

Year 12 Route 2

Unit Title	Key Question	Knowledge	Assessing Understanding
Autumn Pure			
Algebra and functions	Can you solve linear, quadratic and simultaneous equations and inequalities? Can you simplify surds and indices? What does the discriminant tell us? Can you represent inequalities on a graph?	- Extending the algebra covered at GCSE with particular reference to indices, factorising and surds. - Solving of quadratic equations – from a variety of starting 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.
Straight line graphs	Can you confidently sketch straight line graphs? How do you find the equation of a straight line?	- Straight line graph problem solving - Be able to find the length of a line segment and midpoint of a line	Skills - Numerical - Algebraic particularly solving equations and carrying out simple proofs. - Sketching graphs
Graph transformations	Can you confidently sketch quadratic, cubic, quartic and reciprocal graphs? How are curve transformations applied to a range of functions?	- Sketching quadratic, cubic, quartic and reciprocal graphs - Understanding the effects of graph transformations	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.
Algebraic methods	Can you simplify algebraic fractions? Can you use long division in algebra?	- Add, subtract, multiply, divide and simplify algebraic fractions - Factorise cubics using the factor theorem and algebraic long division.	

Statistics Measures of locations and spread Representations of data Mechanics Modelling in mechanics Constant acceleration	How do we use the factor theorem? Can you construct a well-reasoned proof? Can you make interpretations about data based on measures of location and spread? Can you apply coding techniques? Can you compare sets of data using a variety of statistical techniques? What is meant by an outlier? Can you distinguish between vector and scalar quantities? Can you make neat and clear diagrams using given information Can you apply SUVAT equations?	- Carry out simple algebraic proofs – deduction, exhaustion and counter example. - Build on GCSE knowledge of measures of locations and spread - Calculate variance and standard deviation - Understand and use coding techniques - Identify outliers - Be able to draw and interpret box plots, cumulative frequency diagrams and histograms - Correct mechanics terminology. - Modelling of simple real-life situations. - Learn and apply the SUVAT equations. - Draw and/or interpret speed/time graphs. - Solve problems involving vertical motion under gravity	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.
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Pure Differentiation The binomial expansion Vectors Integration	What is differentiation used for? Can you apply the rules of differentiation? Can you carry out a binomial expansion? Do you know the definition of a vector? Can you +,- and carry out scalar multiplications. Can you solve geometric problems using vectors? Do you understand how differentiation and integration are linked? Can you apply the rule of integration to find an area? What is the difference between a definite and indefinite integral?	• The basic differentiation rules • Use differentiation to find the equation of tangents, normals and locate stationary points. • Find and use the second derivative. • Binomial expansion for positive integer powers. • Familiarisation with Pascal's Triangle and nCr notation is needed. • Position vectors, calculate a vector that runs between two given points. Find the distance between two points. • Use ratio theorem to find the position vector of a point which divides a line in a given ratio. • Apply theory to a variety of geometric problems. • Using the fundamental rules for integrating functions such as x^n. • Using both dy/dx and $f'(x)$ notation. • Integrating a gradient function to find the original function. • Using integration to find the area under a curve.	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.
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Exponentials and logarithms	Can you sketch the a^x , e^x and log functions?		
Statistics Correlation	Do you know how to apply the three log rules?	• Know the graphs of a variety of exponential and log/ln functions. • Be able to solve equations which contain these type of functions. • Understand how exponentials can be used to model real life situations such as compound interest and radioactive decay.	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.
Probability	Can you interpret scatter diagrams and regression lines? Can you use a Venn Diagram or a Tree Diagram to solve a probability problem? Can you identify the appropriate method to solve a variety of conditional probability questions?	• Recognise explanatory and response variables. • Interpretation of correlation and regression. • Be able to clean data – deal with missing data, errors and outliers. • Know how Venn diagrams and Tree diagrams are used and which is the best method to use for different types of questions. • Understand the terms mutually exclusive and independent • Understand and use set notation • Solve problems involving conditional probability • Probability formulae	Skills • Numerical • Algebraic particularly solving equations and carrying out simple proofs. • Sketching graphs
Mechanics Forces & motion	Can you draw a force diagram? Do you understand Newton's 3 laws and how they can be applied to a	• Force diagrams, equilibrium, including vector notation. • Find a resultant force • $F=ma$	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.

	simple set of forces acting on a particle? Can you apply Newton's Laws to increasingly complex problems?	Solve problems involving connected particles, pulley systems.	
Spring Pure Circles	Can you find the equation of a circle? Can you use tangent and chord properties to solve geometrical problems?	- Equation of a circle - Find midpoints, perpendicular bisectors, points of intersection	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.
Trig ratio	What is the 'special case' of the sine rule? Can you sketch all trig functions and apply transformations to them?	- Solve triangle problems using the sine and cosine rules - Graphs of trig functions	
Trig identities and equations	Can you find all of the solutions to a trig equation?	- Solve trig equations using the quadrant diagram - Exact trig ratios $\sin^2 \theta + \cos^2 \theta = 1$ $\tan \theta = \frac{\sin \theta}{\cos \theta}$ - Solve trig equations involving identities	
Mechanics Variable acceleration	How is calculus used to deal with variable acceleration?	Solve kinematics problems using differentiation and integration.	

Statistics Statistical distributions Hypothesis testing Data Collection	Can you calculate probabilities from a discrete uniform distribution and from a binomial distribution? Do you know the terminology used in hypothesis testing? How do we carry out one and two tailed tests? Why is sampling used and what are the different methods?	• Deal with discrete distributions finding probabilities, mean and variance. With particular reference to the binomial distribution. • Be able to carry out a statistical hypothesis test for the proportion in a binomial distribution. • Understand that a sample is being used to make an inference about a population. • Appreciate what is meant by significance level. • Understand how each sampling method works and be able to compare them * random, systematic, stratified, quota and • Be able to sample from the large exam data set.	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.
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Unit Title	Key Question	Knowledge	Assessing Understanding
Pure Algebraic methods & proof Functions & Graphs Radians Trigonometric functions	Can you split an expression into partial fractions? Can you prove something is true by contradiction? Can you solve problems involving modulus functions both algebraically and graphically? Can you convert between degrees & radians? Do you know the graphs of $y = \sec x$, $y = \csc x$ and $y = \cot x$? Can you solve equations involving sec, cosec and cot?	• Simplify algebraic fractions • Split expressions into partial fractions • Proof by contradiction • Understand modulus and function notation and language • Find composite functions • Find inverse functions • Sketch functions • Apply transformations to functions • Converting between degrees & radians • Problem solving with sectors & segments using radians • Using small angle approximations • Recognise and use sec, cosec and cot functions including their graphs • Know and use the identities: $\sec^2 \theta \equiv 1 + \tan^2 \theta$ $\csc^2 \theta \equiv 1 + \cot^2 \theta$ • Prove and use the addition formulae	How understanding is assessed Students will be assessed on their ability to: • Carry out mathematical techniques. • Problem solve 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.

Trigonometry and modelling	Can you use trigonometric functions to model real-life situations?	- Understand and use the double angle formulae $R - \alpha$ method - Know and be able to use the chain rule, product rule and quotient rule	
Differentiation	Can you recognise which differentiation techniques to apply to a variety of different problems? Can you differentiate functions involving 2 variables?	- Know how to differentiate trig functions - Use the chain, product & quotient rules - Implicit differentiation	
Binomial expansion	How do you expand a bracket in the form $(ax + b)^n$ when n is not a positive integer?	- Expand brackets in the form $(ax + b)^n$ where n is any rational constant - Use partial fractions to expand expressions	
Mechanics Moments	What effect does distance have on a turning force?	- Calculate a turning force - Find a resultant moment - Solve uniform and non-uniform problems	
Forces and Friction	Can you work out the maximum force required to overcome friction?	- Resolve forces and find resultants - Solve problems involving $F \leq \mu R$	
Projectiles	Can you derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile?	Solve projectile problems by considering both the horizontal and vertical components	

Application of forces 1	Can you draw an effective diagram to model a problem indicating all appropriate forces?	• Apply SUVAT to projectile problems • Solve problems involving forces in equilibrium	
Summer Pure Integration Mechanics Application of forces 2	Can you recognise which integration technique is required to solve a problem? What forces are applied to a pulley? What is meant by limiting equilibrium?	• Know and be able to use the reverse chain rule, substitution and integration by parts • Use trig identities in integration • Find areas under a curve • Trapezium rule • Solve statics problems involving weight, tension and pulleys • Solve problems in limiting equilibrium • Solve problems involving motion on rough or smooth inclined planes • Solve connected particles problems	How understanding is assessed Students will be assessed on their ability to: • Carry out mathematical techniques. • Problem solve 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.
Pure Calculus Parametric equations & calculus	Can you model real-life situations with a differential equation and then solve it? What are parametric equations?	• Using second derivatives • Linking rates of change • Solving differential equations • Convert between parametric and Cartesian equations	

Numerical methods Sequences & series Vectors	Can you use parametric equations in a variety of contexts? What methods can you use to locate the root of an equation? What is the difference between a geometric and arithmetic sequence? Can you model real-life situations with sequences and series? Can you use vectors to solve 3D geometrical problems?	• Sketch the curves of parametric equations • Solve coordinate geometry problems involving parametrics • Parametric differentiation and integration • Approximate solutions to equations by considering sign changes, iteration and the Newton-Raphson method • Use numerical methods to solve problems in a context • nth term • Sum of a series • Sum to infinity • Sigma notation • Recurrence relations • Work with vectors in 3D	
Mechanics Further kinematics Statistics Regression, correlation and hypothesis testing	How does calculus link displacement, velocity and acceleration with respect to time?	• Differentiate and integrate vectors with respect to time • Use calculus with harder function of time involving variable acceleration. • Understand and use exponential models • Understand and calculate product moment correlation coefficient	

The normal distribution	Can you select appropriate distributions and solve real-life problems in context?	• Carry out a hypothesis test for zero correlation • Know the properties of the normal distribution curve • Find values use a standard curve • Approximate a binomial distribution using a normal distribution • Hypothesis testing	
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