Year 12 Pure Mathematics Curriculum Overview

	Title
1	**Algebra and functions**
	Algebraic expressions – basic algebraic manipulation, indices and surds
	Quadratic functions – factorising, solving, graphs and the discriminants
	Equations – quadratic/linear simultaneous
	Inequalities – linear and quadratic (including graphical solutions)
	Graphs – cubic, quartic and reciprocal
	Transformations – transforming graphs – f(x) notation
2	**Coordinate geometry in the (x, y) plane**
	Straight-line graphs, parallel/perpendicular, length and area problems
	Circles – equation of a circle, geometric problems on a grid
3	**Further algebra**
	Algebraic division, factor theorem and proof
	The binomial expansion
4	**Trigonometry**
	Trigonometric ratios and graphs
	Trigonometric identities and equations
5	**Vectors (2D)**
	Definitions, magnitude/direction, addition and scalar multiplication
	Position vectors, distance between two points, geometric problems
6	**Differentiation**
	Definition, differentiating polynomials, second derivatives
	Gradients, tangents, normals, maxima and minima
7	**Integration**
	Definition as opposite of differentiation, indefinite integrals of x^n
	Definite integrals and areas under curves
8	**Exponentials and logarithms:** Exponential functions and natural logarithms

Year 12 Statistics and Mechanics Curriculum Overview

Statistics	
1	**Statistical sampling**
	Introduction to sampling terminology; Advantages and disadvantages of sampling
	Understand and use sampling techniques; Compare sampling techniques in context
2	**Data presentation and interpretation**
	Calculation and interpretation of measures of location; Calculation and interpretation of measures of variation; Understand and use coding
	Interpret diagrams for single-variable data; Interpret scatter diagrams and regression lines; Recognise and interpret outliers; Draw simple conclusions from statistical problems
3	**Probability:** Mutually exclusive events; Independent events
4	**Statistical distributions:** Use discrete distributions to model real-world situations; Identify the discrete uniform distribution; Calculate probabilities using the binomial distribution (calculator use expected)
5	**Statistical hypothesis testing**
	Language of hypothesis testing; Significance levels
	Carry out hypothesis tests involving the binomial distribution
	Mechanics
6	**Quantities and units in mechanics**
	Introduction to mathematical modelling and standard S.I. units of length, time and mass
	Definitions of force, velocity, speed, acceleration and weight and displacement; Vector and scalar quantities
7	**Kinematics 1 (constant acceleration)**
	Graphical representation of velocity, acceleration and displacement
	Motion in a straight line under constant acceleration; *suvat* formulae for constant acceleration; Vertical motion under gravity
8	**Forces & Newton's laws**
	Newton's first law, force diagrams, equilibrium, introduction to **i**, **j** system
	Newton's second law, '$F = ma$', connected particles (no resolving forces or use of $F = \mu R$); Newton's third law: equilibrium, problems involving smooth pulleys
9	**Kinematics 2 (variable acceleration)**
	Variable force; Calculus to determine rates of change for kinematics
	Use of integration for kinematics problems

Year 13 Pure Mathematics Curriculum Overview

	Title
1	**Proof:** Examples including proof by deduction* and proof by contradiction
2	**Algebraic and partial fractions**
	Simplifying algebraic fractions
	Partial fractions
3	**Functions and modelling**
	Modulus function
	Composite and inverse functions
	Transformations
	Modelling with functions* *examples may be Trigonometric, exponential, reciprocal etc.
4	**Series and sequences**
	Arithmetic and geometric progressions (proofs of 'sum formulae')
	Sigma notation
	Recurrence and iterations
5	**The binomial theorem**
	Expanding $(a + bx)^n$ for rational n; knowledge of range of validity
	Expansion of functions by first using partial fractions
6	**Trigonometry**
	Radians (exact values), arcs and sectors
	Small angles
	Secant, cosecant and cotangent (definitions, identities and graphs); Inverse trigonometrical functions; Inverse trigonometrical functions
	Compound* and double (and half) angle formulae *geometric proofs expected
	$R\cos(x \pm \alpha)$ or $R\sin(x \pm \alpha)$
	Proving trigonometric identities
	Solving problems in context (e.g. mechanics)
7	**Parametric equations**
	Definition and converting between parametric and Cartesian forms
	Curve sketching and modelling

	Title
8	**Differentiation**
	Differentiating sin x and cos x from first principles
	Differentiating exponentials and logarithms
	Differentiating products, quotients, implicit and parametric functions.
	Second derivatives (rates of change of gradient, inflections)
	Rates of change problems* (including growth and kinematics) *see Integration (part 2) – Differential equations
9	**Numerical methods***
	Location of roots
	Solving by iterative methods (knowledge of 'staircase and cobweb' diagrams)
	Newton-Raphson method
	Problem solving
	*See Integration (part 2) for the trapezium rule
10	**Integration (part 1)**
	Integrating x^n (including when $n = -1$), exponentials and trigonometric functions
	Using the reverse of differentiation, and using trigonometric identities to manipulate integrals
11	**Integration (part 2)**
	Integration by substitution
	Integration by parts
	Use of partial fractions
	Areas under graphs or between two curves, including understanding the area is the limit of a sum (using sigma notation)
	The trapezium rule
	Differential equations (including knowledge of the family of solution curves)
12	**Vectors (3D):** Use of vectors in three dimensions; knowledge of column vectors and **i**, **j** and **k** unit vectors

Year 13 Statistics and Mechanics Curriculum Overview

	Statistics
1	**Regression and correlation**
	Change of variable
	Correlation coefficients Statistical hypothesis testing for zero correlation
2	**Probability**
	Using set notation for probability Conditional probability
	Questioning assumptions in probability
3	**The Normal distribution**
	Understand and use the Normal distribution
	Use the Normal distribution as an approximation to the binomial distribution Selecting the appropriate distribution
	Statistical hypothesis testing for the mean of the Normal distribution
	Mechanics
4	**Moments:** Forces' turning effect
5	**Forces at any angle**
	Resolving forces
	Friction forces (including coefficient of friction μ)
6	**Applications of kinematics:** Projectiles
7	**Applications of forces**
	Equilibrium and statics of a particle (including ladder problems)
	Dynamics of a particle
8	**Further kinematics**
	Constant acceleration (equations of motion in 2D; the **i**, **j** system)
	Variable acceleration (use of calculus and finding vectors $\dot{\boldsymbol{r}}$ and $\ddot{\boldsymbol{r}}$ at a given time)