sin C$ to calculate areas.				
Use trigonometry in 3-D problems.				
Identify which formulae are related to lengths, area and volume by dimensional analysis.				
Construct and interpret moving average time series, extrapolate data using trends.				
Construct and interpret histograms with equal and unequal class widths.				
Construct and interpret distance/speed/time graphs from real life problems.				
Calculate the area under the graph and interpret results in cases such as velocity-time graphs				

Yr 10 Scheme of Work Term 5

On my end of half term test I scored%

My thoughts on my result;

WWW.....

EBI/Areas for development.....

Learning Objectives	After			
Apply trigonometric ratios including the sine and cosine rules to find missing lengths and angles.				
Derive and apply area = $\frac{1}{2} ab \sin C$ to calculate areas.				
Use trigonometry in 3-D problems.				
Identify which formulae are related to lengths, area and volume by dimensional analysis.				
Construct and interpret moving average time series, extrapolate data using trends.				
Construct and interpret histograms with equal and unequal class widths.				
Construct and interpret distance/speed/time graphs from real life problems.				
Calculate the area under the graph and interpret results in cases such as velocity-time graphs				

Teachers Comments

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My Targets for improvement are;

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Parents comment/signature

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<p><u>SMART</u></p> <p>S = Specific</p> <p>M = Measurable</p> <p>A = Attainable</p> <p>R = Relevant, Rigorous, Realistic, and Results Focused</p> <p>T = Timely and Trackable</p>	<ul style="list-style-type: none">• Use mymaths to review.....• Use the lunchtime drops in sessions in room 1 to work with a maths captain on the topic of• To ask my teacher for a worksheet on• If I finish the test before the time is up, CHECK my work more thoroughly• To change the way I revise, make sure I do questions when I am revising rather than simply reading through my exercise book
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