Progression map: breaks down the key concepts to specify the most important knowledge and how that knowledge builds within the curriculum.

Key Concepts	Year 12	Year 13
Pure maths	● Algebra and functions ● Coordinate geometry ● Further algebra ● Trigonometry ● vectors ● Differentiation ● Integration ● Exponentials and logarithms	● Algebraic methods ● Functions and modelling ● Series and sequences ● Binomial Theorem ● Trigonometry ● Parametric equations ● Differentiation ● Numerical methods ● Integration ● Vectors
statistics	● Statistical sampling ● Data presentation and interpretation ● Probability ● Statistical Distributions ● Statistical Hypothesis Testing	● Regression and correlation ● Probability ● Normal Distribution
Mechanics	● Quantities and units in mechanics ● Kinematics 1 ● Forces and Newtons laws ● Kinematics 2	● Moments ● Forces at any angle ● Application of kinematics ● Application of forces ● Further kinematics

Long-term plan: organises the knowledge from the progression map into units to give an overview of what is taught when in the curriculum.

<table>
<tr><td colspan="6">Year 12</td></tr>
<tr><td colspan="2">Autumn Term</td><td colspan="2">Spring Term</td><td colspan="2">Summer Term</td></tr>
<tr><td>Unit Title:
● Algebra and functions
● Coordinate geometry
● Vectors
● Statistical sampling</td><td>Unit length:
27 hours

13 hours

14 hours
3 hours</td><td>Unit Title:
● Further Algebra
● Trigonometry
● Differentiation
● Data presentation and interpretation
● Probability
● Quantities and units in mechanics
● Kinematics
● Forces and Newtons laws</td><td>Unit length:
8 hours
16 hours
12 hours
8 hours

3 hours
3 hours

17 hours
10 hours</td><td>Unit Title:
● Further Algebra
● Integration
● exponentials and logarithms
● Statistical distributions
● Statistical hypothesis testing</td><td>Unit length:
7 hours
11 hours
12 hours

5 hours

7 hours</td></tr>
<tr><td colspan="2">Domains of Knowledge:
● algebraic manipulation, indices and surds
● factorising,solving,graphs and the discriminants.
● quadratics and linear equations
● linear and quadratic inequalities
● cubic, quartic and reciprocal graphs
● transforming graphs
● straight line graphs including parallel and perpendicular
● equation of a circle
● representing vectors and problems
● Sampling techniques</td><td colspan="2">Domains of Knowledge:
● Algebraic division, factor theorem and proof
● Trigonometric ratios and graphs
● trigonometric identities and equations
● Differentiating polynomials
● Calculation and interpretation of measures of location.
● Interpret diagrams for single variable data.
● Calculating probabilities including independent and mutually exclusive.
● mathematical modelling and standard SI units.
● Forces
● Constant and variable acceleration</td><td colspan="2">Domains of Knowledge:
● Binomial expansion
● integration of definite and indefinite integrals including area under a graph
● Exponential functions and natural logarithms.
● Discrete uniform distribution
● Calculate probabilities using the binomial distribution.
● hypothesis testing involving binomial distribution.</td></tr>
<tr><td colspan="2">Relevant Key Concepts:
● Pure Mathematics</td><td colspan="2">Key Concepts:
● Pure mathematics</td><td colspan="2">Key Concepts:
● Pure mathematics</td></tr>
</table>

• Applied Statistics	• Applied Statistics • Applied Mechanics	• Applied Statistics • Applied mechanics
Gateway knowledge: • collecting like terms and factorising • surds • Solving linear equations • solving quadratic equations • working with inequalities • solving quadratic inequalities • function notation and shapes of standard graphs • rules of indices • simultaneous equations • completing the square. • Infer properties of populations or distributions from a sample, while knowing the limitations of sampling • Apply statistics to describe a population	Gateway knowledge: • Expanding and substitution • Pythagoras and Trigonometry • The sine and cosine rule. Area of any triangle • Bearings • Fractions • Area and Volume • Rearranging equations • Construct and interpret diagrams for grouped discrete data and continuous data. • Change freely between related standard units • Use compound units such as speed, rates of pay, unit pricing, density and pressure • Plot and interpret graphs • Calculate or estimate gradients of graphs and area under graphs. • Solve linear and quadratic equations. Simultaneous equations. • Identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically and turning points by completing the square • Calculate basic probabilities. • Venn diagrams	Gateway knowledge: • expanding and factorisation • proof • differentiation • indices • Order positive and negative integers, decimals and fractions; use the symbols =, ≠, <, >, ≤, and ≥ • Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution • sampling
Assessment end-points:	Assessment end-points:	Assessment end-points:

• Understand and use the laws of indices for all rational exponents • Use and manipulate surds, including rationalising the denominator • Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation • Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions • Represent linear and quadratic inequalities such as $y > x + 1$ and $y > ax^2 + bx + c$ graphically • Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, $y =$ and $y =$ (including their vertical and horizontal asymptotes) • Understand the effect of simple transformations on the graph of $y = f(x)$ including sketching associated graphs: $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$ • Understand and use the equation of a straight line, including the forms y-y_1=m(x-x_1) and ax+by+c=0 • Understand and use the coordinate geometry of the circle including using the equation of a circle in the form 〖(x-a)〗 ^2+ 〖(y-b)〗 ^2=r^2 • Use vectors to solve problems in pure mathematics and in context, (including forces) • Understand and use sampling techniques, including simple random sampling and opportunity sampling. • Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples	• Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem • Understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof, including: proof by deduction, proof by exhaustion, disproof by counter-example • Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity • Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle • Differentiation from first principles for small positive integer powers of x • Differentiate , for rational values of n, and related constant multiples, sums and differences • Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points • Interpret diagrams for single-variable data, Interpret measures of central tendency and variation, extending to standard deviation • Understand and use mutually exclusive and independent events when calculating probabilities • Understand and use fundamental quantities and units in the S.I. system: length, time, mass. • Understand and use derived quantities and units: velocity, acceleration, force, weight • Understand the concept of a force; understand and use Newton's first law.	• Understand and use the binomial expansion of for positive integer n • Integrate (excluding $n = -1$), and related sums, differences and constant multiples • Evaluate definite integrals; use a definite integral to find the area under a curve • Know and use the function and its graph, where a is positive • Know and use the function and its graph • Know and use the exponential function and its graph • Know and use $\ln x$ as the inverse function of exponential function • Understand and use the laws of logarithms: • solve exponential and log equations • Understand and use exponential growth and decay; use in modelling • Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context

can lead to different conclusions about the population	• Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2D (**i**, **j**) vectors). • Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles. • Use calculus in kinematics for motion in a straight line.	

Year 13					
Autumn Term		Spring Term		Summer Term	
Unit Title:	Unit length:	Unit Title:	Unit length:	Unit Title:	Unit length:
• Algebraic Methods	8 hours	• series and sequences	9 hours	• Probability	7 hours
• functions and modelling	10 hours	• The Binomial Theorem	7 hours	• Normal distribution	16 hours
• Trigonometry	24 hours	• Numerical Methods	8 hours	• Applications of kinematics	5 hours
• parametric equations	5 hours	• Integration	28 hours	• Application of forces	8 hours

● differentiation ● vectors ● regression and correlation ● Moments ● Forces at any angle	16 hours 5 hours 7 hours 5 hours 6 hours			● Further kinematics ● revision and practise	6 hours
Domains of Knowledge: ● proof ● algebraic and partial fractions ● modulus/composite and inverse functions ● transformations ● modelling with functions ● radians ● small angles ● sec/cosec/cot ● compound/double and half angles ● equivalent identities ● proofing identities ● conversion between parametric and cartesian forms ● curve sketching and modelling. ● Further differentiation ● Use vectors in 3D ● Correlation coefficients ● statistical hypothesis testing for zero correlation ● Moments ● Resolving forces and friction forces.		Domains of Knowledge: ● Arithmetic and geometric progression ● Recurrence and iterations ● expanding use binomial theorem ● Expansion of functions using partial fractions ● solving by iterative methods. ● Newton Raphson method ● Integration using a variety of techniques.		Domains of Knowledge: ● Using set notation and conditional probability ● Understand and use the Normal Distribution. ● Use the normal distribution as an approximation to the binomial. ● Statistical hypothesis testing for the mean of the normal distribution ● Projectiles ● Equilibrium and statics of a particle. ● Dynamics of a particle. ● Constant and variable acceleration.	
Relevant Key Concepts: ● Pure mathematics ● Applied Statistics ● Applied Mechanics		Key Concepts: ● Pure mathematics		Key Concepts: ● Applied Statistics ● Applied Mechanics	
Gateway knowledge: ● Pythagoras Theorem and Trigonometry ● Algebraic manipulation including completing the square, changing subject of formula and substitution ● Surds, prime and irrational numbers ● Algebraic fractions		Gateway knowledge: ● Generate terms of a sequence from either a term-to-term or a position-to-term rule ● Use simple arithmetic and geometric progression and geometric sequence		Gateway knowledge: ● independent and mutually exclusive events ● simultaneous equations ● Pythagoras, Trigonometry ● Vectors	

● Composite, inverse and transformations of polynomial functions ● Knowledge of polynomial, trigonometric, exponential and logarithmic functions, including their graphs ● Sine and cosine function ● Length of arc and area of sector ● Coordinate geometry ● function notation ● Vectors ● solving simultaneous equations ● 2D trigonometry ● Cosine and sine rules	● Finding expressions for the *n*th term of linear and quadratic sequences ● Algebraic fractions ● Iterations and approximate areas under curves ● Kinematics (velocity–time graphs ●	
Assessment end-points: ● Understand and use the structure of mathematical proof, including proof by contradiction ● Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear expressions only) ● Decompose rational functions into partial fractions ● The modulus of a linear function ● Understand and use composite functions; inverse functions and their graphs ● Understand the effect of simple transformations on the graph of $y = f(x)$ including sketching associated graphs and combinations of these transformations ● Use of functions in modelling, including consideration of limitations and refinements of the models ● Work with radian measure, including use for arc length and area of sector	Assessment end-points: ● Understand and use sigma notation for sums of series ● Understand and work with arithmetic sequences and series, including the formulae for *n*th term and the sum to *n* terms ● Understand and work with geometric sequences and series including the formulae for the *n*th term and the sum of a finite geometric series; the sum to infinity of a convergent geometric series, including the use of $\|r\| < 1$; modulus notation ● Understand and use the binomial expansion of $(a + bx)^n$ for rational *n*, including its use for approximation; ● Solve equations approximately using simple iterative methods; be able to draw associated cobweb and staircase diagrams	Assessment end-points: ● Understand set notation ● Understand conditional probability ● Understand and use the Normal distribution as a model; find probabilities using the Normal distribution ● Link to histograms, mean, standard deviation, points of inflection and the binomial distribution ● Select an appropriate probability distribution for a context, with appropriate reasoning, including recognising when the binomial or the Normal model may not be appropriate ● Conduct a statistical hypothesis test for the mean of the Normal distribution with known, given or assumed variance and interpret the results in context ● Model motion under gravity in a vertical plane using vectors; projectiles ● Understand and use Newton's second law for motion in a straight line. Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles; resolving forces in 2 dimensions; equilibrium of a particle under coplanar forces.

• Understand and use the standard small angle approximations of sine, cosine and tangent • Understand and use the definitions of secant, cosecant and cotangent and of arcsin, arccos and arctan; their relationships to sine, cosine and tangent; understanding of their graphs; their ranges and domains. Use their identities • Understand and use double angle formulae. Understand equivalent forms of $R\cos(\theta \pm \alpha)$ or $R\sin(\theta \pm \alpha)$ • Understand and use the parametric equations of curves and conversion between Cartesian and parametric forms • Differentiation from first principles for $\sin x$ and $\cos x$ • Differentiate e^{kx}, a^{kx}, $\sin kx$, $\cos kx$, $\tan kx$ and related sums, differences and constant multiples. Understand and use the derivative of $\ln x$ • Differentiate using the product rule, the quotient rule and the chain rule, including problems involving connected rates of change and inverse functions • Differentiate simple functions and relations defined implicitly or parametrically, for first derivative only • Construct simple differential equations in pure mathematics and in context, (contexts may include kinematics, population growth and modelling the relationship between price and demand)	• Solve equations using the Newton-Raphson method and other recurrence relations of the form $x_{n+1} = g(x_n)$ • Integrate x^n, (including) and integrate e^{kx}, $\sin kx$, $\cos kx$ and related sums, differences and constant multiples. Standard functions and involving identities • Students should recognise integrals of the form = $\ln \lvert f(x) \rvert + c$. • Use a definite integral to find the area under a curve and the area between two curves • Carry out simple cases of integration by substitution and integration by parts,using partial fractions • Evaluate the analytical solution of simple first order differential equations with separable variables, including finding particular solutions	• Understand and use addition of forces; resultant forces; dynamics for motion of a particle in a plane. • An understanding of $F \leq mR$ in a situation of equilibrium. • Moments: problems involving parallel and non-parallel coplanar forces e.g. ladder problems. • Extend the constant acceleration formulae of motion to 2 dimensions using vectors. • Use calculus in kinematics for (variable acceleration) motion in a straight line. Extend to 2 dimensions using vectors.

● Use and understand vectors in 3D. ● Understand and calculate pmcc ● Carry out hypothesis test for zero correlation. ● Understand and use moments in simple static contexts. ● Understand and use the $F \leq \mu R$ model for friction; coefficient of friction; motion of a body on a rough surface; limiting friction and limiting equilibrium.		