Year 13 Maths - Pure and Mechanics Teacher

Topic		Ref	Ex
Radians	**Radian Measure** • Understand and use radians as a measure of angles • Convert between degrees and radians • Know exact values of angles measured in radians	P5.1 P5.3	5A 5B
	Arc Length and Area of Sector or Segment • Find an arc length using radians • Find areas of sectors and segments using radians.	P5.1	5C 5D
	Solving Trigonometric Equations • Use and apply models that involve quadratic functions	P5.7	5E
	Small angle approximations • Use approximate trigonometric values when θ is small.	P5.2	5F
Differentiation	**Trigonometric functions 1 (sin x and cos x)** • Differentiate sin x and cos x from first principles • Differentiate sin kx and cos kx.	P7.1	9A
	Exponentials and Logarithms • Differentiate exponentials and logarithms including e^{kx}, a^{kx}, ln x and ln kx.	P7.2	9B
	Chain Rule • Differentiate composite functions and functions of functions using the chain rule.	P7.4	9C
	Product Rule • Differentiate the product of two functions using the product rule.	P7.4	9D
	Quotient Rule • Differentiate the quotient of two functions using the product rule.	P7.4	9E
	Trigonometric functions 2 • Differentiate tan kx, cosec kx, sec kx and cot kx • Use the chain rule to differentiate composite trigonometric functions.	P7.4	9F
	Parametric Differentiation • Differentiate functions defined parametrically without converting to Cartesian form. • Use this to find equations of tangents and normals.	P7.5	9G
	Implicit Differentiation • Differentiate functions defined implicitly. • Use this to find equations of tangents and normal.	P7.5	9H
	Second Derivatives • Use the second derivative to determine whether a curve is convex or concave on a given domain. • Use it to determine the nature of a stationary point.	P7.1	9I
	Rates of Change • Use the chain rule to connect rates of change in situations involving more than one variable.	P7.4	9J
Term 1 Assessment			

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Topic		Ref	Ex
Integration	**Standard Functions** • Integrate e^{kx}, 1/x, sin kx, cos kx and other trigonometric functions	P8.2	11A
	f(ax+b) • Integrate a function of the form f(ax+b) by using the reverse chain rule for differentiation.	P8.2	11B
	Using Trigonometric Identities • Use trigonometric identities to make the integrant into something that can be integrated.	P8.2	11C
	Integration "by sight" • Integrate by sight functions of the form: $k\frac{f'(x)}{f(x)}$ or $kf'(x)(f(x))^n$	P8.5	11D
	Integration by Substitution • Use a substitution to simplify an integral • Includes definite integrals.	P8.5	11E
	Integration by Parts • Use integration by parts to integrate a product of functions • Use this technique to integrate ln x, • Use more than one application of this method e.g. for integrating e^x sin x.	P8.5	11F
	Partial Fractions • Integrate algebraic fractions using partial fractions	P8.6	11G
	Finding Areas under or between curves • Use any of the integration techniques to find areas under or between curves.	P8.3	11H
	Trapezium Rule • Use the trapezium rule to approximate the area under a curve whose function you cannot integrate algebraically. • Determine whether this gives an under or over estimate.	P9.4	11I
	Differential Equations • Solve first order differential equations by separating the variables. • Interpret the solution of a DE in the context of solving a problem.	P8.7 P8.8	11J 11K
Term 2 Assessment			

Year 13 Maths - Pure and Mechanics Teacher

Topic		Ref	Ex
Vectors in 3D	**Vectors in 3 dimensions** • Use vectors in 3D both in column vector form and **i**, **j**, **k** unit vector form. • Find the angle between a 3D vector and any of the coordinate axes	P10.1	12A 12B
	Geometric Problems • Solve geometric problems involving vectors in 3D	P10.5	12C
	Mechanics Problems • Model problems in mechanics using 3D vectors	P10.5	12D
Moments	**Definition** • Understand the definition of a moment • Calculate the turning effort of a force applied to a rigid body – the moment.	A9.1	A4A
	Resultant Moments • Find the resultant moment for several coplanar forces acting on a rigid body.	A9.1	A4B
	Equilibrium • Solve problems involving uniform rods in equilibrium	A9.1	A4C
	Centres of Mass • Solve problems involving non-uniform rods in equilibrium by finding its centre of mass.	A9.1	A4D
	Tilting • Solve problems involving uniform rods on the point of tilting.	A9.1	A4E
Forces and Friction	**Resolving Forces** • Resolve forces into components • Use the triangle law to find a resultant force.	A8.2 A8.4 A8.5	A5A
	Inclined Planes • Resolve forces into components parallel to and at right angles to the inclined plane	A8.4 A8.5	A5B
	Friction • Understand Friction and the coefficient of friction • Use $F \leq \mu R$ model for friction	A8.6	A5C
Projectiles	**Horizontal Projection** • Model motion under gravity for an object projected horizontally	A7.5	A6A
	Projection at any angle • Resolve velocity into horizontal and vertical components. • Solve problems involving particles projected at an angle	A7.3 A7.5	A6B A6C
	Projectile motion formulae • Derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile.	A7.5	A6D
Term 3 Assessment			

Year 13 Maths - Pure and Mechanics Teacher

Topic		Ref	Ex
Applications of Forces	**Static Particles** • Use force diagrams to model objects in static equilibrium. • Find an unknown force when a system is in equilibrium • Solve statics problems involving weights, tension and pulleys. • Understand and solve problems involving limiting equilibrium and friction.	A8.4 A8.6	A7A A7B A7C
	Static Rigid Bodies • Solve static problems including rotational forces acting on an object.	A8.6	A7D
	Dynamics and Inclined Planes • Solve problems involving motion on smooth or rough inclined planes.	A8.6	A7E
	Connected Particles • Solve problems involving connected particles that require the resolution of forces.	A8.5 A8.6	A7F
Further Kinematics	**Vectors in Kinematics** • Use two dimensional vectors to describe motion in a plane. • Work with vectors for displacement, velocity and acceleration when using the vector equations of motion. • Use vector equations of motion for projectiles in a vertical plane	A7.3	A8A A8B
	Variable Acceleration • Understand how to model variable acceleration as a function of time. • Use calculus for harder functions of time, including trigonometric or exponential functions. • Differentiate and integrate vectors with respect to time. • Use calculus with vectors to solve problems involving motion in two dimensions with variable acceleration.	A7.4	A8C A8D A8E
Term 4 Assessment			