

Year
12

Autumn 1

Autumn 2

Spring 1

Spring 2

Summer 1

Summer 2

Quadratics

- Functions
 - The discriminant
 - Modelling with quadratics
- Equations and Inequalities**
- Simultaneous equations on graphs (using discriminant)
 - Inequalities on graphs
 - Regions

Graphs & transformations

- Cubic graphs
- Quartic graphs
- Reciprocal graphs
- Points of intersection
- Translating graphs
- Stretching Graphs
- Transforming functions

Differentiation

- Gradients of curves
- Finding the derivative
- Differentiating
- Differentiating quadratics
- Differentiating functions
- Gradients, tangents, normals
- Increasing and decreasing functions
- Second order derivatives
- Stationary points
- Sketching gradient functions
- Modelling with differentiation

Straight line graphs

- Equations of straight lines
- Length and area
- Modelling with straight lines

Circles

- Midpoints and perpendicular bisectors
- Equation of a circle
- Intersections of straight lines and circles
- Use tangent and chord properties
- Circles and triangles

Algebraic Methods

- Dividing Polynomials
- The factor theorem
- Mathematical proof
- Methods of proof

Binomial Expansion

- Pascal's triangle
- Factorial notation
- The binomial expansion
- Solving binomial problems
- Binomial estimation

Trigonometric Ratios

- Areas of triangles
- Solving triangle problems
- Transforming trigonometric graphs

Trigonometric identities and equations

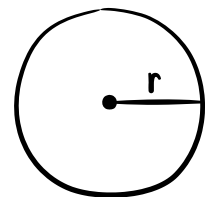
- Angles in all four quadrants
- Exact values of Trig. ratios
- Trigonometric identities
- Simple Trig. equations
- Harder Trig. Equations
- Equations and identities

Vectors

- Vector properties, laws
- Representing Vectors
- Magnitude and direction
- Position vectors
- Solving geometric problems
- Modelling with Vectors

Integration

- Integrating
- Indefinite integrals
- Finding functions
- Definite integrals
- Areas under curves
- Areas under the
- Areas between curves and lines

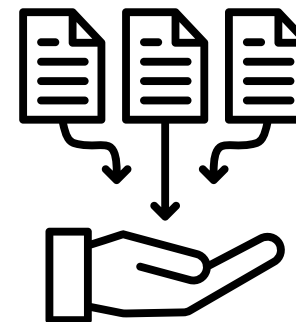


$$A = \pi r^2$$

Exponentials and Logarithms

- Exponential functions
- Exponential modelling
- Logarithms
- Laws of logarithms
- Solving equations using logarithms
- Working with natural logarithms
- Logarithms and non-linear data

$$\log_a x = \frac{\log_c x}{\log_c a}$$



Modelling in mechanics

- Constructing a model
- Modelling assumptions
- Quantities and units
- Working with vectors

Constant acceleration

- Displacement-time graphs
- Velocity-time graphs
- Constant acceleration f1
- Constant acceleration f2
- Vertical motion under gravity

Forces and Motion

- Force diagrams
- Forces as vectors
- Forces and acceleration
- Motion in 2 dimensions
- Connected particles
- Pulleys

Variable Acceleration

- Functions of time
- Using differentiation
- Maxima and minima problems
- Using integration
- Constant acceleration formulae

Data Collection

- Populations and samples
- Sampling
- Non-random sampling
- Types of data
- The large data set

Measures of location and spread

- Measures of central tendency
- Other measures of location
- Measures of spread
- Variance and standard deviation
- Coding

Representation of Data

- Outliers
- Box plots
- Cumulative frequency
- Histograms
- Comparing Data

Correlation

- Correlation: strong, weak...
- Linear regression

Probability

- Calculating probabilities
- Venn diagrams
- Mutually exclusive and independent events
- Tree diagrams

Statistical Distributions

- Probability distributions
- The binomial distribution
- Cumulative probabilities

Hypothesis testing

- Hypothesis testing language
- Finding critical values
- One-tailed tests
- Two-tailed tests



Summer 2

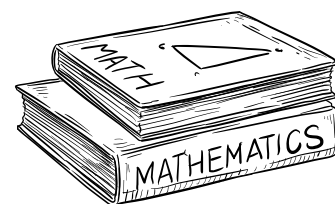
Summer 1

Spring 2

Spring 1

Autumn 2

Autumn 1



- The normal distribution**
 - the normal distribution
 - finding probabilities for normal distributions
 - the inverse normal distribution
 - the standard normal distribution
 - finding μ and σ
 - approximating a binomial distribution
 - hypothesis testing with the normal distribution
- Moments**
 - moments
 - resultant moments
 - equilibrium
 - centres of mass
 - tilting
- Forces and friction**
 - resolving forces
 - inclined planes
 - friction
- Projectiles**
 - horizontal projection
 - horizontal and vertical components
 - projection at any angle
 - projectile motion formulae
- Applications of forces**
 - static particles
 - modelling with statics
 - friction and static particles
 - static rigid bodies
 - dynamics and inclined planes
 - connected particles
- Further Kinematics**
 - vectors in kinematics
 - vector methods with projectiles
 - variable acceleration in one dimension
 - differentiating vectors
 - integrating vectors

- Vectors**
 - 3D coordinates
 - vectors in 3D
 - solving geometric problems
 - application to mechanics
- Regression, correlation and hypothesis testing**
 - exponential models
 - measuring correlation
 - hypothesis testing for zero correlation
- Conditional probability**
 - set notation
 - conditional probability
 - conditional probabilities in Venn diagrams
 - probability formulae
 - tree diagrams

$$(\sqrt[n]{a})^m = \sqrt[n]{a^m} = a^{\frac{m}{n}}$$

- Parametric equations**
 - parametric equations
 - using trigonometric identities
 - curve sketching
 - points of intersection
 - modelling with parametric equations
- Differentiation**
 - differentiating $\sin x$ and $\cos x$
 - differentiating exponentials and logarithms
 - the chain rule
 - the product rule
 - differentiating trigonometric functions
 - parametric differentiation
 - implicit differentiation
 - using second derivatives
 - rates of change
- Numerical methods**
 - locating roots
 - iteration
 - the Newton-Raphson method
 - applications to modelling
- Integration**
 - integrating standard functions
 - integrating $f(ax+b)$
 - using trigonometric identities
 - reverse chain rule
 - integration by substitution
 - integration by parts
 - partial fractions
 - finding areas
 - the trapezium rule
 - solving differential equations
 - modelling with differential equations

- Algebraic methods**
 - Proof by contradiction
 - Algebraic fractions
 - Partial fractions
 - Repeated fractions
 - Algebraic division
- Functions and Graphs**
 - The modulus function
 - Functions and mappings
 - Composite functions
 - Inverse functions
 - $y=|f(x)|$ and $y=f(|x|)$
 - combining transformations
 - solving modulus problems
- Sequences and series**
 - Arithmetic sequences
 - Arithmetic series
 - geometric sequences
 - geometric series
 - sum to Infinity
 - sigma notation
 - recurrence relations
 - modelling with series
- Binomial expansion**
 - Expanding $(1+x)^n$
 - Expanding $(a+bx)^n$
 - Using Partial fractions
- Radians**
 - Radian measure
 - arc length
 - areas of sectors and segments
 - solving trigonometric equations
 - small angle approximations
- Trigonometric functions**
 - secant, cosecant and cotangent
 - graphs of $\sec x$, $\operatorname{cosec} x$ and $\cot x$
 - trigonometric identities
 - inverse trigonometric functions