SUBJECT CURRICULUM PLAN

HASMONEAN
אל תקרי בניך אלא בוניך

SUBJECT:	Mathematics(Key Stage 5)	YEAR GROUP:	12
SUBJECT INTENT:	To transition students smoothly into rigorous abstract mathematical systems, developing core differentiation, algebraic structures, statistical modeling, and Newtonian kinematics.		

Autumn Term Plan

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Autumn	Pure: Quadratics & Discriminant	Solving indices equations, algebraic fractions, using the discriminant to identify real/imaginary roots, and solving disguised quadratics.	Discriminant, roots, quadratic form, indices properties.	Extends GCSE Higher factoring rules. Underpins optimization thresholds in calculus.
Autumn	Pure: Quadratics & Discriminant	Solving indices equations, algebraic fractions, using the discriminant to identify real/imaginary roots, and solving disguised quadratics.	Discriminant, roots, quadratic form, indices properties.	Extends GCSE Higher factoring rules. Underpins optimization thresholds in calculus.
Autumn	Pure: Graphs & Transformations	Sketching cubic, quartic, and reciprocal lines; applying f(x+a), af(x), f(ax), and f(-x) transformations to general configurations including square root profiles.	Asymptotes, horizontal/vertical shift, stretch factor, reflection axis.	Extends KS4 coordinate structures. Prerequisite for wave behavior analyses in Year 13 trigonometry.
Autumn	Pure: Coordinate Geometry & Circles	Using the line equation forms y-y1 = m(x-x1) and	Gradient, intersection, normal	Advances from Year 10 coordinate rules. Vital setup for calculus tangent vectors and engineering physics circles.

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TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
		ax+by+c=0, calculating perpendicular bisectors, and completing the square to find center (a,b) and radius r from x^2+y^2+2gx+2fy+c=0.	lines, circle radius, midpoints.	
Autumn	Pure: Algebraic Methods	Dividing polynomials using grid or long methods; applying the Factor Theorem and Remainder Theorem to completely factor cubic expressions.	Polynomial quotient, remainder constraints, polynomial factors.	Extends Year 9 abstract factoring equations. Essential background for Year 13 algebraic integration and partial fractions.
Autumn	Pure: Partial Fractions	Decomposing algebraic fractions into linear, repeated, or improper fractional components using grid division and equating coefficients.	Decomposition, proper components, linear components, repeated roots equations.	Follows Year 12 polynomial division. Essential setup for evaluating advanced Year 13 integration tasks.
Autumn	Pure: Binomial Expansion	Expanding brackets up to any positive integer power n using combination coefficients or Pascal's Triangle.	Factorial notation, combinations, expansion series, terms coefficient.	Transitions from basic expanding models at GCSE. Directly leads to Year 13 infinite series expansions with negative coefficients.
Autumn	Pure: Trigonometric Ratios & Identities	Using the exact values of standard angles; deriving and applying identities sin^2 x + cos^2 x = 1 and tan x = sin x / cos x to solve equations.	Identities, quadrant ranges, periodic repetitions, exact trigonometric values.	Deepens Key Stage 4 SOHCAHTOA. Prerequisite for Year 13 wave dynamics and calculus derivatives.

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TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Autumn	Applied: Stats - Sampling & Presentation	Distinguishing qualitative and quantitative fields; selecting random, systematic, stratified, quota, or opportunity data samples; interpreting large dataset frameworks.	Sampling frame, random bias, continuous variable, extreme outliers.	Upgrades GCSE statistics tracking. Crucial for completing live data evaluation projects in downstream components.

Spring Term Plan

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Spring	Pure: Differentiation	Deriving equations from first principles; evaluating derivative = n*x^(n-1); finding tangents, normals, second derivatives, and computing turning limits to optimize variables.	Rate of change, tangents, normal equation, stationary turning points.	Introduces rates of change calculus. Direct framework dependency for kinematic tracking and variable rates in Year 13.
Spring	Pure: Differentiation	Deriving equations from first principles; evaluating derivative = n*x^(n-1); finding tangents, normals, second derivatives, and computing turning limits to optimize variables.	Rate of change, tangents, normal equation, stationary turning points.	Introduces rates of change calculus. Direct framework dependency for kinematic tracking and variable rates in Year 13.
Spring	Pure: Integration	Reversing differentiation for x^n functions; determining constants of integration C using coordinate boundaries; evaluating area	Integrals, integration constant, indefinite vs definite fields, area bound.	Follows directly from differentiation logic. Mandatory for evaluating complex physical mechanics spaces and volumes.

SUBJECT CURRICULUM PLAN

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
		under a line between definite bounds.		
Spring	Pure: Exponentials & Logarithms	Evaluating curves y=e^x and transformations; implementing rules log_a(xy)=log_a x + log_a y; resolving unknown indices using natural logs.	Asymptotes, log inverses, base systems, non-linear regression mapping.	Advances from Year 10 powers. Essential for statistical continuity models and variable exponential decay problems.
Spring	Applied: Stats - Probability & Distributions	Analyzing Venn diagrams, mutually exclusive events, independent trees; defining discrete probability functions; computing properties of Binomial Distributions.	Sample probability spaces, discrete distributions, trial count, success rate (p).	Extends Year 11 dependent sample tracks. Foundational for Year 13 hypothesis significance testing metrics.

Summer Term Plan

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Summer	Pure: Modulus and Functions	Defining domain limits, mapping range definitions, evaluating composite combinations gf(x), and constructing inverse reflections. Sketching graphs of y=|f(x)| and y=f(|x|); solving modular inequalities using algebraic intersections.	Mapping space, domain range boundaries, self-inverse properties. Absolute value, absolute mapping, reflected quadrants, intercept points.	Upgrades basic formula transformations. Mandatory tracking tool for processing multi-step functions across advanced systems. Refines Year 12 graph transformation rules. Required for modeling precise limit tolerances across vector spaces.

SUBJECT CURRICULUM PLAN

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Summer	Pure: Sequences & Series	Deriving formulas for arithmetic progressions (a+(n-1)d) and geometric lines; finding the sum of finite series and the convergent threshold to infinity.	Common difference, geometric multiplier, series summation, infinity limit.	Extends Year 9 sequence generation rules. Prerequisite for evaluating Taylor and Maclaurin expansions at advanced stages.
Summer	Applied: Mechanics - Kinematics	Constructing displacement-time lines, evaluating gradient acceleration, applying SUVAT constant parameters, and applying differentiation/integration tools for variable changes.	Kinematic curves, constant variables, displacement limits, calculus tracking.	Refines basic GCSE mechanics formulas. Directly feeds into Year 13 projectile mechanics trajectories.

SUBJECT:	**Mathematics**(Key Stage 5)	YEAR GROUP:	13

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SUBJECT INTENT:	To master advanced calculus systems, model real-world behaviors using differential equations, and formulate analytical proofs, statistics hypotheses, and multi-variable force mechanics.

Autumn Term Plan

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Autumn	Pure:2D & 3D Vectors	Adding, subtracting, and tracking magnitude of column and unit matrices i and j; finding vector points along partitioned lines.	Scalar multipliers, magnitude, unit grid vectors, line position ratios.	Advances Year 11 2D vector systems. Standard baseline system for mechanical physics vector environments.
Autumn	Pure: Trigonometry (Reciprocals & Identities)	Defining secant, cosecant, and cotangent graphs; implementing identities 1+tan^2 x = sec^2 x and compounding addition frameworks.	Reciprocal wave paths, double angle properties, identities proofs.	Builds on Year 12 trig identities. Critical for solving compound wave functions and derivative expressions in calculus.
Autumn	Pure: Parametric Equations	Converting parametric relationships x=f(t), y=g(t) into Cartesian structures; calculating gradients along parametric paths.	Parameter variable, coordinate conversion, parametric calculus tracking.	Connects Year 12 graphs with coordinate equations. Directly applied to track physical moving positions in advanced mechanics.
Autumn	Pure: Advanced Differentiation	Executing the Chain Rule, Product Rule, and Quotient Rule; differentiating implicit functions, exponential lines, and parametric paths.	Leibniz syntax, implicit derivation, rate differentials, tangent coordinates.	Deepens Year 12 calculus methods. Crucial tool for constructing complex variable differential equations.
Autumn	Applied: Mechanics - Forces & Friction	Resolving multi-directional vectors, formulating static equilibrium states,	Normal reaction, friction index (mu), equilibrium	Integrates Year 12 kinematics with physical vectors. Prerequisite for calculating sliding or sliding-limit dynamics.

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TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
		calculating friction thresholds via F <= mu * R.	resolution, force vector fields.	
Autumn	Applied: Mechanics - Projectiles	Formulating 2D projectile paths under gravity vector fields (a = -g j); computing peak heights, horizontal ranges, and landing windows.	Trajectory paths, flight duration, motion independence, projection angles.	Combines Year 12 kinematics with Year 13 trigonometry. Forms the concluding applied physics mechanics baseline.

Spring Term Plan

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Spring	Pure: Advanced Integration	Integrating functions via custom substitution parameters, parts methods, and using partial fraction components; solving differential models.	Integration parts, differential conditions, separation constants.	Transforms Year 12 integration. Fundamental for solving core physical engineering expansion curves.
Spring	Pure: Numerical Methods	Locating formula roots via sign shifts; evaluating iterative convergence formulas x_n+1 = g(x_n); using the Newton-Raphson approach.	Root approximation, iterative algorithms, chord convergence tracking.	Utilizes Year 12 functions logic. Offers critical alternative methods when standard integration blocks are unsolvable.
Spring	Pure: Advanced Proofs	Structuring formal mathematical paths through deductive logic, exhaustive validation, and	Axiomatic deduction, contradiction bounds, counterexample	Upgrades KS4 geometric proofs. Essential for establishing logical precision inside higher analytical pathways.

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TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
		indirect proof by contradiction.	criteria.	
Spring	Applied: Stats - Continuous Data & Normal	Evaluating continuous probability curves using the Normal Distribution model; verifying sample mean properties via hypothesis testing matrices.	Z-transform scores, significance levels, critical tracking margins, continuity bounds.	Upgrades Year 12 discrete binomial models. Essential for executing precise real-world hypothesis analytics.

Summer Term Plan

TERM	TOPIC	CORE LEARNING	KEY CONCEPTS	SEQUENCING
Summer	Final Revision & Exam Engineering	Reviewing exam frameworks, performing mock script analyses, and implementing optimization strategies under timed conditions.	Topic synthesis, multi-variable tracking, timing management.	Synthesizes the Key Stage 5 mathematics blueprint, ensuring exam success and a confident transition to higher education tracks.