Key Stage 5 (12 & 13)		
Course title: AS and A-Level Further Mathematics		
Exam board: OCR		
Specification code: H235 (AS) and H245		
	Teacher 1	**Teacher 2**
Autumn 1 (September-October) Autumn 2 (October-December) Spring 1 (January-February)	**Pure Core 1:** **Matrices** • Language of matrices • Matrix operations • Determinants of matrices • Inverse matrices **Complex Numbers** • Language of complex numbers • Express in cartesian form • Operations on complex numbers • Argand diagrams • Loci **Vectors** • Intersection of two lines • Scalar product • Vector product **Proof by Induction** **Roots of Polynomials** • Use relationships between symmetric functions	**Additional Pure Year 1:** **Number bases** • Notation • Convert between base n and 10 • Calculations • Proof **Divisibility** • Notation • Standard divisibility tests • Division algorithm • Euclid's Lemma • Proof • Modular arithmetic **Prime Numbers** • Fundamental theorem of arithmetic • Integer combinations **Binary Operations** • Definitions • Cayley tables • Properties

	• Use substitution to obtain equation with related roots **More Complex Numbers** • Conjugate pairs • Find roots • Solve quadratic equations with complex roots • Solve or factorise cubic or quartic equations with real coefficients **More Matrices** • Transformations in 2D • Successive transformations • Single linear transformations in 3D • Invariant points and lines	**Sets** • Notation • Group axioms • Latin Square property • Abelian groups • Infinite groups • Order • Cyclic groups • Subgroups • Properties of groups of order 1-7 **Surfaces and Partial Differentiation** • Multivariable functions • Contours and sections • Partial differentiation • Mixed derivatives theorem • Stationary points • Applications and problem solving **Vectors** • Vector product • Properties and geometric interpretation of vector product • Vector product equation of a line **Sequences and Series** • Notation • Classifying behaviour of sequences and series • Limit of a sequence

		• Fibonacci and Lucas numbers • Proof by induction and sequences • Solving recurrence systems • Modelling
Spring 2 (February-March) & Summer 1 (April-May)	**Mechanics Year 1:** **Work, Energy and Power** • Work done by a force • Kinetic energy • Potential, mechanical and conservation of energy • Work done by a force at an angle • Power **Dimensional Analysis** • Defining and calculating • Units and dimensions of sums, differences and angles • Finding dimensions and predicting formulae **Momentum and Collisions** • Momentum and impulse • Collisions and conservation of momentum • Restitution, kinetic energy and impulsive tension **Circular Motion** • Linear speed vs angular speed • Acceleration in horizontal circular motion • Problem solving	
May/ June – AS Further maths exams		
Summer 2 (May-July),	**Pure Core 2:** **Series and Induction** • Review proof by induction	**Mechanics Year 2:** **Centres of Mass** • Of a system of pointed masses

Autumn 1 (September-October), Autumn 2 (October-December), Spring 1 (January-February), Spring 2 (February-March)	• Summation and induction • Standard summation series • Method of differences **Lines and Planes in Space** • Equation of a plane • Intersection between a line and a plane • Angles between lines and planes • Distances between points, lines and planes **Simultaneous Equations and Planes** • Linear simultaneous equations • Intersections of planes **Powers and Roots of Complex Numbers** • De Moivre's Theorem • Complex exponents • Roots of complex numbers • Roots of unity • Further factorising • Geometry of complex numbers **Complex Numbers and Trigonometry** • Deriving multiple angle formulae • Application to polynomial equations • Powers of trigonometric functions • Trigonometric series **Hyperbolic Functions** • Defining hyperbolic functions	• Of standard shapes • Of composite bodies **Work, Energy and Power** • Work done by a variable force • Hooke's law • Problem solving **Linear Motion Under a Variable Force** • Working with acceleration, velocity and displacement • Variable force **Momentum and Collisions** • Variable force and vector notation • Oblique impacts • Oblique collisions **Circular Motion** • Conservation of mechanical energy • Components of acceleration • Problem solving **Centres of Mass** • By integration • Equilibrium of a rigid body **Additional Pure Year 2:** **Sequences and Series** • Solve second order recurrence relations

	• Inverse hyperbolic functions • Hyperbolic identities • Solving harder hyperbolic equations • Differentiation • Integration **Further Calculus Techniques** • Differentiation of inverse trigonometric functions • Differentiation of inverse hyperbolic functions • Using inverse trigonometric and hyperbolic functions in integration • Using partial fractions in integration **Applications of Calculus** • Maclaurin series • Using standard Maclaurin series • Improper integrals • Volumes of revolution • Mean value of a function **Polar Coordinates** • Curves in polar coordinates • Features of polar curves • Changing between polar and Cartesian coordinates • Area enclosed by a polar curve • Area between two curves **Differential Equations** • Terminology • Integrating factor method	**Number Theory** • Solve simultaneous linear congruences • Quadratic residues • Fermat's little theorem **Groups** • Lagrange's theorem for subgroups • Isomorphic groups • Groups of order greater than 7 **Further Vectors** • Volumes of tetrahedra and parallelopipeds • The scalar triple product **Surfaces and Partial Differentiation** • Classifying stationary points in 3-D • Equation of a tangent plane of a 3-D curve **Further Calculus** • Integration by reduction • Arc lengths and surfaces of revolution

	• Homogeneous second order linear differential equations • Non-homogeneous second order linear differential equations **Applications of Differential Equations** • Forming differential equations • Simple harmonic motion • Damping and damped oscillations • Linear systems	
Summer 1 (April-May)	**Revision**	**Revision**