Timing	Unit Title	Key Question	Knowledge	Assessing understanding
Autumn 1	**Pure**			**How understanding is assessed:** Students will be assessed on their ability to: ● Carry out mathematical techniques ● Problem solving using the knowledge and techniques they have gained **Skills developed:** ● Numerical ● Algebraic particularly solving equations and carrying out simple proofs ● Sketching graphs **Assessment points:** The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.
	Repeated factors	**Can you decompose algebraic fractions with repeated linear factors into partial fractions?** **Can you use partial fractions with repeated factors as a stepping stone into integration or binomial expansion?**	● Decompose algebraic fractions with repeated linear factors into partial fractions. ● Recognise when a fraction is improper and deal with it appropriately before decomposing. ● Use partial fractions with repeated factors as a stepping stone into integration or binomial expansion.	
	Algebraic division	**Can you divide a polynomial by a linear or quadratic expression using algebraic long division?** **Can you use the factor theorem alongside algebraic division to fully factorise a polynomial?**	● Divide a polynomial by a linear or quadratic expression using algebraic long division. ● Express the result of a division in the form dividend = divisor × quotient + remainder. ● Use the factor theorem alongside algebraic division to fully factorise a polynomial.	

Curriculum Information - Year 13

Department: Mathematics

Timing	Unit Title	Key Question	Knowledge	Assessing understanding
Autumn 1	**Functions**	**Can you understand and use the language of functions: domain, range, one-to-one, and composite functions?** **Can you find and verify the inverse of a function and interpret it graphically?** **Can you sketch and analyse modulus functions and solve modulus equations and inequalities?**	• Distinguish between different types of mappings and understand what makes a valid function. • Find the domain and range of a function and sketch functions for a given domain. • Find and simplify composite functions. • Find and sketch inverse functions and understand their relationship to the original function. • Sketch modulus functions and solve modulus equations and inequalities. • Combine transformations of graphs, tracking the effect on key points.	**How understanding is assessed:** Students will be assessed on their ability to: • Carry out mathematical techniques • Problem solving using the knowledge and techniques they have gained **Skills developed:** • Numerical • Algebraic particularly solving equations and carrying out simple proofs • Sketching graphs **Assessment points:** The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.
	Differentiation	**Can you differentiate using the chain rule, product rule, and quotient rule?** **Can you differentiate trigonometric, exponential, and logarithmic functions?** **Can you use implicit and parametric differentiation to find gradients and equations of tangents and normals?**	• Differentiate using the chain rule, product rule, and quotient rule. • Differentiate trigonometric, exponential, and logarithmic functions. • Use implicit differentiation to find gradients of curves defined implicitly. • Find stationary points and determine their nature using the second derivative. • Construct and solve connected rates of change problems using the chain rule.	

Timing	Unit Title	Key Question	Knowledge	Assessing understanding
Autumn 1	**Mechanics**			**How understanding is assessed:** Students will be assessed on their ability to: ● Carry out mathematical techniques ● Problem solving using the knowledge and techniques they have gained **Skills developed:** ● Numerical ● Algebraic particularly solving equations and carrying out simple proofs ● Sketching graphs **Assessment points:** The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.
	Projectiles	**Can you resolve the motion of a projectile into horizontal and vertical components and apply SUVAT to each?** **Can you find the range, maximum height, and time of flight of a projectile?**	● Resolve the motion of a projectile into independent horizontal and vertical components. ● Apply SUVAT equations to each component separately to find displacement, velocity, and time of flight. ● Find the range, maximum height, and time of flight of a projectile. ● Derive and use the equation of the trajectory of a projectile in Cartesian form.	
Autumn 2	**Pure**			
	Integration	**Can you integrate a range of functions including trigonometric, exponential, and logarithmic functions?** **Can you use integration techniques including substitution, integration by parts, and partial fractions?** **Can you solve differential equations using separation of variables and apply them to modelling contexts?**	● Integrate a range of functions including trigonometric, exponential, and logarithmic functions. ● Use integration by substitution to integrate more complex functions. ● Use integration by parts to integrate products of functions. ● Use partial fractions to integrate rational functions. ● Evaluate definite integrals and use them to find areas under curves and between curves. ● Solve differential equations by separating variables and apply them to modelling contexts.	

Timing	Unit Title	Key Question	Knowledge	Assessing understanding
Autumn 2	**Vectors**	**Can you work with vectors in three dimensions, finding magnitudes, unit vectors, and angles between vectors?** **Can you use the equation of a straight line in vector form and solve problems involving distances and intersections?**	• Understand and use 3D Cartesian coordinates. • Use vectors in three dimensions, including finding magnitudes and unit vectors. • Use vectors to solve geometric problems, including finding distances and position vectors. • Model 3D motion in mechanics using vectors.	**How understanding is assessed:** Students will be assessed on their ability to: • Carry out mathematical techniques • Problem solving using the knowledge and techniques they have gained **Skills developed:** • Numerical • Algebraic particularly solving equations and carrying out simple proofs • Sketching graphs **Assessment points:** The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.
	Mechanics			
	Forces and friction	**Can you resolve forces in two dimensions and apply Newton's laws to particles in equilibrium and non-equilibrium situations?** **Can you model friction using F = μR and solve problems involving limiting equilibrium on horizontal and inclined planes?**	• Resolve forces in two dimensions and apply Newton's laws to particles in equilibrium and non-equilibrium situations. • Model friction using F = μR and understand the difference between static and dynamic friction. • Solve problems involving limiting equilibrium on horizontal and inclined planes. • Solve problems involving connected particles on inclined planes.	

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<table>
<tr><th>Timing</th><th>Unit Title</th><th>Key Question</th><th>Knowledge</th><th>Assessing understanding</th></tr>
<tr><td>Autumn 2</td><td>Moments</td><td>Can you calculate the moment of a force about a point and apply the principle of moments to solve problems?

Can you solve problems involving non-uniform rods and beams, including finding unknown forces or distances?</td><td>● Calculate the moment of a force about a point, including the sense of the moment.
● Apply the principle of moments to solve problems involving bodies in equilibrium.
● Solve problems involving non-uniform rods, beams, and laminas, including finding unknown forces or distances.
● Solve problems involving a body on the point of tilting.</td><td rowspan="3">How understanding is assessed:
Students will be assessed on their ability to:
● Carry out mathematical techniques
● Problem solving using the knowledge and techniques they have gained

Skills developed:
● Numerical
● Algebraic particularly solving equations and carrying out simple proofs
● Sketching graphs

Assessment points:
The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.</td></tr>
<tr><td rowspan="2">Spring 1</td><td colspan="3">Statistics</td></tr>
<tr><td>Regression, correlation, hypothesis testing</td><td>Can you calculate and interpret the regression line of y on x and use it to make predictions, understanding the dangers of extrapolation?

Can you carry out a hypothesis test for the population correlation coefficient using the product moment correlation coefficient?</td><td>● Calculate and interpret the regression line of y on x and use it to make predictions within the data range.
● Understand the dangers of extrapolation and the distinction between interpolation and extrapolation.
● Carry out a hypothesis test for the population correlation coefficient using the PMCC and interpret the result in context.</td></tr>
</table>

Timing	Unit Title	Key Question	Knowledge	Assessing understanding
Spring 1	**The normal distribution**	**Can you calculate probabilities from a normal distribution N(μ, σ^2) using the normal distribution tables or your calculator?** **Can you standardise a normal distribution and use the standard normal distribution Z to find unknown means and standard deviations?** **Can you use the normal distribution as an approximation to the binomial distribution and apply a continuity correction?**	• Understand the properties of the normal distribution and use the notation N(μ, σ^2). • Calculate probabilities from a normal distribution using a calculator. • Standardise a normal distribution and use it to find unknown means and standard deviations. • Use the normal distribution as an approximation to the binomial distribution, applying a continuity correction. • Select and justify an appropriate statistical model for a given context.	**How understanding is assessed:** Students will be assessed on their ability to: • Carry out mathematical techniques • Problem solving using the knowledge and techniques they have gained **Skills developed:** • Numerical • Algebraic particularly solving equations and carrying out simple proofs • Sketching graphs **Assessment points:** The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.
	Mechanics			
	Applications of forces	**Can you apply Newton's laws to solve problems involving connected particles, including particles on inclined planes and over pulleys?** **Can you model and solve problems involving static and dynamic friction in more complex multi-force scenarios?**	• Solve problems involving particles on inclined planes with friction, including those on the point of moving. • Solve problems involving connected particles, including over pulleys and on inclined planes. • Understand and apply the concept of a particle in static equilibrium under three or more forces using resolving. • Solve problems involving rigid bodies on hinges, finding the reaction force at the hinge. • Solve ladder problems, including cases where the ladder rests against a smooth wall and rough ground.	

<table>
<tr><th>Timing</th><th>Unit Title</th><th>Key Question</th><th>Knowledge</th><th>Assessing understanding</th></tr>
<tr><td>Spring 1</td><td>Further kinematics</td><td>Can you use calculus to work with vectors in two dimensions to describe motion, including finding velocity, speed, and acceleration at a given time?

Can you solve problems involving variable acceleration in two dimensions using integration and differentiation of vector functions?</td><td>● Use calculus to differentiate and integrate vector functions to find velocity and acceleration in two dimensions.
● Solve problems involving variable acceleration in two dimensions using vector functions.
● Use calculus to find the speed and direction of motion of a particle at a given time.
● Apply initial conditions to find constants of integration in vector kinematics problems.</td><td rowspan="3">How understanding is assessed:
Students will be assessed on their ability to:
● Carry out mathematical techniques
● Problem solving using the knowledge and techniques they have gained

Skills developed:
● Numerical
● Algebraic particularly solving equations and carrying out simple proofs
● Sketching graphs

Assessment points:
The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.</td></tr>
<tr><td rowspan="2">Spring 2</td><td colspan="3">Pure</td></tr>
<tr><td>Parametric equations</td><td>Can you convert between parametric and Cartesian form and sketch curves defined parametrically?

Can you differentiate parametric equations using the chain rule to find gradients, tangents, and normals?

Can you integrate parametric equations to find areas under parametrically defined curves?</td><td>● Understand and use parametric equations to define a curve and convert between parametric and Cartesian form.
● Sketch curves defined by parametric equations, identifying key features such as intersections with axes.
● Differentiate parametric equations using the chain rule to find gradients, tangents, and normals.
● Integrate parametric equations to find areas under parametrically defined curves.</td></tr>
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Timing	Unit Title	Key Question	Knowledge	Assessing understanding
Spring 2	**Numerical methods**	**Can you locate roots of equations using sign changes and interval bisection?** **Can you apply the Newton-Raphson method and iteration with a given recurrence relation to find approximate solutions to equations?** **Can you use numerical integration, including the trapezium rule, to approximate the area under a curve and comment on the accuracy of the approximation?**	• Locate roots of equations using sign changes and understand the conditions required for this method to work. • Use interval bisection and the Newton-Raphson method to find approximate solutions to equations. • Use iteration with a given recurrence relation to find approximate solutions and understand convergence and divergence. • Use the trapezium rule to approximate the area under a curve and comment on whether it is an overestimate or underestimate.	**How understanding is assessed:** Students will be assessed on their ability to: • Carry out mathematical techniques • Problem solving using the knowledge and techniques they have gained **Skills developed:** • Numerical • Algebraic particularly solving equations and carrying out simple proofs • Sketching graphs **Assessment points:** The Pure, Mechanics and Statistics lessons run side by side and all assessment is by using exam standard questions on the topics studied either as homework or tests.
	Proof by contradiction	**Can you understand the structure of a proof by contradiction and apply it to prove mathematical statements?** **Can you use proof by contradiction to prove classic results such as the irrationality of $\sqrt{2}$ and the infinitude of primes?**	• Understand the structure of a proof by contradiction: assume the negation of the statement and derive a contradiction. • Use proof by contradiction to prove the irrationality of surds such as $\sqrt{2}$. • Use proof by contradiction to prove that there are infinitely many prime numbers.	
Summer 1	**Revision**			