

Year 12 Maths: Mechanics

Year 12 A level Maths: Mechanics

Focus	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Topic	Algebra: straight line graphs and circles Geometry: Trigonometry and Vectors	Kinematics & Newtons laws & Forces	Binominal Theorem & Exponentials and Logrithms	Algebraic/ Partial fractions and Functions & Transformations	Trigonometry	Binomials, sequences and series
Key concepts/ideas	To use skills learned at GCSE and develop them more to use in applied situations and work on more complex problem solving skills	To use SI units, draw and interpret displacement and velocity graphs against time, use formulae for motion and use calculus for variable acceleration. To understand mass and weight, to calculate magnitude and direction of a resultant force, resolve forces.	To simplify and factorise polynomials, use the binomial theorem, to divide polynomials by algebraic expressions, to use the factor theorem and sketch graphs of functions. To convert between powers and logarithms, to manipulate and solve equations involving powers and logarithms, to use graphs of exponential functions, to use mathematical models.	To decompose partial fractions, to divide polynomials by algebraic expressions. To understand function notation, find inverse and composite functions.	To convert between radians and degrees, use inverse trig relationships, use trigonometric formulae for compound and double angles, to solve equations using trig identities.	To use the binomial expansion and estimate value of surds, understand if a sequence is increasing or decreasing, find the order of a periodic sequences, find the nth term and the sum of arithmetic and geometric series.
Key skills	Straight lines 1) Calculate gradient of a line 2) Calculate the distance between 2 points 3) Finding midpoints of a line segment 4) Calculate the equation of a straight line given different pieces of information 5) Understand gradient conditions for 2 lines to be parallel or perpendicular 6) Use straight lines models in a variety of contexts. Circles 1) Understand the form of the equation of a circle 2) Complete the square to find the centre and radius of a circle 3) Use properties to solve problems (angle in a semi-circle is a right angle, perpendicular from the centre to a chords bisects the chord, radius and tangent are perpendicular when they meet on the circumference) Trigonometry 1) Use the Sine/Cosine Rule/area of triangle 2) Understand and know properties of the 3 trigonometric graphs 3) Understand 2 trigonometric identities; $\tan x = \sin x / \cos x$ and $\sin^2 x + \cos^2 x = 1$ 4) Solve simple trigonometric equations in a given interval Vectors 1) Use vectors in 2-D and 3-D	Kinematics 1) SI units and dimensions 2) Understand the Kinematic Graphs and their properties 3) Know the Constant acceleration formulae and how to apply them 4) Variable Acceleration Differentiation: Newtons Laws and Forces 1) Forces and equilibrium 2) Dynamics and $F = ma$ 3) Motion under gravity 4) Systems of forces	Binominal Theorem 1) Factorial notation 2) The nCr function and Pascals triangle 3) Expansion of brackets to a given power 4) Use of expansions in approximations Exponentials and Logrithms 1) The laws of logarithms 2) Exponential functions 3) Exponential graphs and processes 4) Curve fitting	Algebraic/ Partial fractions 1) Can multiply and divide algebraic fractions as well as add and subtract 2) Can split an algebraic fraction into partial fractions 3) Can use partial fractions on repeated brackets 4) Can use partial fractions on improper algebraic fractions Functions & Transformations 1) Find a composite function 2) Find an inverse function 3) Function notation and terminology 4) Modulus functions	Trigonometry 1) How to solve trig equations 2) What is a radian and how to use it 3) Small angle approximations 4) Reciprocal and inverse trig functions	Binomials, sequences and series 1) Binomial expansion for positive integers 2) Binomial expansion for negatives and fractions 3) Sequence notation 4) Arithmetic sequences 5) Geometric sequences

	2) Calculate the magnitude and direction of a vector 3) Operations with vectors and scalars 4) Understand position vectors and calculate the distance between 2 points 5) Solve problems in pure maths and kinematics					
Key terms/vocab	Coordinates, Magnitude, Pythagoras, Scalar, Chord, Gradient, Midpoint, Perpendicular, Tangent, Distance, Parallel, Equation.	Kinematics, Differentiation, Derivative, Integration, Integral, Tangent, , Rate of change, Equilibrium, Forces, Acceleration, Variable, Gravity, Weight, Mass.	Coefficient, Polynomial, Factorisation, Expansion, Surd, Rationalise, Irrational, , Reciprocal, Asymptote	Algebraic division, Polynomial, Manipulate, Factorise, Expand, Factor Theorem, Decompose, Functions, Set, Domain, Range, Inverse, Composite.	Trigonometry, Sine, Cosine, Tangent, Angle, Radians, Degrees, Period, Graph, Equivalent, Identity	Expansion, Notation, Algebraic, Partial Fraction, Surds, Arithmetic, Geometric, Series, Sigma.
Independent learning / wider reading	Straight line graphs: 1) https://www.youtube.com/watch?v=ykeCKm9JqSA 2) https://www.youtube.com/watch?v=0IOEPcAHgi4 3) https://www.youtube.com/watch?v=8lln-wsg0rU Trigonometry: 1) Sine and cosine rule- https://www.youtube.com/watch?v=I8LI7wPSvNI 1) Area of a triangle- https://www.youtube.com/watch?v=ORKNWz9ADNU	Kinematics https://www.youtube.com/watch?v=7GJ_SYM8cyU https://www.youtube.com/watch?v=V5E_LLUGbjl		Algebraic/ Partial Fractions: https://www.youtube.com/watch?v=93Y8hc0Oaj0 https://www.youtube.com/watch?v=c89f9lewdkl Functions & Transformations https://www.youtube.com/watch?v=2PwFHLXq7hM	Trigonometry https://www.youtube.com/watch?v=1KxhQbbr49s https://www.youtube.com/watch?v=ZkK4ifsQoGk	Binomials, sequences and series https://www.youtube.com/watch?v=h3wdStMSfXk Skip to about 4 minutes
Assessment	Introduction test- assess what students already know on the GCSE crossover material	Autumn Test on topics covered on both sides of the course so far	Mock examination on topics covered on both sides of the course so far (pure and mechanics, no statistics)	Spring test on all pure content studied so far and Statistics (no mechanics)		Progress exam on all year 12 content
Careers links	Engineering, Builders, Construction, Architect, Physicist, Economics , Forecasting, Biology, Chemistry, Physics	Engineering, Construction, Builders, Architects, Finance, Forecasting, Biology, Chemistry, Physics, Pilots, Geographer, Route planner	Economics, Finance, Geographer, Forecasting, any sort of business analysis, Biology, Chemistry, Physics	Economics, Finance, Geographer, Forecasting, any sort of business analysis, Biology, Chemistry, Physics	Architects, Builders, Surveyors, Astronauts, Engineers, Crime Scene investigators.	Economics, Finance, Geographer, Forecasting, any sort of business analysis, Biology, Chemistry, Physics