# UNIT 3 MATHEMATICAL METHODS INDEX 

## ALGEBRA

## Substitution of Values

Rearrangement and Substitution

## Polynomial Expressions

Expanding Expressions
Expanding Expressions by Rule
Perfect Squares
The Difference of Two Squares
Expanding Perfect Cubes by Rule

## Techniques in Factorisation

Number Systems
Highest Common Factors
The Difference of Two Squares
Quadratic Trinomials
Factorising Quadratic Trinomials by Rule
Factorising Quadratic Trinomials (FOIL)
Equations That Can Be Reduced to Quadratic Expressions
Completing the Square
Transposition Using Completing the Square
The Sum or Difference of Two Cubes
Grouping Terms
Long Division of Polynomial Expressions
Division Done Easy
Synthetic Division
The Remainder Theorem
The Factor Theorem
Finding Factors
Factorising Higher Order Polynomial Expressions

## Solving Algebraic Equations

Verifying Solutions
The Quadratic Formula
The Discriminant
Solving Equations by Equating Coefficients
Advanced Algebraic Applications
Numerical Estimation of Roots/Solutions
Literal Equations

## Simultaneous Equations

Solving Linear Equations (Two Variables)
Predicting Solutions of Linear Equations by
Solving Literal Linear Simultaneous Equations
Solutions of Literal Linear Simultaneous Equations
Solving One Linear and One Second Degree Equation

## The Binomial Theorem

## Matrices

Dimension/Order/Size of Matrices
Representing Matrices and Elements
Special Types of Matrices
Equality of Matrices
Algebra of Matrices
Addition and Subtraction of Matrices
Scalar Multiplication
Matrix Multiplication
The Identity Matrix
The Determinant \& Multiplicative Inverse (Inverse Matrix
Finding Inverse Matrices
Solving Matrix Equations
Solving Linear Simultaneous Equations in Terms of Two Variables
Solutions of Simultaneous Linear Equations
Simultaneous Equations in Terms of Three Unknowns
Geometric Representation of Solutions to Equations With 3 Unknowns
Simultaneous Equations With More Than 3 Unknowns

## RELATIONS, FUNCTIONS \& THEIR GRAPHS

## Relations, Functions and Their Graphs

Relations
Types of Relations
Functions and Inverses

## Function Notation

Number Systems
Notations Used to Describe Domains and Ranges
The Domain
The Range
The Largest Possible Domain
Continuity and Discontinuity

## Curve Sketching

Common Curve Shapes
Determining the Sign of a Relation

Sketching Curves by Considering the Essential Features of a Graph
Y Intercepts
X Intercepts
Stationary Points
Asymptotes
Asymptotic Behaviour
Sketching and Solving Inequations

## Relations and Transformations

Dilations
Reflections
Translations
Summary of Transformation Notations
The Order of Transformations
Identifying Transformations
Transformation Mapping Notation
Matrix Representation of Transformations
Finding the Image of a Point
Finding the Image of a Relation of Function

## Polynomial Functions

A. Linear Functions and Their Graphs
B. Quadratic Functions and Their Graphs
C. Cubic Functions and Their Graphs
D. Quartic Functions and Their Graphs
E. Higher Order Polynomial Functions

## Negative Power Functions

A. The Rectangular Hyperbola

Higher Order Negative Odd Power Functions
Transformations Involving Negative Odd Power Functions

## B. The Truncus

Higher Order Negative Even Power Functions
Transformations Involving Negative Even Power Functions

## Fractional Power Functions

Square Root Functions and Their Graphs
Other Fractional Power Functions
Transformations Involving Square Root and Related Functions

## The Discriminant Function

Calculating the Discriminant
Solving Discriminant Applications

## EXPONENTIAL \& LOGARITHMIC FUNCTIONS

## Exponential and Logarithmic Functions

Indicial Expressions and Equations
Rational Exponents

## Index Laws

Simplifying Indicial Expressions

## Solving Indicial Equations

## Logarithms

Simplifying Logarithmic Expressions
Logarithmic Laws
Solving Logarithmic Equations
Change of Base Rule

## Review of Transformations

Transformation Notations
Identifying Transformations
Matrix Representation of Transformations
Finding the Image of a Function or Relation

## Graphing Exponential and Logarithmic Functions

The Exponential Graph
Transformations Involving Exponential Functions
Solving Exponential Inequations
Finding Equations Describing Exponential Functions
The Logarithmic Graph
Transformations Involving Logarithmic Functions
Finding Equations Describing Logarithmic Functions
Solving Logarithmic and Exponential Inequations
Modelling with Exponential Functions
Modelling with Logarithmic Functions

## CIRCULAR FUNCTIONS (TRIGONOMETRY)

## Circular Functions/Trigonometry

## Circles and Trigonometric Ratios

The Unit Circle
Angle Measures
Angle Conversions
Angle Directions
Quadrants and Angles
Summary of Signs (CAST)

Angles on the Axes
Exact Values Based on the Axes
Inverse Operations
Reciprocal Functions
Exact Values in the First Quadrant
Symmetry Properties of the Unit Circle
Supplementary Angles
Negative Angles
Complementary Angles
Summary - Exact Values to Commit to Memory
Summary - Rules to Commit to Memory
Trigonometric Identities
Compound Angle Formulae
Double Angle Formulae

## Graphs of Trigonometric Functions

The Sine Graph
The Cosine Graph
The Relationship Between Sine and Cosine
The Tangent Graph
The Amplitude
The Period
Horizontal Translations
Vertical Translations
The Range (Maximum and Minimum Values)
Asymptotes
Transformations Involving Trigonometric Functions
Sketching Trigonometric Functions by Considering Transformations
Determining Rules for Sine and Cosine Functions
Determining Rules for Tangent Functions

## Solving Trigonometric Equations

The Significance of Solving Trigonometric Equations
Solving Trigonometric Inequations
Solving Complex Trigonometric Equations
General Solutions for Trigonometric Equations

## The Period of Combined Functions

## TECHNIQUES IN DIFFERENTIATION

## Limits and Derivatives

Conditions For the Existence of a Limit
Evaluating Limits Graphically
Evaluating Limits Algebraically
Limit Theorems
Differentiation
Derivatives From First Principles
Differentiation by Rule
Derivatives of Polynomial and Rational Functions
Finding Derivatives - Method
Derivatives of Trigonometric Functions
Derivatives of Logarithmic Functions
Derivatives of Exponential Functions
The Chain Rule
Differentiating Functions Involving Brackets and Powers
Differentiating Complex Trigonometric Functions
Differentiating Complex Exponential Functions
Differentiating Complex Logarithmic Functions
The Product Rule
The Quotient Rule
Summary of Differentiation Techniques
Conditions For Differentiability
Gradients at Specific Points
Derivatives of Hybrid Functions
Derivatives of Composite Functions
APPLICATIONS IN DIFFERENTIATION
Graphs of the Derivative Function
Sketching the Derivative Function
Sketching $f(x)$ from the Derivative Function
Joining Functions Smoothly
Stationary Points
Locating Stationary Points
The First Derivative Test
The Second Derivative Test
False Stationary Points
Maxima and Minima
Maximum and Minimum Values
Solving Worded Optimisation Questions

## Strictly Increasing and Strictly Decreasing Functions

## Tangents and Normals

Rates of Change
Rates and Graphs
Average and Instantaneous Rates of Change
Solving Worded Problems Involving Rates of Change
Motion in a Straight Line
Relationships Between Displacement, Velocity and Acceleration
Vessels and Rates of Change
Analysis Tasks

