# UNIT 3 SPECIALIST MATHS INDEX

# **Coordinate Geometry**

Sketching Power Functions Defined by  $f(x) = ax^m + bx^{-n}$ 

Method 1: Addition of Ordinates

Method 2: Considering Essential Features

Sketching Rational Algebraic Functions Defined by  $f(x) = \frac{P(x)}{O(x)}$ 

Key Features on Sketch Graphs – Summary Method 3: Sketching Reciprocal Functions The Ellipse The Hyperbola

The Conjugate Hyperbola

The Modulus Function

#### **Vectors**

**Vector Notations** 

**Position Vectors** 

**Equality of Vectors** 

Addition of Vectors

The Identity Vector

The Inverse Vector

Subtraction of Vectors

Multiplication of a Vector by a Scalar

**Unit Vectors** 

Vectors in 3 Dimensional Space

**Position Vectors** 

The Magnitude of a Vector

**Creating Unit Vectors** 

The Scalar Product of Two Vectors

Properties of the Scalar Product

Scalar Product in Component Form

**Angles Between Vectors** 

#### Resolution of Vectors

Scalar Resolutes Vector Resolutes

Linear Dependence and Independence Vector Proofs Circle Geometry Geometric Proofs Using Vectors

# **Circular (Trigonometric) Functions**

Exact Values
Graphs of Trigonometric Functions
The Fundamental Identities
The Addition Theorems

The Double Angle Formulae Inverse Circular Functions Maximal Domains and Ranges Transformations of Functions – Summary

# **Complex Numbers**

The Imaginary Number Operations Involving Imaginary Numbers

## **Properties of Complex Numbers**

Equality
Addition and Subtraction
Multiplication
Complex Conjugates
Magnitude
The Multiplicative Inverse
Division of Complex Numbers

## **The Complex Number Plane**

Geometrical Interpretation of Subtraction
Polar Form
Converting Cartesian Forms into Polar Form
Converting the Polar Form into Cartesian Form
Multiplication and Division in Polar Form
Geometrical Interpretation of Multiplication and Division

#### De Moivre's Theorem

Solving Equations in the Form  $z^n=a$  Using De Moivre's Theorem Finding nth Roots of a Complex Number The nth Roots of Unity Finding Square Roots in Exact Cartesian Form

#### **Polynomials Over C**

The Fundamental Theorem of Algebra
The Factor Theorem
The Conjugate Root Theorem
Factors Over C of Polynomials

Factorising Quadratics Over C
Factorising Cubics Over C
Factorising Polynomials of Degree Greater Than 3 Over C

# **Solution Over C of Polynomial Equations**

#### **Relations and Regions in the Complex Plane**

#### **Relations in the Complex Plane**

Restrictions on Magnitude Solving Questions Involving Restrictions on Magnitude Rays and Lines Common Types of Relations – Summary

# **Regions in the Complex Plane**

Common Types of Regions – Summary

#### **Differential Calculus**

Formula

The Derivative of tan(kx) and cot(kx)
The Second Derivative
Applications of the Second Derivative
Implicit Differentiation

**Derivatives of Inverse Circular Functions** 

# Integral Calculus (Part 1) – Techniques in Anti-Differentiation

Definition

**Basic Properties** 

Standard Anti-Derivatives

Linear Substitution

The 'Reverse Chain Rule'

Anti-Derivatives of  $\frac{1}{\sqrt{a^2-x^2}}$  and  $\frac{1}{a^2+x^2}$ 

Anti-Derivatives of  $\sin^2(kx)$  and  $\cos^2(kx)$ 

Anti-Derivatives of odd powers of sin(kx) and cos(kx)

Anti-Derivatives of  $tan^{n}(kx)$  and  $cot^{m}(kx)$ 

Anti-Derivatives of Expressions of the Form  $\sin^m(kx)\cos^n(kx)$ 

Partial Fraction Decomposition

**Rational Functions** 

N(x) = Polynomial of Degree 2 or Higher

Anti-Derivatives of Rational Functions with Quadratic Denominators

Anti-Differentiation by Recognition

The Relationship between the Graph of a Function and the Graph of its Anti-Derivative

## Integral Calculus (Part 2) - Integration and its Applications

Definite Integrals
Basic Properties
The Area Under a Curve
The Area Between a Cur

The Area Between a Curve and the Y Axis

The Area Between Two Curves

Volumes of Solids of Revolution

# **Lengths of Curves in the Plane**

The Length of a Parametric Curve