Hartland High School Curriculum Overview - Mathematics

Every student will climb their own personal mountains to the very best universities in the country or careers of their choosing. We achieve this through the following curriculum, filled with powerful knowledge and expertly delivered.

	Unit 1	Unit 2	Unit 3
Year 7	**Topics: Number, Factors Multiples & Primes, Accuracy, Fractions**	**Topics: Algebraic Manipulation, Units of Measure, Mensuration, Ratio, Percentages, Solving Equations, Sequences**	**Topics: Angles, Perimeter & Area, Average & Spread, Representing Data, Probability**
	GQ: What are the appropriate calculation strategies to solve increasingly complex problems?	GQ: How to use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships?	GQ: How would you analyse data with graphical and diagrammatic representations?
	Example: *Write "seven hundred twenty-three thousand, four hundred fifty-six" in digits.* *A book costs £12.99, and a pen costs £3.49. What is the total cost of 3 books and 5 pens?* *Simplify 18/24 to its lowest terms.* *What is 6²?*	Example: *Convert 5 kilometers into meters and centimeters.* *Divide £120 in the ratio 3:2* *What is 15% of £250?* *Simplify: 3(y + 2) - 5*	Example: *What is angle x if one angle is 65°?* *Find the perimeter and area. Length = 12 cm, width = 5 cm.* *Find the mean and range: 45, 52, 48, 55, 50.* *What's the probability of picking red? (5 red, 3 blue, 2 green balls)*
	IP Q's: *A number is divisible by 2, 3, and 5. What is the smallest number that satisfies this co*	IP Q's: *If the ratio of boys to girls in a class is 5:4 and there are 36 students, how many are boys?* *If a population increases by 12% from 50,000, what is the new population?*	IP Q's: *Interpret the pie chart showing the percentage distribution of students' favourite subjects: Maths (40%), Science (30%), English (20%), History (10%)* *A dice is rolled. What is the probability of rolling a number greater than 4?*

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Year 8	Topics: Place Value, Order of Operations, Negative Numbers, Roots and Powers, Primes Factors and Multiples, Fractions, Probability	Topics: Calculate Area and Perimeter, Area and Circumference of Circles, Sequences, Algebraic Manipulation, Solving and Changing the Subject, Linear Graphs	Topics: Percentages, Ratio, Proportion, Angles, Constructions, Similarity and Congruence, Averages
	GQ: What are the appropriate calculation strategies to solve increasingly complex problems?	GQ: How to use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships?	GQ: How would you analyse data with graphical and diagrammatic representations?
	Example: *Calculate: 6 + 3 × 4 - 2* *Work out: -5 + 8* *Find the value of 3^4* *List all the factors of 24* *Simplify: 12/18* *A bag contains 3 red balls and 5 blue balls. What is the probability of picking a red ball?*	Example: *What is the area and perimeter of a rectangle with length 8 cm and width 5 cm?* *Find the area and circumference of a circle with radius 7 cm.* *What is the next term in the sequence: 3, 7, 11, 15, ...?* *Expand and simplify: 3(x + 4) + 2(x - 1)* *Solve for x: 5x - 3 = 17* *Make t the subject of the formula: v = u + at*	Example: *What is 15% of 80?* *Simplify the ratio 12:18* *If 5 pens cost £3, how much do 8 pens cost?* *Find the size of the missing angle in a triangle with angles 65° and 48°* *Two triangles have sides in the ratio 2:3. If the smaller triangle has a base of 4 cm, what is the base of the larger triangle?* *Find the mean of the following numbers: 5, 8, 12, 15, 10*
	IP Q's: *Divide (45.678) by (0.123) and round your answer to three decimal places. Explain how you handle the decimal point during division* *A number is divisible by 2, 3, and 5 but not by 7. List three such numbers and explain your reasoning*	IP Q's: *If the ratio of sugar to flour in a recipe is 2:5 and you have 500g of flour, how much sugar do you need?* *If a tank fills at a rate of 20 liters per minute, how long will it take to fill a 500-liter tank?*	IP Q's: *A car's value depreciates by 15% each year. If the car is worth £20,000 now, what will its value be after 2 years?* *Solve the inequality: (2x - 4 > 8), and represent the solution on a number line*

Year 9	Topics: Place Value, Primes Factors and Multiples, Index Laws and Standard Form, Fractions, FDP, Percentages	Topics: Probability, Expanding and Factorising, Algebraic Manipulation, Solving Equations, Inequalities, Substitution and Rearranging, Linear Graphs, Non-Linear Graphs	Topics: Area and Volume, Angles, Pythagoras and Trigonometry, Transformations, Representing Data
	GQ: What are effective approaches for solving increasingly challenging mathematical problems efficiently and accurately?	GQ: How does algebra allow us to explore the structure of arithmetic? What patterns does it reveal, and how can it help us express mathematical relationships more effectively?	GQ: How can data be better understood through graphs and diagrams? What patterns, relationships, or trends might these visual tools reveal, and how do they enhance the analysis process?
	Example: *What is the value of the digit 5 in the number 37,854?* *What is the highest common factor (HCF) of 18 and 24?* *Simplify: $2^3 \times 2^5$* *Calculate: 3/4 + 2/5* *Convert 0.65 into a fraction and a percentage.* *Increase 120 by 15%*	Example: *A fair dice is rolled. What is the probability of getting a number greater than 4?* *Simplify: 4a + 3b - 2a + 5b* *Solve the inequality: 2x - 5 > 9* *If y = 3x - 4, find the value of y when x = 5.* *Sketch the graph of $y = x^2$*	Example: *Find the size of angle x when two parallel lines are cut by a transversal and the corresponding angle is 115°.* *A right-angled triangle has sides of 5 cm and 12 cm. Find the length of the hypotenuse.* *Describe the transformation that maps triangle A with vertices (1,2), (3,2), (1,4) to triangle B with vertices (2,4), (6,4), (2,8).*
	IP Q's: *If two bells ring every 12 minutes and 18 minutes, how often will they ring together?* *Two angles are supplementary, and one is twice the size of the other. What are the angles?*	IP Q's: *Using only a compass and straightedge, construct a 60° angle and describe the steps.* *If 5 pencils cost £2, how much would 12 pencils cost? Solve using proportion.*	IP Q's: *A jacket is discounted by 15%, and its original price was £80. Find the sale price and explain the calculation.* *Rotate a triangle with vertices ((1, 2), (3, 2), (2, 4)) by 90° clockwise about the origin. What are the new coordinates?*

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Year 10	**Topics: Product Rule, Bounds, Standard Form, Surds, Recurring Decimals, Growth and Decay, Solving Linear Equations, Changing the Subject, Equation of a Straight Line, Factorising and Solving Quadratics, Sequences, Integers and Place Value, Rounding, Indices, Algebraic Manipulation, Expanding Factorising and Substitution, Fractions, FDP, Percentages**	**Topics: Non-Linear Graphs, Simultaneous Equations, Linear Inequalities, Quadratic Inequalities, Algebraic Fractions, Pythagoras and Trigonometry, Vectors, Charts and Tables, Pie Charts, Percentages, Equations and Inequalities, Sequences, Angles**	**Topics: Interpreting Data, Ratio and Proportion, 2D shapes, Advanced Data, 3D shapes, Similarity and Congruence, Probability, Area and Volume, Straight Line, Pythagoras and Trigonometry**
	GQ: 1.1 How are factors and multiples used to solve everyday problems? 1.2 How can algebra be applied to solve real-world problems? 1.3 How does rounding impact the precision of calculations? 1.4 Why are the laws of indices important for simplifying expressions? 1.5 How can you calculate the volume of 3D shapes like spheres and cones?	GQ: 1.1 How are formulas applied to calculate areas and perimeters of shapes? 1.2 What is the significance of direct and inverse proportion in solving real-world problems? 1.3 Why are percentage increases and decreases useful in everyday scenarios? 1.4 How can equations be used to model and solve real-world situations?	GQ: 1.1 How do you solve simultaneous equations involving both linear and quadratic expressions? 1.2 What are the causes, impacts and responses to two contrasting extreme weather events? 1.3 How can unit conversions be applied effectively when working with compound units? 1.4 How are 2D shapes represented in 3D space, and what is the importance of nets in visualising 3D objects?
	Example: *Expand: (x + 3)(x - 2)(x + 1)* *A rectangle has length 5.7 cm (to 1 d.p.). What are the lower and upper bounds?* *Write 0.00456 in standard form.* *Simplify: $\sqrt{18} + \sqrt{8}$*	Example: *Sketch the graph of $y = x^2 - 4x + 3$* *Solve the simultaneous equations: 2x + y = 10 and x - y = 2* *Solve the inequality: $3x - 5 \leq 7$ and represent the solution on a number line.*	Example: *A recipe for 4 people uses 300g of flour. How much flour is needed for 7 people?* *Find the area of a trapezium with parallel sides 8 cm and 12 cm, and height 5 cm.* *Two shapes are similar with a scale factor of 3. If the area of the smaller shape is 16 cm²,*

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Express 0.7̇ as a fraction. *A car depreciates by 12% each year. If it costs £15,000 now, what will it be worth after 3 years?*	*Simplify: (x² + 3x)/(x + 3)* *A right-angled triangle has an angle of 35° and a hypotenuse of 10 cm. Find the length of the opposite side.*	*what is the area of the larger shape?* *A bag contains 5 red, 3 blue and 2 green counters. Two counters are picked without replacement. Find the probability both are red.* *Calculate the volume of a cylinder with radius 4 cm and height 10 cm.*
IP Q's: How are HCF & LCM applied in problem-solving? *What is the difference between rounding to significant figures and decimal places?*	*IP Q's: How do quadratic equations differ from linear equations, and how are they solved?* *Solve (x^2 - 5x + 6 = 0) by factorisation and verify the roots.*	*IP Q's: What are the methods for solving equations with algebraic fractions, and why are they useful?* *What are the similarities and differences between calculating area for 2D shapes and surface area for 3D objects?*

Year 11	Topics: Factors Multiples and Primes, Fractions, Expressions, Equations, Simultaneous Equations, Angles, Pythagoras and Trig, Surface Area and Volumes, Statistical Diagrams, Probability, Inequalities, Vectors, Percentages, Surds, Algebraic Fractions, Rationalising, Trig Graphs, Circle Theorems, Sine and Cosine Rule, Histograms	Topics: Functions, Transformations, Iteration, Algebraic Proofs, Similarity, Geometric Proofs	Topics: Revisions & GCSE exams
			1. Structured Revision Plan
			2. Practicing Past Papers
			3. Strengthening Weak Areas
			4. Mastering Exam Techniques
			5. Using Revision Tools
	GQ: 1.1 What are the key properties of circles, including radius, diameter, and circumference?	GQ: 1.1 What are the four main types of transformations, and how do they change the position, orientation, or size of a shape?	6. Staying Motivated
	1.2 How can Venn diagrams be used to represent sets and probabilities?	1.2 How can the properties of similar shapes be used to calculate unknown sides or angles?	
	1.3 What is the process for finding the nth term of a quadratic sequence?	1.3 What is the significance of addition, subtraction, and scalar multiplication of vectors in problem-solving?	
	1.4 How can graphs be used to represent and solve equations or inequalities?	1.4 What strategies can be applied to perform well under timed conditions during mock exams?	
	1.5 What are the advantages and limitations of using iterative techniques in problem-solving?		
	Example: *Calculate: 2/3 × 3/5*	Example: *Describe the transformation that maps the graph $y = x^2$ to $y = (x - 3)^2$.*	
	Simplify: 5x + 3y - 2x + 4y	*Use the iteration formula $x_{n+1} = \sqrt{(2x_n + 3)}$ with $x_0 = 2$ to find x_1 and x_2.*	
	Solve the simultaneous equations: x + 2y = 8 and 3x - y = 5		
	A triangle has angles of 72° and 45°. Find the third angle.	*Prove that the sum of any two consecutive odd numbers is*	

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In a right-angled triangle, the opposite side is 7 cm and the adjacent side is 5 cm. Find the angle using tan.

Find the surface area of a cube with side length 6 cm.

A histogram shows class intervals 0-10, 10-20, 20-30 with frequency densities 2, 5, 3.
How many values are in the 10-20 interval?

IP Q's: A fair die is rolled twice. What is the probability of rolling a total greater than 7 or getting the same number on both rolls?

How can the nth term formula of a quadratic sequence be derived from its terms?

always even.

Two triangles are similar. The smaller triangle has sides 4 cm, 6 cm, 8 cm. If the longest side of the larger triangle is 12 cm, find the other two sides.

Prove that the angle in a semicircle is always 90°

IP Q's: What are the criteria for triangles and other polygons to be similar?

How are vectors used to represent movement in terms of magnitude and direction?

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Year 12 (Unit 1)	**Pure Mathematics**
	Pure Maths forms the backbone of advanced mathematical understanding, emphasizing logical reasoning and abstract concepts. Topics include:
	• **Quadratic Functions:** Explore the nature of parabolas, roots, and the discriminant for solving quadratic equations.
	• **Simultaneous Equations:** Solve systems of equations algebraically or graphically.
	• **Inequalities:** Analyse inequalities using graphical methods and algebraic techniques.
	• **Polynomial Equations and Graphs:** Understand polynomial functions and their graphical behaviour.
	• **Coordinate Geometry:** Study lines and circles, including equations and geometric properties.
	• **Indices and Surds:** Master simplifying expressions involving powers and irrational numbers.
	• **Transformations of Graphs:** Investigate shifts, stretches, reflections, and combinations of graph transformations.
	• **Trigonometry:** Delve into trigonometric identities, graphs, and solving equations.
	• **Binomial Expansion:** Discover the expansion of binomial expressions using Pascal's triangle and algebra.
	• **Vectors in 2-D:** Learn vector representation, operations, and geometric applications.
	Introduction to Calculus: Understand differentiation and integration, foundational tools for analysing change and area.
	Statistics
	Statistics introduces techniques to manage and interpret data, preparing students for quantitative reasoning in diverse fields:
	• **Data Processing, Presentation, and Interpretation:** Organise raw data, present it graphically, and derive meaningful interpretations.
	• **Probability:** Understand theoretical and experimental probability, including conditional probability and independence.
	Mechanics
	Mechanics bridges mathematics and physics, focusing on modeling real-world motion:

	● **Introduction to Modelling:** Build mathematical models to represent physical phenomena. ● **Travel Graphs:** Analyse journeys using distance-time and velocity-time graphs. **Motion under Constant Acceleration:** Explore the equations of motion to predict and describe linear movement.
Year 12 (Unit 2)	**Pure Mathematics** Pure Maths extends foundational concepts to more advanced techniques, emphasizing their utility in problem-solving: ● **Differentiation Techniques and Applications:** Learn advanced differentiation techniques and use them to solve problems involving tangents, rates of change, and optimization. ● **Integration:** Understand integration as the reverse of differentiation and apply it to calculate areas under curves. ● **Exponentials and Logarithms:** Explore the properties and applications of exponential growth/decay and logarithmic functions. **Statistics** Statistics equips students with the tools to manage uncertainty and draw meaningful conclusions from data: ● **Statistical Distributions and Associated Probabilities:** Understand key distributions and their probabilities. ● **Binomial Distribution:** Study scenarios involving two possible outcomes and their probabilities. ● **Sampling Techniques:** Learn methods for collecting representative data samples. ● **Hypothesis Testing:** Use statistical tests to draw conclusions and evaluate claims. **Mechanics** Mechanics applies mathematical principles to physical problems, with a focus on motion and forces: ● **Force Diagrams:** Visualize forces acting on objects to solve equilibrium and motion problems. ● **Newton's Laws of Motion:** Explore the fundamental principles governing the relationship between forces and motion.

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	● **Connected Particles:** Solve problems involving systems of particles connected by strings or rods.
Year 12 (Unit 3)	**Pure Mathematics** Pure Maths continues to refine your skills in algebra, trigonometry, and functions, offering deeper insights and applications: ● **Trigonometry:** Study radians, trigonometric identities, and inverse functions to solve problems and analyse periodic behaviour. Explore into addition and double-angle formulae for more advanced applications. ● **Functions:** Explore domain and range, inverse and composite functions, modulus functions, and transformations to understand how functions behave and interact. ● **Formal Proof:** Develop logical rigor with formal proof techniques, including proof by contradiction, to validate mathematical statements. **Algebraic Fractions:** Master simplifying algebraic fractions, improper fractions, and partial fractions to streamline calculations and solve equations.

Year 13 (Unit 1)	**Pure Mathematics** Pure Maths introduces powerful techniques and concepts to explore more complex problems and mathematical structures: ● **Differentiation:** Master the chain rule, product rule, quotient rule, and applications to more intricate functions. Explore differentiation for inverse functions and implicit differentiation for deeper insights. ● **Sequences and Series:** Analyse arithmetic and geometric sequences using sigma notation and inductive definitions to identify patterns and relationships. ● **Parametric Equations:** Understand parametric equations and how they describe motion or other phenomena. ● **Binomial Expansion:** Extend binomial expansion to include negative or rational indices and connect it with partial fractions. ● **Integration:** Apply integration techniques, including substitution and more complex functions, to solve problems involving areas and accumulation. **Statistics** Statistics provides tools for interpreting data and understanding relationships, with a focus on: ● **Regression and Correlation:** Analyse relationships between variables and perform hypothesis testing to validate trends. ● **Probability:** Use conditional probability, standard formulae, and Venn diagrams to calculate and visualize likelihoods. **Mechanics** Mechanics bridges mathematics and physical principles, focusing on forces and motion: ● **Resolving Forces:** Break down forces into components to solve equilibrium and motion problems. ● **Friction and Inclined Planes:** Understand the role of friction and analyse motion on sloped surfaces. ● **Moments of Forces:** Study the turning effect of forces, including applications to uniform and non-uniform beams.

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Year 13 (Unit 2)	**Pure Mathematics** Pure Maths explores sophisticated techniques and applications for advanced mathematical problem-solving: ● **Differentiation:** Investigate points of inflection and related rates of change to analyse behaviour and dynamics in functions. ● **Integration:** Study integration techniques such as integration by parts, parametric integration, the use of partial fractions, and the trapezium rule for numerical estimation. ● **Vectors in 3-D:** Expand your understanding of vectors to three dimensions, exploring spatial problems and geometric applications. ● **Numerical Methods:** Develop problem-solving strategies using sign-change tests, iteration methods, and the Newton-Raphson technique for finding roots. ● **Differential Equations:** Solve equations involving rates of change and analyse real-world systems modelled mathematically. **Statistics** Statistics equips students with tools to analyse uncertainty and patterns in data, focusing on: ● **Normal Distribution:** Understand the properties of the normal distribution and calculate associated probabilities. ● **Hypothesis Testing (Normal Distribution):** Perform hypothesis testing using the normal distribution to draw conclusions and evaluate claims. **Mechanics** Mechanics applies mathematical techniques to the physical world, emphasizing motion and forces: ● **Constant Acceleration in 2-D Problems:** Use constant acceleration formulae to solve problems involving two-dimensional motion and its links with vectors. ● **Projectile Motion:** Analyse motion in two dimensions, including trajectory, range, and time of flight. **Calculus in Mechanics:** Apply differentiation and integration techniques to solve mechanics problems involving motion in two dimensions.

| Year 13
(Unit 3)

(Revision Tips
& Exam
Practice) | Familiarise Yourself with Exam Style: Regularly practice past papers to get comfortable with the format and style of A-level questions. Learn to Manage Time: Use timed practice sessions to develop your ability to complete exam questions efficiently without sacrificing accuracy. Review Mark Schemes: Understand what examiners are looking for by carefully studying mark schemes for past paper solutions. Pay attention to precision and clarity in your answers. Focus on Problem-Solving: Challenge yourself with complex, multi-step problems that require making connections across different topics. Practice Graphical Methods: Ensure you're proficient in drawing and interpreting graphs, as they're often a key component in mechanics and statistics questions. Test Yourself on Application: Attempt questions that ask you to apply mathematics to unfamiliar contexts. This mimics the unpredictability of exam scenarios. |

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