

Year 13

Timing	Unit Title	Key Question	Knowledge	Assessing Understanding
Autumn	Pure <i>The first 3 pure topics will have mainly been taught in Y12.</i> Algebraic methods & proof Radians Sequences & series Functions and Graphs	Can you split an expression into partial fractions? Can you prove something is true by contradiction? Can you solve trig questions in radians and solve geometric problems? What is the difference between a geometric and arithmetic sequence? Can you model real-life situations with sequences and series? Can you solve problems involving modulus functions both algebraically and graphically?	<i>One teacher will teach Pure and Mechanics, the other Pure and Statistics.</i> - Simplify algebraic fractions - Split expressions into partial fractions - Use of proof by contradiction - Converting between degrees & radians - Problem solving with sectors & segments using radians - Using small angle approximations - nth term - Sum of a series - Sum to infinity - Sigma notation - Recurrence relations - Understand modulus and function notation and language - Find composite functions - Find inverse functions - Sketch functions - Apply transformations to functions	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 - Numerical - Algebraic particularly solving equations and carrying out simple proofs. - Sketching graphs Assessment point information 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.

	• Trigonometric functions • Trigonometry and modelling • Differentiation • Integration (1) Mechanics • Forces & friction & Application of Forces (1)	Do you know the graphs of $y = \sec x$, $y = \operatorname{cosec} x$ and $y = \cot x$? Can you solve equations involving sec, cosec and cot? Can you use trigonometric functions to model real-life situations? Can you recognise which differentiation techniques to apply to a variety of different problems? Can you differentiate functions involving 2 variables? Can you recognise which integration technique is required to solve a problem? Can you work out the maximum force required to overcome friction? What forces are applied to a pulley?	• Recognise and use sec, cosec and cot functions including their graphs • Know and use the identities: $\sec^2 \theta \equiv 1 + \tan^2 \theta$ $\operatorname{cosec}^2 \theta \equiv 1 + \cot^2 \theta$ • Prove and use the addition formulae • Understand and use the double angle formulae • $R - \alpha$ method • Know and be able to use the chain rule, product rule and quotient rule • Know how to differentiate trig functions • Use implicit differentiation • Know and be able to use the reverse chain rule and partial fractions • Use trig identities in integration • Find areas under a curve • Resolve forces and find resultants • Solve problems involving $F \leq \mu R$ • Solve problems involving motion on rough or smooth inclined planes, pulleys and connected particles • Solve projectile problems by considering both the horizontal and vertical components	
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	- Projectiles Statistics - Probability	Can you derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile? Can you identify the appropriate method to solve a variety of conditional probability questions?	- Apply SUVAT to projectile problems - Understand and use set notation - Solve problems involving conditional probability - Probability formulae	
Spring	Pure - Integration (2) - Binomial expansion - Parametrics - Vectors	Can you recognise which integration technique is required to solve a problem? How do you expand a bracket in the form $(ax + b)^n$ when n is not a positive integer? What are parametric equations? Can you use parametric equations in a variety of contexts? Can you use vectors to solve 3D geometrical problems?	- Use partial fractions to expand expressions - Integration by substitution and integration by parts - Expand brackets in the form $(ax + b)^n$ where n is any rational constant - Trapezium rule and limit of a sum - Convert between parametric and Cartesian equations - Sketch the curves of parametric equations - Solve coordinate geometry problems involving parametrics - Parametric differentiation and integration - Work with vectors in 3D	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 - Numerical - Algebraic particularly solving equations and carrying out simple proofs. - Sketching graphs Assessment point information 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.

	- Calculus - Numerical methods Mechanics - Moments - Application of forces (2) - Further kinematics	Can you model real-life situations with a differential equation and then solve it? What methods can you use to locate the root of an equation? What effect does distance have on a turning force? Can you draw an effective diagram to model a problem indicating all appropriate forces? What is meant by limiting equilibrium? How does calculus link displacement, velocity and acceleration with respect to time?	- Using second derivatives - Linking rates of change - Solving differential equations - Approximate solutions to equations by considering sign changes, iteration and the Newton-Raphson method - Use numerical methods to solve problems in context - Calculate a turning force - Find a resultant moment - Solve uniform and non-uniform problems - Solve problems involving forces in equilibrium - Solve statics problems involving weight & tension - Solve problems in limiting equilibrium - Solve connected particles, ladder and rod problems - Differentiate and integrate vectors with respect to time - Use calculus with harder functions of time involving variable acceleration.	
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	Statistics • The normal distribution • Regression, correlation and hypothesis testing	Can you select appropriate distributions and solve real-life problems in context?	• Know the properties of the normal distribution curve • Find values use a standard curve • Approximate a binomial distribution using a normal distribution • Hypothesis testing • Understand and use exponential models • Understand and calculate product moment correlation coefficient • Carry out a hypothesis test for zero correlation	
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