

## CHAPTER 1 - COORDINATE GEOMETRY OF A STRAIGHT LINE

Lines on the Cartesian Plane, horizontal and vertical lines, gradient of a straight line, positive and negative gradient, calculating gradient, gradient of horizontal and vertical lines, parallel and perpendicular lines, general form of the equation of a straight line, intercepts on the  $x$ - and  $y$ -axes, midpoint of a straight line and the point of intersection of two straight lines.

## CHAPTER 2 – INDICES

Laws of indices- multiplication, division, power of a power, zero index, negative and fractional indices. Solving equations when the unknown is an index.

## CHAPTER 3 – SURDS

Examples of surds, defining a surd, rules for operations on surds and rationalizing a surd.

## CHAPTER 4 – QUADRATICS

Quadratic expressions, features of a quadratic function, quadratic equations, solving quadratic equations by factorization, formula. The nature of roots of a quadratic equation, completing the square, maximum and minimum value of a quadratic function, equating coefficients to express a quadratic expression in the form  $a(x + b)^2 + c$ , point(s) of intersection of a line and a curve and disguised quadratic equations.

## CHAPTER 5 - ROOTS OF A QUADRATIC

Expressing a quadratic equation in the form  $\alpha$  and  $\beta$ , sum and product of the roots and obtaining equations with roots that are related to  $\alpha$  and  $\beta$ .

## CHAPTER 6 - QUADRATIC INEQUALITIES

Quadratic (and linear) inequalities, solutions of quadratic inequalities in one unknown and solving inequalities of the type  $\frac{ax + b}{cx + d} > 0$  or  $\geq 0$  or  $< 0$  or  $\leq 0$ .

## CHAPTER 7 - COORDINATE GEOMETRY OF THE CIRCLE

The equation of a circle, center  $(0, 0)$ , center  $(a, b)$ , center  $(-g, -f)$ , tangent and normal to a circle, position of a point relative to a circle and point(s) of intersection of a circle and a straight line.

## CHAPTER 8 – RELATIONS AND FUNCTIONS

The definition of a relation, representing relations, range and codomain, functions and relations, onto functions vertical and horizontal line tests, describing the range of a function, the inverse of a function, self-inverse, undefined values, the graph of a function and its inverse, inverse of non-linear functions and composite functions.

## CHAPTER 9 – LOGARITHMS

The logarithm of a number, index and log form, properties of logs, common and natural logs, the graph of a log function, antilogs, the laws of logs, change of base, solving equations involving logs and application of logs to linear form.

## CHAPTER 10 - SERIES AND SEQUENCES

Sequence and series, finite and infinite sequences, the arithmetic series or progression (AP), the  $n^{\text{th}}$  term of an AP, the sum of the first  $n$  terms of an AP, the geometric progression (GP), the  $n^{\text{th}}$  term of a GP, the sum of the first  $n$  terms of a GP, divergent and convergent series, the sum to infinity of an AP and sequences and series using  $\Sigma$  notation.

## CHAPTER 11 - THE REMAINDER AND FACTOR THEOREM

Solving and simplifying polynomials, division of a polynomial by a linear expression, the remainder and factor theorem and factorising polynomials.

## CHAPTER 12 - TRIGONOMETRY 1

Measure of angles, degrees, radians, the relationship between degrees and radians, arc length, area of a sector, trigonometric ratios, angles on the Cartesian Plane, trigonometric ratios of angles greater than  $90^\circ$ , basic acute angle, trigonometric ratios for special angles, compound angle formulae and double angle formulae, trigonometric identities and proofs in trigonometry.

## CHAPTER 13- TRIGONOMETRY 2

Graphs of trigonometric functions, transformed trigonometric functions, periodicity, horizontal stretch factor, vertical and horizontal shifts, reflection in the  $x$ - and  $y$  axes and solving trigonometric equations.

## CHAPTER 14 – DIFFERENTIATION

The gradient of a curve, gradient function, chain rule, product rule and quotient rule, differentiation as a limit, the derivatives of  $\sin x$ ,  $\cos x$ ,  $\sin ax$  and  $\cos ax$ .

## CHAPTER 15 - APPLICATIONS OF DIFFERENTIATION

Stationary points, the nature of a stationary point, increasing and decreasing functions, maxima and minima. Small changes, differentiation as a rate of change and related rates of change.

## CHAPTER 16- INTEGRATION

Defining integration, the law of integration, the constant of integration, the integral of  $x^{-1}$ , integration of  $x^n$  and  $ax^n$ , integrating a sum, integrating a constant, integrating products and quotients, the integral of  $(ax + b)^n$ , the constant of integration, the definite integral, using integration to find the equation of a curve, the indefinite and definite integrals and the integral of trigonometric functions.

## CHAPTER 17 - APPLICATION OF INTEGRATION

Measure of area, area bounded by a straight line and an axis, area under a curve, measure of volume, volume of a solid of revolution, rotation of regions on the Cartesian Plane, regions with curved boundaries and volume of solids formed by rotating about the  $x$ -axes

## CHAPTER 18 – VECTORS

Scalar and vector quantities, parallel and equal vectors, adding parallel vectors, adding non-parallel vectors, parallelogram law of vector addition, triangle law of vector addition, vectors on the Cartesian Plane, column vectors, position vectors, unit vectors, the modulus of a vector, the direction of a vector, unit vectors, unit vectors not parallel to the axes, proofs in vectors, collinearity, scalar or dot product, angle between two vectors and perpendicular vectors.

## CHAPTER 19 – KINEMATICS

Speed, distance and time, velocity and acceleration, travel graphs, distance/displacement-time graphs, velocity/speed-time graphs, motion of a particle in a straight line under constant acceleration and using calculus to solve problems in kinematics

## CHAPTER 20- STATISTICS

Qualitative and quantitative data, discrete and continuous variables, frequency tables, grouped and un-grouped, class intervals, class width, boundary and limit, measures of central tendency- mean, mode, median, measures of spread-range, inter-quartile range, variance and standard deviation, interpretation of standard deviation, percentiles.

Stem and leaf plot, advantages and disadvantages of stem and leaf plots, box and whisker plots, advantages and disadvantages of box and whisker plots and outliers and extremes values.

## CHAPTER 21 – PROBABILITY

Terms used in probability, experiment, simple and compound event, outcome, sample space, defining probability, equally likely events, laws of probability, sure event, impossible event, probability scale, experimental and theoretical probability, mutually exclusive events, the addition law of probability, the multiplication rule of probability, dependent event, independent event, conditional probability and tree diagrams.

## INTRODUCTION

The book, **A COMPLETE STUDY GUIDE FOR ADDITIONAL MATHEMATICS**, covers the syllabus content of the Caribbean Secondary Education Certificate (CSEC) Additional Mathematics Course. The intention of the authors is to provide support material for students as they prepare for this examination. The treatment of the topics is comprehensive, yet concise, thereby allowing students to focus on the essential concepts and principles that are necessary for success in CSEC Additional Mathematics.

This study guide assumes that students will be exposed to classroom learning experiences. Students must also acquire sufficient practice through such experiences, especially through interactions with their tutors and peers. The specific features that the guide addresses are:

- It acts as a companion to the student who needs to be reminded of the content of each topic and the skills required to master the content.
- It presents the material in a well-sequenced and coherent form so that critical understandings are addressed while developing a sound foundation.
- The material has aesthetic appeal through the use of colour, diagrams and other displays. This will facilitate all learning styles, especially the visual and multi-sensory learner.
- There is a wide range of worked examples to guide the students on how a topic is tested at the examination level. These examples vary in terms of content and difficulty level.
- The examples also provide model solutions, so that students are guided in how to construct proper responses questions.

The authors have pooled their wide experiences in the teaching of mathematics with their knowledge of content and pedagogy, to produce this guide.

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