

**A COMPLETE STUDY GUIDE**

**FOR  
CSEC  
MATHEMATICS**



**Shereen A. Khan** BSc, MEd, MEd, EdD

**&**

**Fayad W. Ali** MSc, PhD

## INTRODUCTION

The ***Complete Study Guide for CSEC Mathematics*** covers the syllabus content of the Caribbean Secondary Education Certificate (CSEC) Mathematics Syllabus (Effective for examinations from May-June 2018). 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 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 familiar with the content of each topic and with 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 graphic 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.

**Shereen A. Khan & Fayad W. Ali**

# TABLE OF CONTENTS

## CHAPTER 1 – COMPUTATION

<b>Fractions</b> .....	1
<i>Representing fractions, equivalent fractions, mixed numbers and improper fractions, addition and subtraction of fractions, multiplication of fractions, division of fractions, mixed operations involving fractions</i>	
<b>Decimals</b> .....	4
<i>Expanded notation, expressing decimals as common fractions, expressing common fractions as decimals, mixed operations involving decimals</i>	
<b>Approximations</b> .....	5
<i>Decimal places, standard form (scientific notation), significant figures</i>	

## CHAPTER 2 – NUMBER THEORY

<b>Types of numbers</b> .....	7
<i>Number sets, rational numbers, irrational numbers, real numbers, odd and even numbers, prime and composite numbers, multiples and factors, lowest common multiple (L.C.M.), highest common factor (H.C.F.), solving problems involving H.C.F and L.C.M., number sequences, properties of operations, identity elements and inverses, number bases</i>	

## CHAPTER 3 – CONSUMER ARITHMETIC

<b>Percentages</b> .....	17
<i>Concept of percent, percent to fraction, percent to decimal, fraction to percent, calculating the percent of a quantity, expressing one quantity as a percent of another, calculating the whole given a part expressed as a percent, profit and loss, discount, sales tax, commission, formula for calculating compound interest, appreciation and depreciation, hire purchase</i>	
<b>Ratios</b> .....	21
<i>Definition and notation, sharing a quantity in a given ratio, finding the missing part of a ratio, unitary method, equivalent rates (ratios) method, currency conversion, overtime, utility bills</i>	

## CHAPTER 4 – INTRODUCING ALGEBRA

<b>Directed numbers</b> .....	26
<i>Addition and subtraction, multiplication and division</i>	
<b>Algebraic symbols</b> .....	27
<i>Formulating algebraic expressions, simplifying algebraic expressions, addition and subtraction of algebraic terms, multiplication and division and algebraic terms, laws of indices. Simplifying algebraic terms with indices</i>	
<b>Substitution</b> .....	31
<b>Binary operations</b> .....	32

## CHAPTER 5 – EQUATIONS AND INEQUALITIES

<b>Solution of equations</b> .....	33
<i>Additive inverse, multiplicative inverse, equations involving one inverse, equations involving two inverses, equations with unknown on both sides, equations involving brackets</i>	
<b>Word problems</b> .....	34
<b>Algebraic fractions</b> .....	34
<i>L.C.M. of algebraic terms, adding and subtracting algebraic fractions, solving equations involving fractions, solving equations involving brackets and fractions</i>	
<b>Linear inequalities</b> .....	37
<i>Solution of inequalities</i>	

## CHAPTER 6 – ALGEBRAIC FACTORISATION AND FORMULAE

<b>Algebraic factorisation</b> .....	<b>40</b>
<i>Highest common factor in algebra, common factor method, common factors with grouping, quadratic expressions, difference of two squares</i>	
<b>Formulae</b> .....	<b>43</b>

## CHAPTER 7 – SET THEORY

<b>Basic concepts</b> .....	<b>46</b>
<i>Defining and describing sets, naming sets, elements of a set, number of elements in a set, empty sets, finite and infinite sets, set builder notation, Universal set, subset, complement of a set, equivalent sets, equal sets, Venn diagrams, union of two sets, intersection of two sets, disjoint sets, number of elements in the union of two sets, solving problems on sets – Venn diagrams</i>	

## CHAPTER 8 – ANGLES AND ANGLE PROPERTIES

<b>Introducing angles</b> .....	<b>56</b>
<i>Points, lines and rays, defining angles, classification of angles by size of turn, unit for measuring angles, using a protractor to measure angles, naming angles, properties of angles, angles formed by intersecting lines, angles formed by parallel lines</i>	

## CHAPTER 9 – PLANE GEOMETRY

<b>Plane figures</b> .....	<b>62</b>
<i>Triangles, naming triangles, sum of the angles in a triangle, exterior angle of a triangle, general properties of triangles, types of triangles, congruence, similar figures, Pythagoras' theorem, quadrilaterals, polygons, regular and irregular polygons, sum of the interior angles of a polygon, sum of the exterior angles of a polygon</i>	

## CHAPTER 10 – MEASUREMENT

<b>Measurement attributes</b> .....	<b>74</b>
<i>The metric system of measures, perimeter of plane shapes, area of plane shapes, area of the triangle, area of trapezium, estimating the area of shapes – curved edges, measurement of the circle,</i>	
<b>Scale drawings</b> .....	<b>79</b>
<i>Errors in a measurement, volume and surface area, nets of three dimensional shapes, surface area of solids, measurement of the sphere</i>	

## CHAPTER 11 – GEOMETRIC CONSTRUCTIONS

<b>Geometric instruments</b> .....	<b>87</b>
<i>Constructing angles, drawing a line of a given length, constructing the perpendicular bisector of a straight line, constructing the perpendicular to a line from a point outside the line, constructing a line passing through a given point and parallel to a given line, constructing plane figures, constructing triangles, constructing a parallelogram</i>	

## CHAPTER 12 – COORDINATE GEOMETRY

<b>The Cartesian plane</b> .....	<b>95</b>
<i>Length of a straight line, midpoint of a straight line, gradient of a straight line, positive and negative gradient</i>	
<b>The equation of a straight line</b> .....	<b>100</b>
<i>Horizontal and vertical lines, linear and non-linear equations, graphing linear equations, to determine the equation of a straight line given the value of <math>m</math> and <math>c</math>, to determine the equation of a straight line given the gradient and a point on the line, to determine the equation of a straight line given two points on the line, intercepts on the <math>x</math> and <math>y</math> axes</i>	

## CHAPTER 13 – SIMULTANEOUS EQUATIONS

<b>Solution of a linear equation</b> .....	105
<i>Solution of linear equations in two variables, solving simultaneous equations – elimination, solving simultaneous equations – substitution, worded problems involving two variables</i>	

## CHAPTER 14 – RELATIONS AND FUNCTIONS

<b>Relations</b> .....	112
<i>Representing relations – arrows diagrams and ordered pairs, types of relations, relations and functions, the inverse of a function, composite functions, the composition of inverse functions</i>	

## CHAPTER 15 – STATISTICS AND PROBABILITY

<b>Statistics</b> .....	121
<i>Sample statistics and population parameters, types of variables, frequency distributions, displaying data</i>	
<b>Statistical indices</b> .....	128
<i>Measurement scales</i>	
<b>Measures of central tendency</b> .....	129
<i>The mean, the median, the mode, mean, median and mode from frequency tables</i>	
<b>Measures of spread or dispersion</b> .....	133
<i>The range, semi-interquartile range, median and quartiles from cumulative frequency curve, the standard deviation</i>	
<b>Probability</b> .....	138
<i>The probability scale, equiprobable or equally likely events, impossible and certain events, laws of probability</i>	

## CHAPTER 16 – TRANSFORMATION GEOMETRY

<b>Transformations</b> .....	145
<i>Translation, translation on the Cartesian plane, properties of translations</i>	
<b>Reflection</b> .....	147
<i>Reflection on the Cartesian plane, properties of reflection</i>	
<b>Rotation</b> .....	151
<i>Rotation on the Cartesian plane, rotational symmetry, properties of rotation</i>	
<b>Dilation or enlargement</b> .....	154
<i>Enlargement and reduction, enlargement on the Cartesian plane, properties of enlargement</i>	

## CHAPTER 17 – MATRICES AND MATRIX TRANSFORMATIONS

<b>Matrices</b> .....	160
<i>Rows and columns, order of a matrix, row matrices, column matrices, square matrices, the position of elements in a matrix, diagonal elements, diagonal matrices, zero matrix, operations on matrices, scalar multiplication, equal matrices, the identity or unit matrix, matrix multiplication, commutative property, identity elements and inverses – <math>2 \times 2</math> matrices, inverse of a <math>2 \times 2</math> matrix, property of the inverse, using matrices to solve a pair of simultaneous equations, using matrices to solve word problems</i>	
<b>Matrix transformations</b> .....	169
<i>Matrices for translation, deriving matrices for transformations, matrices for reflection, matrices for rotation, matrix for dilation (enlargement), matrices for combined transformations</i>	

**CHAPTER 18 – VECTORS**

**Vector and scalar quantities.....174**  
*Vector notation, parallel and equal vectors, adding parallel vectors, adding non-parallel vectors, vectors on the Cartesian plane, position vectors, unit vectors, the modulus of a vector, the direction of a vector, adding of vectors – unit vector notation, unit vectors that are not parallel to the x and y axes, proofs in vectors*

**CHAPTER 19 – INVESTIGATIONS**

**Patterns in Mathematics.....182**  
*Continuing a pattern*

**CHAPTER 20 – GEOMETRY OF THE CIRCLE**

**Parts of the circle.....186**  
*Diameter and chord, arcs, segments, sectors, the tangent of a circle*  
**Circle theorems.....187**

**CHAPTER 21 – QUADRATIC FUNCTIONS**

**Defining quadratic functions.....193**  
*The quadratic function, interpreting the quadratic graph*  
**Solving quadratic equations.....195**  
*Solving quadratic equations by graphical methods, solving quadratic equations by factorisation, solving quadratic equations using the quadratic formula, solving quadratic equations by completing the square, determining the maximum and minimum of a quadratic function, the points of intersection of a line and a curve, solving a pair of equations in two variables when one is linear and the other is not linear*

**CHAPTER 22 – VARIATION**

**Direct and inverse variation.....202**  
*Direct variation, inverse variation*

**CHAPTER 23 – TRIGONOMETRY**

**Solution of right-angled triangles.....205**  
*The standard notation for a triangle, right-angled triangles, solving triangles, Pythagoras’ theorem, introducing trigonometric ratios, trigonometric ratios*  
**Solution of non-right-angled triangles.....208**  
**Application of trigonometry.....211**  
*Angles of elevation and depression, bearings*  
**Solid trigonometry.....217**

**CHAPTER 24 – TRAVEL GRAPHS**

**Types of travel graphs.....219**  
*The gradient of a straight line, gradient of a curve, travel graphs*

**CHAPTER 25 – LINEAR PROGRAMMING**

**Terminology.....227**  
*Equalities and inequalities in one variable, linear inequations on the Cartesian plane, conventions in drawing lines, solution of a system of inequalities, converting worded problems into linear inequalities, linear programming*