

## Year 13

Timing	Unit Title	Key Question	Knowledge	Assessing Understanding
Autumn	<p><b>Pure</b> <i>The first 3 pure topics will have mainly been taught in Y12.</i></p> <ul style="list-style-type: none"> <li>• <b>Algebraic methods &amp; proof</b></li> <li>• <b>Radians</b></li> <li>• <b>Sequences and series</b></li> <li>• <b>Functions and Graphs</b></li> </ul>	<p><b>Can you split an expression into partial fractions? Can you prove something is true by contradiction?</b></p> <p><b>Can you solve trig questions in radians and solve geometric problems?</b></p> <p><b>What is the difference between a geometric and arithmetic sequence?</b></p> <p><b>Can you model real-life situations with sequences and series?</b></p> <p><b>Can you solve problems involving modulus functions both algebraically and graphically?</b></p>	<p>One teacher will teach Pure and Mechanics, the other Pure and Statistics.</p> <ul style="list-style-type: none"> <li>• Simplify algebraic fractions.</li> <li>• Split expressions into partial fractions.</li> <li>• Use of proof by contradiction.</li> <li>• Converting between degrees and radians.</li> <li>• Problem solving with sectors and segments using radians.</li> <li>• Using small angle approximations.</li> <li>• nth term.</li> <li>• Sum of a series.</li> <li>• Sum to infinity.</li> <li>• Sigma notation.</li> <li>• Recurrence relations.</li> <li>• Understand modulus and function notation and language.</li> <li>• Find composite functions.</li> <li>• Find inverse functions.</li> <li>• Sketch functions.</li> <li>• Apply transformations to functions.</li> </ul>	<p><b>How understanding is assessed</b> Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> <li>• carry out mathematical techniques</li> <li>• problem solve using the knowledge and techniques they have gained.</li> </ul> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>• Numerical.</li> <li>• Algebraic particularly solving equations and carrying out simple proofs.</li> <li>• Sketching graphs.</li> </ul> <p><b>Assessment point information</b> 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.</p>

	<ul style="list-style-type: none"> <li>● <b>Trigonometric functions</b></li> <li>● <b>Trigonometry and modelling</b></li> <li>● <b>Differentiation</b></li> <li>● <b>Integration (1)</b></li> </ul> <p><b>Mechanics</b></p> <ul style="list-style-type: none"> <li>● <b>Forces and friction and Application of Forces (1)</b></li> </ul>	<p><b>Do you know the graphs of <math>y = \sec x</math>, <math>y = \operatorname{cosec} x</math> and <math>y = \cot x</math>?</b></p> <p><b>Can you solve equations involving sec, cosec and cot?</b></p> <p><b>Can you use trigonometric functions to model real-life situations?</b></p> <p><b>Can you recognise which differentiation techniques to apply to a variety of different problems? Can you differentiate functions involving 2 variables?</b></p> <p><b>Can you recognise which integration technique is required to solve a problem?</b></p> <p><b>Can you work out the maximum force required to overcome friction? What forces are applied to a pulley?</b></p>	<ul style="list-style-type: none"> <li>● Recognise and use sec, cosec and cot functions including their graphs</li> <li>● Know and use the identities: <ul style="list-style-type: none"> <li><math>\sec^2 \theta \equiv 1 + \tan^2 \theta</math></li> <li><math>\operatorname{cosec}^2 \theta \equiv 1 + \cot^2 \theta</math></li> </ul> </li> <li>● Prove and use the addition formulae.</li> <li>● Understand and use the double angle formulae.</li> <li>● <math>R - \alpha</math> method.</li> <li>● Know and be able to use the chain rule, product rule and quotient rule.</li> <li>● Know how to differentiate trig functions.</li> <li>● Use implicit differentiation.</li> <li>● Know and be able to use the reverse chain rule and partial fractions.</li> <li>● Use trig identities in integration.</li> <li>● Find areas under a curve.</li> <li>● Resolve forces and find resultants.</li> <li>● Solve problems involving <math>F \leq \mu R</math></li> <li>● Solve problems involving motion on rough or smooth inclined planes, pulleys and connected particles.</li> </ul>	
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	<ul style="list-style-type: none"> <li>● <b>Projectiles</b></li> </ul> <p><b>Statistics</b></p> <ul style="list-style-type: none"> <li>● <b>Probability</b></li> </ul>	<p><b>Can you derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile?</b></p> <p><b>Can you identify the appropriate method to solve a variety of conditional probability questions?</b></p>	<ul style="list-style-type: none"> <li>● Solve projectile problems by considering both the horizontal and vertical components.</li> <li>● Apply SUVAT to projectile problems.</li> <li>● Understand and use set notation.</li> <li>● Solve problems involving conditional probability.</li> <li>● Probability formulae.</li> </ul>	
Spring	<p><b>Pure</b></p> <ul style="list-style-type: none"> <li>● <b>Binomial expansion</b></li> <li>● <b>Integration (2)</b></li> <li>● <b>Parametrics</b></li> <li>● <b>Vectors</b></li> </ul>	<p><b>How do you expand a bracket in the form <math>(ax + b)^n</math> when <math>n</math> is not a positive integer?</b></p> <p><b>Can you recognise with integration technique is required to solve a problem?</b></p> <p><b>What are parametric equations?</b></p> <p><b>Can you use parametric equations in a variety of contexts?</b></p> <p><b>Can you use vectors to solve 3D geometrical problems?</b></p>	<ul style="list-style-type: none"> <li>● Expand brackets in the form <math>(ax + b)^n</math> where <math>n</math> is any rational constant.</li> <li>● Use partial fractions to expand expressions.</li> <li>● Integration by substitution and integration by parts.</li> <li>● Trapezium rule and limit of a sum.</li> <li>● Convert between parametric and Cartesian equations.</li> <li>● Sketch the curves of parametric equations.</li> <li>● Solve coordinate geometry problems involving parametrics.</li> <li>● Parametric differentiation and integration.</li> <li>● Work with vectors in 3D.</li> </ul>	<p><b>How understanding is assessed</b> Students will be assessed on their ability to:</p> <ul style="list-style-type: none"> <li>● carry out mathematical techniques</li> <li>● problem solve using the knowledge and techniques they have gained.</li> </ul> <p><b>Skills</b></p> <ul style="list-style-type: none"> <li>● Numerical.</li> <li>● Algebraic particularly solving equations and carrying out simple proofs.</li> <li>● Sketching graphs.</li> </ul> <p><b>Assessment point information</b> 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.</p>

	<ul style="list-style-type: none"> <li>● <b>Calculus</b></li>   <li>● <b>Numerical methods</b></li>   <li><b>Mechanics</b></li> <li>● <b>Moments</b></li>   <li>● <b>Application of forces (2)</b></li>   <li>● <b>Further kinematics</b></li> </ul>	<p><b>Can you model real-life situations with a differential equation and then solve it?</b></p> <p><b>What methods can you use to locate the root of an equation?</b></p> <p><b>What effect does distance have on a turning force?</b></p> <p><b>Can you draw an effective diagram to model a problem indicating all appropriate forces?</b></p> <p><b>What is meant by limiting equilibrium?</b></p> <p><b>How does calculus link displacement, velocity and acceleration with respect to time?</b></p>	<ul style="list-style-type: none"> <li>● Using second derivatives.</li> <li>● Linking rates of change.</li> <li>● Solving differential equations.</li>   <li>● Approximate solutions to equations by considering sign changes, iteration and the Newton-Raphson method.</li> <li>● Use numerical methods to solve problems in a context.</li>   <li>● Calculate a turning force.</li> <li>● Find a resultant moment.</li> <li>● Solve uniform and non-uniform problems.</li>   <li>● Solve problems involving forces in equilibrium.</li> <li>● Solve statics problems involving weight and tension.</li> <li>● Solve problems in limiting equilibrium.</li> <li>● Solve connected particles, ladder and rod problems.</li>   <li>● Differentiate and integrate vectors with respect to time.</li> <li>● Use calculus with harder functions of time involving variable acceleration.</li> </ul>	
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	<p><b>Statistics</b></p> <ul style="list-style-type: none"><li>● <b>The normal distribution</b></li> <li>● <b>Regression, correlation and hypothesis testing</b></li></ul>	<p><b>Can you select appropriate distributions and solve real-life problems in context?</b></p>	<ul style="list-style-type: none"><li>● Know the properties of the normal distribution curve.</li><li>● Find values use a standard curve.</li><li>● Approximate a binomial distribution using a normal distribution.</li><li>● Hypothesis testing.</li> <li>● Understand and use exponential models.</li><li>● Understand and calculate product moment correlation coefficient.</li><li>● Carry out a hypothesis test for zero correlation.</li></ul>	
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