Further Maths Curriculum Map

YEAR 12	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Content	**CORE PURE Complex numbers** Complex numbers Argand Diagrams **DECISION Algorithms and Graph Theory** Flow charts Sorting algorithms Graph theory Planetary theorem Prims and Kruskals Flyod's algorithm **DECISION Route Inspection** Eulerian graphs Route inspection	**CORE PURE Series** Natural numbers Squares and cubes **CORE PURE Roots of Polynomials** Quadratics Cubics Quartics Transformations **CORE PURE Proof by Induction** Mathematical Induction Divisibility results Matrices **DECISION Travelling salesman** Minimum spanning tree upper and lower bounds Nearest neighbour algorithm **DECISION Critical Paths Analysis** Critical Paths Gantt charts Resource histograms Scheduling diagrams	**CORE PURE Matrices** Matrix multiplication Determinants Inverting matrices Solving systems **CORE PURE Linear Transformations** Two dimensions Three dimensions The inverse **CORE PURE Proof by Induction** Mathematical Induction Divisibility results Matrices **DECISION Linear Programming** Linear programming problems Graphing Optimal point **DECISION Simplex Algorithm** Simplex method Two stage simplex Big M Method	**CORE PURE Vectors** Equation of lines and planes in 3D Scalar product Angles Perpendiculars Points of intersection **PURE Trigonometry** Formula Trig Identities Trig equations Parametric equations	**PURE Trigonometry** Parametric equations **PURE Calculus** Differentiation	**PURE Calculus** Integration **CORE PURE Complex numbers** Complex numbers De Moivre's theorem Geometric Problems
Skills	AO1: Use and apply	AO1: Use and apply	AO1: Use and apply	AO1: Use and apply	AO1: Use and apply	AO1: Use and apply

	standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts
Key Questions	Complex Numbers Argand Diagrams	Series (1) Series (2) Roots of Polynomials Volumes of Revolution	Matrices Linear Transformations	Proof by Induction Vectors		
Assessment	Baseline Test Topic Tests Consolidation exam questions at the end of every lesson	Topic Tests Consolidation exam questions at the end of every lesson	Topic Tests Consolidation exam questions at the end of every lesson	D1 Practice Mock Topic Tests Consolidation exam questions at the end of every lesson	End of Year Mocks Topic Tests Consolidation exam questions at the end of every lesson	Topic Tests Consolidation exam questions at the end of every lesson
Literacy/numeracy/SMSC/Character	**Further Reading** ● ***The Code Book* – Simon Singh** ● ***The Music of the Primes* – Marcus du Sautoy** ● ***Thinking About Mathematics* – Stewart Shapiro** ● ***Chaos, Making a New Science* – James Gleick** ● ***Alex's Adventures in Numberland: Dispatches from the Wonderful World of Numbers* – Alex Belllos** ● **I*t Must be Beautiful: Great Equations of Modern Science* – edited by Graham Farmeloâ** ‹	**Key Words** Core Pure Ch1&2 - Conjugate, real part, imaginary part, complex conjugate, root, discriminant, Argand diagram, Cartesian coordinates, vector, magnitude, modulus, argument, principal argument, radians, modulus-argument form, polynomial, coefficient, quadratic, quartic, cubic, complex conjugate pair, locus, loci. Ch3 - Sigma notation, series, sum, arithmetic series, geometric series, binomial series, integer, natural numbers, Ch4 - Quadratic, cubic, quartic, polynomial, coefficient, degree, root, complex conjugate, degree, Vieta's formulas Ch5 - Rotation, solid of revolution, volume of revolution, bounded area, arc, cubic units, parameter, Cartesian equation. Ch6&7 - Array, dimension, rows, columns, elements, scalar, square matrices, commutative, associative, transformation, rotation, translation, reflection, enlargement, linear transformation, scale factor, vector, position vector, object, image, identity, determinant,				

	● *The Problems of Mathematics, Nature's Numbers, From Here to Infinity, Game, Set and Math and The Magical Maze* **– Ian Stewart** ● *What is Mathematics?* **– Courant and Robbins** ● *Mathematics: The Golden Age* **– Devlin** ● *A Mathematician's Apology* **– Hardy** ● *Makers of Mathematics* **– Hollingdale**	inverse, transpose, symmetric, zero matrix, minor, cofactor, singular, non-singular, three-dimensional space, line, plane, parameter, vector equation, Cartesian equation, simultaneous equations, invariant point, invariant line, sheaf, prism, Ch8 - Mathematical induction, general statement, basis, assumption, inductive, conclusion, integer, summation, divisible, matrix. Ch9 - Vector, scalar, magnitude, modulus, direction, vector quantity, scalar quantity, displacement vector, zero vector, unit vector, base vector, component, equal vectors, localised vector, free vector, resultant, triangle law, parallelogram law, position vector, vector equation, Cartesian equation, scalar product, dot product, collinear, skew, concurrent, direction ratio, perpendicular, Pythagoras' Theorem. <u>Decision 1</u> Ch1, 2 &3 - Algorithm, flow chart, size, order, efficiency, loops, bubble sort, iteration, quick sort, pivot, mid-point, bin packing, first-fit, first-fit decreasing, optimal solutions, vertices, nodes, edges, arcs, graph, network, path, cycle, Hamiltonian cycle, Eulerian graph, semi-Eulerian graph, Eulerian cycle, subgraph, weighted graph, connected graph, simple graph, complete graph, degree, valency, digraph, tree, spanning tree, k notation, isomorphic, planar.Minimum spanning tree, Kruskal's algorithm, Prim's algorithm, network, distance matrix, Dijkstra's algorithm, working values, final values, directed network, source vertex, destination vertex, distance table, sequence table, Floyd's algorithm. Ch4&5 - Traversable, odd valency, Eulerian, Semi-Eulerian, minimum weight, upper bound, lower bound, nearest neighbour algorithm, complete network, triangle inequality, walk, tour. Ch6&7 - Decision variables, constraints, objective function, slack variables, Simplex method, surplus variables, artificial variables, basic and non-basic variables, Simplex tableau, feasible solution, feasible region, optimal solution, pivotal column, pivotal row, pivot, optimality condition, big-M Ch8 - Activities, events, precedence table, activity networks, source node, sink node, dummies, earliest event times, latest event times, critical path, critical activities, total float, Gantt (cascade) chart, resource histogram, scheduling, lower bound.
Enrichment opportunities and futures	**Further Study** Mathematics Degree Related Degree Subjects More information: https://www.mathscareers.org.uk/degree-cours	**Career Paths** STEM subjects Insurance and Risk Data Science Computing	**Extracurricular at Haydon** Webinars Maths Works Maths Modelling Challenge MC3 Shared podcasts

	es-a-level-mathematics/	Natural and Life Sciences Business and Operations Humanities Banking/Finance Business Operations	Online uni events Senior UKMT		

YEAR 13	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1
Content	**CORE PURE Series** Higher derivatives Maclaurin Series **F MECHANICS Momentum and Impulse** Conservation of Momentum **F MECHANICS Work, energy and power** Conservation of Mechanical Energy Work Energy Principal	**CORE PURE Methods in calculus** Improper Integrals Trig functions Partial fractions **CORE PURE Volumes of revolution** Volumes of revolution Parametric equations **CORE PURE Polar coordinates** Polar coordinates and equations Sketching Curves Tangents **F MECHANICS Elastic**	**CORE PURE Hyperbolic functions** Hyperbolic functions Calculus Identities **CORE PURE Differential equations** Methods in Differential equations Modelling with differential equation	Exam Preparation	

		Collisions Collision in one dimension Collision in two dimensions			
	F MECHANICS **Elastic Strings and Springs** Hooke's Law Elastic Energy				
Skills	AO1: Use and apply standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	AO1: Use and apply standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	AO1: Use and apply standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	AO1: Use and apply standard techniques. AO2: Reason, interpret and communicate mathematically AO3: Solve problems within mathematics and in other contexts	
Key Questions	Series	Methods in Calculus Polar Coordinates	Hyperbolic Functions Methods in Differential Equations Modelling with Differential Equations		
Assessment	Baseline Pure Mock assessment Topic Tests Consolidation exam questions at the end of every lesson	● Topic Tests ● Consolidation exam questions at the end of every lesson	● Mock Exams ● Topic Tests ● Consolidation exam questions at the end of every lesson	● Practice Core Pure Mock	External Exams Two Papers in Core Pure One Paper in Decision One Paper in Further Mechanics
Literacy	**Further Reading** ● *The Code Book* **– Simon Singh** ● *The Music of the Primes –* **Marcus du Sautoy**	**Key Words** Core Pure			

	● *Thinking About Mathematics* – **Stewart Shapiro** ● *Chaos, Making a New Science* – **James Gleick** ● *Alex's Adventures in Numberland: Dispatches from the Wonderful World of Numbers* – **Alex Belllos** ● I*t Must be Beautiful: Great Equations of Modern Science* – **edited by Graham Farmeloâ** ‹ ● *The Problems of Mathematics, Nature's Numbers, From Here to Infinity, Game, Set and Math and The Magical Maze* – **Ian Stewart** ● *What is Mathematics?* – **Courant and Robbins** ● *Mathematics: The Golden Age* – **Devlin** ● *A Mathematician's Apology* – **Hardy** ● *Makers of Mathematics* – **Hollingdale**	Ch1 - Conjugate, real part, imaginary part, complex conjugate, nth root, distinct root, discriminant, Argand diagram, Cartesian coordinates, vector, magnitude, modulus, argument, principal argument, radians, modulus-argument form, polynomial, coefficient, quadratic, quartic, cubic, de Moivre, unity, exponential, multiple angle. Ch2 - Series, sigma, differences, sum, term, general term, partial fraction, function, Maclaurin, range, power. Ch3&4 - Improper, undefined, continuous, mean, integrate, partial, fraction, radical, inverse. Ch5 - Polar, Cartesian, coordinates, convert, parallel, point, enclosed, area Ch6 - Hyperbolic, sinh, cosh, tanh, domain, range, exponential, function, radical. Ch7&8 - Integrating, factor, complementary, function, differential, equation, order, auxiliary, discriminant, general, particular. Further Mechanics Ch1 - Mass, velocity, speed, Ns, momentum, impulse, force, time, collisions, direct, smooth, body, sphere, coalesce, conservation, vector, **i**, **j**, **unit vector**, magnitude, string, light, inextensible, jerk, impulsive tension. Ch2 - Work, energy, power, joules, gravitational potential energy (GPE), kinetic energy (KE), energy change, resistance, force, distance, displacement, speed, velocity, conservation of mechanical energy, external force, work-energy principle, reaction, **power, watts, KW, tractive (driving) force**, acceleration, inclined plane, resistance, rate of working, rough/smooth surface, friction. Ch3 - String, spring, light, elasticity, modulus of elasticity (λ), extension, natural length, elastic potential energy (EPE), kinetic energy (KE), gravitational potential energy (GPE), joules (J), conservation of energy, equilibrium, work-energy principle, Newton's 2nd law of motion, work done, joined or parallel strings/springs, friction, coefficient of friction, inclined plane. Ch4 - Mass, velocity, N s, momentum, impulse, force, collisions, direct, impact, smooth, sphere, elastic, conservation, coefficient of restitution (*e*), Newton's (experimental) law of restitution, approach speed, separation speed, opposite direction, perfectly elastic, inelastic, plane, energy, kinetic energy, joules, 'loss' of mechanical energy. Ch5 - Impact, momentum, impulse, magnitude, direction, sphere, equal radii, collision, oblique, smooth, coefficient of restitution, Newton's (experimental) law of restitution, rebound, conservation, perfectly elastic, inelastic, vector, component, parallel, perpendicular, normal, line of centres, deflection, scalar product, kinetic energy.
Enrichment opportunities	**Further Study** Mathematics Degree Related Degree Subjects	**Career Paths** STEM subjects	**Extracurricular at Haydon** Webinars

| and futures | More information:
https://www.mathscareers.org.uk/degree-courses-a-level-mathematics/ | Insurance and Risk
Data Science
Computing
Natural and Life Sciences
Business and Operations
Humanities
Banking/Finance
Business
Operations | Maths Works Maths Modelling Challenge
MC3
Shared podcasts
Online uni events
Senior UKMT |