CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Secondary Education Certificate
CSEC®

MATHEMATICS SYLLABUS

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Contents

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Please note that the syllabus has been revised and amendments are indicated by italics and vertical lines.

First Published in 1977
Revised in 1981
Revised in 1985
Revised in 1992
Revised in 2001
Revised in 2008

Mathematics Syllabus

♦ RATIONALE

The guiding principles of the Mathematics syllabus direct that Mathematics as taught in Caribbean schools should be *relevant to the existing and anticipated needs of Caribbean society, related to the abilities and interests of Caribbean students and aligned with the philosophy of the educational system.* These principles focus attention on the use of Mathematics as a problem solving tool, as well as on some of the fundamental concepts which help to unify Mathematics as a body of knowledge. The syllabus explains general and unifying concepts that facilitate the study of Mathematics as a coherent subject rather than as a set of unrelated topics.

Every citizen needs basic computational skills (addition, subtraction, multiplication and division) and the ability to use these mentally to solve everyday problems. All citizens should recognize the importance of accuracy in computation as the foundation for deductions and decisions based on the results. In addition, the citizen should have, where possible, a choice of mathematical techniques to be applied in a variety of situations. A 'range of mathematical techniques' is therefore, specified in recognition of the need to accommodate different levels of ability. Citizens need to use Mathematics in many forms of decision-making: shopping, paying bills, budgeting and for the achievement of personal goals, critically evaluating advertisements, taxation, investing, commercial activities, banking, working with and using current technologies, measurements and understanding data in the media. Improving efficiency and skills in these matters will be beneficial to the community as well as to the individual.

The syllabus seeks to provide for the needs of specific mathematical techniques in the future careers of students, for example, in agriculture and in commercial and technical fields. *By the end of the normal secondary school course, students should appreciate that the various branches of Mathematics are not rigidly segregated and that the approach to the solution of any problem is not necessarily unique.*

♦ AIMS

This syllabus aims to:

1. *help students appreciate the use of mathematics as a form of communication*;

2. help students acquire a range of mathematical techniques and skills and to foster and maintain the awareness of the importance of accuracy;

3. make Mathematics relevant to the *interests* and *experiences* of students *by* helping them to recognize Mathematics in their environment;

4. cultivate the ability to apply mathematical knowledge to the solution of problems which are meaningful to students as citizens;

5. help students cultivate the ability to think logically and critically;

6. help students develop positive attitudes, such as open-mindedness, self-reliance, persistence and a spirit of enquiry;

7. prepare students for the use of Mathematics in further studies;

8. help students develop an appreciation of the wide application of Mathematics and its influence in the *development and* advancement of civilization;

9. help students become increasingly aware of the unifying structure of Mathematics.

♦ ORGANIZATION OF THE SYLLABUS

The syllabus is arranged as a set of topics, and each topic is defined by its specific objectives *and content*. It is expected that students would be able to master the specific objectives *and related content* after pursuing a course in Mathematics over five years of secondary schooling.

The design allows for a **Core** which contains selected mathematical skills, knowledge and abilities necessary for any citizen in our contemporary society as well as objectives to meet the needs of those who will be:

(a) pursuing careers as agriculturalists, engineers, scientists, economists;
(b) proceeding to study Mathematics at an advanced level;
(c) engaged in the business and commercial world.

The Examination will also comprise an Optional section which will be defined by *additional* specific objectives.

♦ FORMAT OF THE EXAMINATIONS

The examination will consist of two papers: Paper 01, an objective type paper based on the **Core *Objectives*** and Paper 02, an essay or problem solving type paper *based on **both** the Core and Optional Objectives*.

Paper 01
(1 hour 30 minutes)

The Paper will consist of 60 multiple-choice items, sampling the Core as follows:

Sections	**No. of items**
Computation	6
Number Theory	4
Consumer Arithmetic	8
Sets	4
Measurement	8
Statistics	6
Algebra	9
Relations, Functions and Graphs	6
Geometry *and Trigonometry*	9
Total	**60**

Each item will be allocated one mark.

Paper 02
(2 hours and 40 minutes)

The Paper consists of two sections.

Section I: 90 marks

The section will consist of 8 compulsory *structured and* problem-solving *type* questions based on the **Core**.

The marks allocated to the topics are:

Sections	**No. of marks**
Sets	5
Consumer Arithmetic and Computation	10
Measurement	10
Statistics	10
Algebra	15
Relations, Functions and Graphs	10
Geometry and Trigonometry	20
*Combination question/ investigation	10
Total	**90**

* Combination question/investigation may be set on any combination of objectives in the ***Core*** including Number Theory.

Section II: 30 marks

This section will consist of *3 structured or* problem-solving questions based mainly on the **Optional Objectives** of the syllabus. There will be 1 question from each of the *Sections* Algebra and Relations, Functions and Graphs; *Measurement and* Geometry and Trigonometry; and Vectors and Matrices.

Candidates will be required to answer **any two** questions. Each question will be allocated 15 marks.

The optional questions will be set as follows:

ALGEBRA AND RELATIONS, FUNCTIONS AND GRAPHS

The *question* in this section may be set on:

Algebra

Optional Specific Objective 17 or any of the other Specific Objectives in Algebra.

Relations, Functions and Graphs

Optional Specific Objectives 15, 22, 23, 24, 25 or any of the other Specific Objectives in Relations, Functions and Graphs.

MEASUREMENT AND *GEOMETRY* AND TRIGONOMETRY

The *question* in this section may be set on:

Measurement

Optional Specific Objectives 5, 6 or any of the other Specific Objectives in Measurement.

Geometry and Trigonometry

Optional Specific Objective 20 or any of the other Specific Objectives in Geometry *and Trigonometry*.

VECTORS AND MATRICES

The *question* in this section may be set on:

Optional Specific Objectives 5, 11, 12, 13 or any of the other Specific Objectives in Vectors and Matrices.

♦ *CERTIFICATION* AND PROFILE DIMENSIONS

The subject will be examined for certification at the General Proficiency.

In each paper, items and questions will be classified, according to the kind of cognitive demand made, as follows:

Knowledge Items that require the recall of rules, procedures, definitions and facts, that is, items characterized by rote memory as well as simple computations, computation in measurements, constructions and drawings.

Comprehension Items that require algorithmic thinking that involves translation from one mathematical mode to another. Use of algorithms and the application of these algorithms to familiar problem situations.

Reasoning Items that require:

(i) translation of non-routine problems into mathematical symbols and then choosing suitable algorithms to solve the problems;

(ii) combination of two or more algorithms to solve problems;

(iii) use of an algorithm or part of an algorithm, in a reverse order, to solve a problem;

(iv) the making of inferences and generalizations from given data;

(v) *justification of results or statement*;

(vi) analyzing and synthesizing.

Candidates' performance will be reported under Knowledge, Comprehension and Reasoning that are roughly defined in terms of the three types of demand.

WEIGHTING OF PAPER AND PROFILE DIMENSIONS

PROFILES	PAPER 01	PAPER 02	TOTAL
Knowledge	18	36	54
Comprehension	24	48	72
Reasoning	18	36	54
Total	**60**	**120**	**180**

♦ REGULATIONS FOR PRIVATE CANDIDATES

Candidates who are registered privately will be required to sit Paper 01 and Paper 02. Detailed information on Papers 01 and 02 is given on pages 2 – 4 of this syllabus.

Private candidates must be entered through institutions recognized by the Council.

♦ REGULATIONS FOR RESIT CANDIDATES

Resit candidates will be required to sit Paper 01 and Paper 02. Detailed information on Paper 01 and 02 is given on pages 2 - 4 of this syllabus.

Resit candidates must be entered through a school or other approved educational institution.

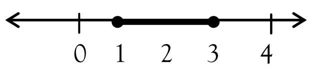
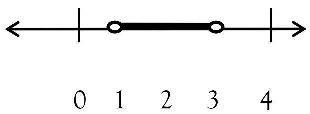
♦ SYMBOLS USED ON THE EXAMINATION PAPERS

The symbols shown below will be used on examination papers. Candidates, however, may make use of any symbol or nomenclature provided that such use is consistent and understandable in the given context. Measurement will be given in S I Units.

SYMBOL	DEFINITION
<u>Sets</u>	
U	universal set
{ } or ф	the null (empty) set
$\subset$	a subset of

A'	complement of set A
{x: . . . }	the set of all x such that . . .

Relations and Functions and Graphs

$y \propto x^n$	y varies as x^n
gf(x)	g[f(x)]
$g^2(x)$	g[g(x)]
	$\{x : 1 \leq x \leq 3\}$
	$\{x : 1 < x < 3\}$

Number Theory

W	the set of whole numbers
ℕ	the set of natural (counting) numbers
ℤ	Z^+ - positive integers, Z^- - negative integers: the sets of integers
Q	the set of rational numbers
R	the set of real numbers
$5.\dot{4}\dot{3}\dot{2}$	5.432 432 432 . . .
$9.87\dot{2}\dot{1}$	9.87212121 . . .

Measurement

05:00 h.	5:00 a.m.
13:15 h.	1:15 p.m.
7mm ± 0.5 mm	7mm to the nearest millimetre
10 m/s or 10 ms^{-1}	10 metres per second

Geometry

For transformations these symbols will be used.

M	reflection
R_θ	rotation through θ^o
T	translation
G	glide reflection
E	enlargement
MR_θ	rotation through θ followed by reflection
$\measuredangle$, $\angle$, $\wedge$	angle
$\equiv$	is congruent to
$\overleftrightarrow{AB}$	line AB
$\overrightarrow{AB}$	ray AB
$\overline{AB}$	line segment AB

Vectors and Matrices

$\underline{a}$ or **a**	vector **a**
$\overrightarrow{AB}$	vector AB
$\lvert\overrightarrow{AB}\rvert$	magnitude of vector AB

If or $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is the matrix X $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

then $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$ is the determinant of X, written $|X|$ or det X.

A^{-1}	inverse of the matrix A

I	identity matrix
O	zero matrix

<u>Other Symbols</u>

$=$		is equal to or equals
$\geq$		is greater than or equal to
$\leq$		is less than or equal to
$\simeq$		is approximately equal to
$\Rightarrow$		implies
$A \Rightarrow B$		if A, then B
$A \Leftrightarrow B$	If A, then B and If B, then A	A is equivalent to B

♦ FORMULAE AND TABLES PROVIDED IN THE EXAMINATION

Volume of a prism — $V = Ah$ where A is the area of a cross-section and h is the perpendicular length.

Volume of cylinder — $V = \pi r^2 h$ where r is the radius of the base and h is the perpendicular height.

Volume of a right pyramid — $V = \frac{1}{3}Ah$ where A is the area of the base and h is the perpendicular height.

Circumference — $C = 2\pi r$ where r is the radius of the circle.

Area of a circle — $A = \pi r^2$ where r is the radius of the circle.

Area of trapezium — $A = \frac{1}{2}(a + b)\,h$ where a and b are the lengths of the parallel sides and h is the perpendicular distance between the parallel sides.

Roots of quadratic equations — If $ax^2 + bx + c = 0$,

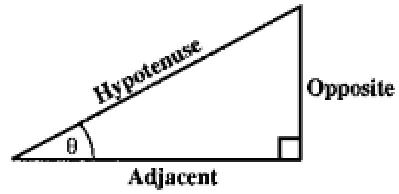
then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric ratios

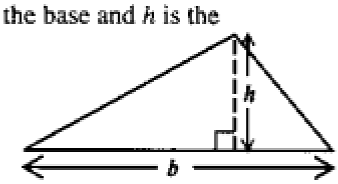
$\sin\theta = \dfrac{\text{opposite side}}{\text{hypotenuse}}$

$\cos\theta = \dfrac{\text{adjacent side}}{\text{hypotenuse}}$

$\tan\theta = \dfrac{\text{opposite side}}{\text{adjacent side}}$



Area of triangle — Area of $\Delta = \frac{1}{2}bh$ where b is the length of the base and h is the perpendicular height



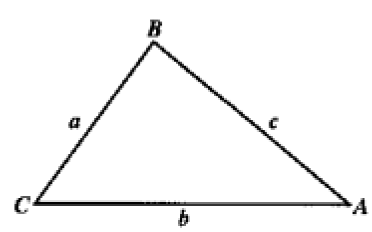
Area of $\Delta ABC = \frac{1}{2}ab\sin C$

Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \dfrac{a + b + c}{2}$

Sine rule — $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule — $a^2 = b^2 + c^2 - 2bc\cos A$



♦ USE OF ELECTRONIC CALCULATORS

Candidates are expected to *have* an electronic calculator and are encouraged to use such a calculator in Paper 02.

Guidelines for the use of electronic calculators are listed below.

1. Silent, electronic hand-held calculators may be used.

2. Calculators should be battery *or solar powered*.

3. Candidates are responsible for ensuring that calculators are in working condition.

4. Candidates are permitted to bring a set of spare batteries in the examination room.

5. **No** compensation will be given to candidates because of faulty calculators.

6. **No** help or advice is permitted on the use or repair of calculators during the examination.

7. Sharing calculators is **not** permitted in the examination room.

8. Instruction manuals, and external storage media (for example, card, tape, disk, smartcard or plug-in modules) are **not** permitted in the examination room.

9. Calculators with graphical display, data bank, dictionary or language translation are **not** allowed.

10. Calculators that have the capability of communication with any agency in or outside of the examination room **are prohibited**.

♦ SECTION 1 - COMPUTATION

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *demonstrate* an understanding of place value;
2. *demonstrate* computational skills;
3. be aware of the importance of accuracy in computation;
4. appreciate the need for numeracy in everyday life;
5. *demonstrate the ability to make* estimates fit for purpose.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. perform *computation using* any of the *four* basic operations with real numbers;	*Addition, multiplication, subtraction and division of whole numbers, fractions and decimals.*
2. *convert* among fractions, percentages and decimals;	*Conversion of fractions to decimals and percentages, conversion of decimal to fractions and percentages, conversion of percentages to decimals and fractions.*
3. *convert from one set of units to another;*	*Conversion using conversion scales, converting within the metric scales, 12-hour and 24-hour clock, currency conversion.*
4. *express* a value to a given number of: (a) *significant* figures; (b) *decimal* places;	*1, 2 or 3 significant figures.* *1, 2 or 3 decimal places.*
5. write any rational number in standard form;	*Scientific notation.*

COMPUTATION (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
6. calculate any fraction or percentage of a given quantity;	*Calculating fractions and percentages of a whole.*
7. express one quantity as a fraction or percentage of another;	*Comparing two quantities using fractions and percentages.*
8. *compare* two quantities *using ratios*;	*Ratio and proportion.*
9. *divide* a quantity in a given ratio;	*Ratio and proportion.*
10. *solve* problems involving: (a) fractions; (b) decimals; (c) percentages; (d) ratio, rates and proportions; (e) *arithmetic mean.*	

♦ SECTION 2 - NUMBER THEORY

GENERAL OBJECTIVES

On completion of this Section, students should:

1. understand and appreciate the decimal numeration system;
2. *appreciate* the development of different numeration systems;
3. *demonstrate the ability to* use rational approximations of real numbers;
4. *demonstrate the ability to* use number properties to solve problems;
5. *develop the ability to use* patterns, trends and investigative skills.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. distinguish among sets of numbers;	Set of numbers: natural numbers {1, 2, 3, ...}, whole numbers {0, 1, 2, 3, ...}, integers {...-2, -1, 0, 1, 2, ...}, rational numbers ($\frac{p}{q}$:p and q are integers, q ≠ 0), irrational numbers (numbers that cannot be expressed as terminating or recurring decimals, for example, numbers such as π and √2), the real numbers (the union of rational and irrational numbers); sequences of numbers that have a recognizable pattern; factors and multiples; *square numbers; even numbers; odd numbers; prime numbers; composite numbers.*
2. order a set of real numbers;	
3. generate *a term of a sequence given a rule*;	*Sequences of numbers that have a recognizable pattern.*
4. *derive an appropriate rule given the terms of a sequence*;	*Sequences of numbers that have a recognizable pattern.*
5. *identify* a given set of numbers as a subset of another set;	Inclusion relations, for example, $\mathbf{N} \subset \mathbf{W} \subset \mathbf{Z} \subset \mathbf{Q} \subset \mathbf{R}$.
6. list *the set of factors* or a set of multiples of a given positive integer;	

NUMBER THEORY (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
7. compute the H.C.F. or L.C.M. of two or more positive integers;	
8. state the *value* of a digit in a numeral in base *n*, *where* $n \leq 10$;	*Place value and face value of numbers 2, 3, 4, 5, 6, 7, 8, 9 and 10 in base.*
9. *use* properties of numbers and operations in computational tasks;	*Additive and multipicative identities and inverses, concept of closure, properties of operations such as commutativity, distributivity and associativity, order of operations in problems with mixed operations.*
10. solve *problems involving concepts in number theory*.	

♦ SECTION 3 - CONSUMER ARITHMETIC

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *develop the ability to* perform the calculations required in normal business transactions, and in computing their own budgets;

2. *appreciate* the need for both accuracy and speed in calculations;

3. *appreciate* the advantages and disadvantages of different ways of investing money;

4. appreciate that business arithmetic is indispensable in everyday life;

5. *demonstrate the ability to use concepts in consumer arithmetic to describe, model and solve real-world problems.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. calculate discount, sales tax, profit or loss;	
2. *express a* profit, loss, *discount, markup and purchase tax*, as a percentage *of some value*;	
3. solve problems involving marked price (or selling price), cost price, percentage profit, loss or discount;	
4. solve problems involving payments by installments as in the case of hire purchase and mortgages;	
5. solve problems involving simple interest,	Principal, time, rate, amount.

CONSUMER ARITHMETIC (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
6. solve problems involving compound interest, appreciation, and depreciation;	Principal, time, rate, amount (not more than 3 periods).
7. solve problems involving measures and money;	Include exchange rate.
8. solve problems involving: (a) rates and taxes; (b) utilities; (c) invoices and shopping bills; (d) salaries and wages; (e) insurance and investments.	

♦ SECTION 4 - SETS

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *demonstrate the ability to communicate using* set language *and concepts*;
2. *demonstrate the ability to* reason logically;
3. *appreciate the importance and utility of sets in analyzing and solving real-world* problems.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *explain concepts relating to sets*;	*Examples and non-examples of sets, description of sets using words, membership of a set, cardinality of a set, finite and infinite sets, universal set, empty set, complement of a set, subsets.*
2. *represent* a set in various forms;	*Listing elements, for example, the set of natural numbers 1,2 and 3.* *Set builder notation, for example, {x: 0<x<4 where x* $\in$ *N}.* *Symbolic representation, for example,* ***A****={1,2,3}.*
3. *describe relationships among sets using set notation and symbols;*	*Universal, complement, subsets, equal and equivalent sets, intersection, disjoint sets and union of sets.*
4. *list subsets of a given set*;	*Number of subsets of a set with n elements.*
5. *determine elements in intersections, unions and complements of sets;*	*Intersection and union of not more than three sets.* *Apply the result* $n(A \bigcup B) = n(A) + n(B) - n(A \bigcap B)$.
6. *construct Venn diagrams to represent relationships among sets;*	*Not more than 4 sets including the universal set.*
7. *solve problems involving the use of Venn diagrams;*	
8. *solve problems in Number Theory, Algebra and Geometry using concepts in Set Theory.*	

♦ SECTION 5 - MEASUREMENT

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *understand that the attributes of an object can be quantified using measurement*;

2. *appreciate that all measurements are approximate and that the relative accuracy of a measurement is dependent on the measuring instrument and the measurement process;*

3. *demonstrate the ability to use concepts in measurement to model and solve* real-world problems.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. calculate the perimeter of a polygon, a circle, and a combination of polygons and circles;	Measures of length, perimeters of polygons and circles.
2. *calculate* the length of an arc of a circle;	
3. *calculate* the area of polygons, a circle and any combination of these;	Rectangle, square, parallelogram, trapezium, *rhombus* and circle.
4. *calculate* the area of a sector of a circle;	
5. *calculat*e the area of a triangle given two sides and the included angle;	***Optional Specific Objective.*** Area of Δ = ½ abSinC.
6. *calculate* the area of a segment of a circle;	***Optional Specific Objective.***
7. *estimate* the area of irregularly shaped plane figures;	
8. *calculate* the surface area of solids;	Prism, cylinder, cone, sphere, *cube and cuboid*.

MEASUREMENT (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
9. *calculate* the volume of solids;	Prism, cylinder, pyramid, cone, sphere, *cube and cuboid*.
10. *convert* units of length, area, capacity, time and speed;	
11. *use* the appropriate SI unit of measure for area, volume, mass, temperature and time (24-hour clock) and other derived quantities;	
12. *solve* problems involving time, distance and speed;	
13. *estimate* the margin of error for a given measurement;	Sources of error. Maximum and minimum measurements.
14. *use* maps and scale drawings to determine distances and areas;	
15. *solve* problems involving measurement.	

♦ SECTION 6 - STATISTICS

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *appreciate* the advantages and disadvantages of the various ways of presenting *and representing* data;

2. appreciate the necessity for taking precautions in collecting, analyzing and *interpreting* statistical data *and making inferences*;

3. *demonstrate the ability to use concepts in statistics and probability to describe, model and solve real-world problems.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *differentiate between types of data*;	Discrete and continuous variables. Ungrouped and grouped data.
2. *construct* a frequency table for a given set of data;	Ungrouped and grouped data.
3. *determine* class *features* for a given set of data;	Class interval, class boundaries, class limits, class midpoint, class width.
4. *construct* statistical diagrams;	Pie charts, bar charts, line graphs, histograms and frequency polygons.
5. *interpret* statistical diagrams;	Pie charts, bar charts, line graphs, histograms and frequency polygons.
6. *determine* measures of central tendency for raw, ungrouped and grouped data;	Mean, median and mode.
7. *determine* when it is most appropriate to use the mean, median and mode as the average for a set of data;	Mean, median and mode as measures of central tendency.
8. *determine* the measures of dispersion (spread) for raw, ungrouped and grouped data;	Range, interquartile range and semi-interquartile range.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
9. *construct* a cumulative frequency table for ungrouped and grouped data;	
10. *draw* cumulative frequency curve (Ogive);	Appropriate scales for axes. Class boundaries as domain.
11. *use statistical diagrams*;	*Mean, mode, median, quartiles range, interquartile range, semi-interquartile range.*
12. *determine* the proportion or percentage of the sample above or below a given value from raw data, table or cumulative frequency curve;	
13. *identify* the sample space for sample experiment;	Set of all possible outcomes.
14. *determine* experimental and theoretical probabilities of events;	
15. *make* inference(s) from statistics.	Raw data, tables, diagrams.

♦ SECTION 7 - ALGEBRA

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *appreciate the use of algebra as a language and a form of communication*;
2. *appreciate the role of symbols and algebraic techniques in solving problems in mathematics and related fields*;
3. *demonstrate the ability to reason* with abstract entities.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. use symbols to represent numbers, operations, variables and relations;	Symbolic representation.
2. *translate statements expressed algebraically into verbal phrases*;	
3. perform *arithmetic* operations involving directed numbers;	
4. *perform* the four basic operations with algebraic expressions;	
5. substitute numbers for algebraic symbols in simple algebraic expressions;	
6. *perform* binary operations (other than the four basic ones);	
7. *apply* the distributive law to factorize or expand algebraic expressions;	*For example,* $x(a+b) = xa+xb$ *and* $(a+b)(x+y) = (a+b)x + (a+b)y = ax+bx+ay+by$.

ALGEBRA (cont'd)

SPECIFIC OBJECTIVES	**CONTENT**
Students should be able to:	
8. simplify algebraic fractions;	
9. use the laws of indices to manipulate expressions with *integral* indices;	
10. solve linear equations in one unknown;	
11. solve simultaneous linear equations, in two unknowns, algebraically;	
12. solve a simple linear inequality in one unknown;	
13. change the subject of formulae;	Including those involving roots and powers.
14. *factorize* algebraic expressions;	$a^2 - b^2$; $a^2 \pm 2ab + b^2$ $ax + bx + ay + by$ $ax^2 + bx + c$ where a, b, and c are integers and $a \neq 0$
15. *solve* quadratic equations;	
16. *solve* word problems;	Linear equation, Linear inequalities, two simultaneous linear equations, quadratic equations.
17. *solve* a pair of equations in two variables when one equation is quadratic or non-linear and the other linear;	***Optional Specific Objective***.
18. *prove* two algebraic expressions to be identical;	
19. *represent direct and indirect variation symbolically*;	
20. *solve problems* involving direct variation and inverse *variation.*	

SECTION 8 - RELATIONS, FUNCTIONS AND GRAPHS

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *appreciate* the importance of relations in Mathematics;
2. *appreciate* that many mathematical relations may be represented in symbolic form, tabular or pictorial form;
3. *appreciate the usefulness of concepts in* relations, functions and graphs to solve real-world problems.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *explain* concepts associated with relations;	*Concept of a relation, types of relation, examples and non-examples of relations, domain, range, image, co-domain.*
2. *represent* a relation in various ways;	Set of ordered pairs, arrow diagrams, graphically, algebraically.
3. *state* the characteristics that define a function;	Concept of a function, examples and non-examples of functions.
4. *use functional notation*;	For example $f : x \rightarrow x^2$; or $f(x) = x^2$ as well as $y = f(x)$ for given domains.
5. *distinguish between a relation and a function;*	Ordered pairs, arrow diagram, graphically (vertical line test).
6. *draw and interpret* graphs of linear functions;	Concept of linear function, types of linear function ($y = c$; $x = k$; $y = mx + c$; where m, c and k are real numbers).
7. determine the intercepts of the graph of linear functions;	x-intercepts and y-intercepts, graphically and algebraically.
8. *determine the gradient of a straight line;*	*Concept of slope.*

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
9. determine *the equation of a straight line*;	The graph of the line. The co-ordinates of two points on the line. The gradient and one point on the line. *One point* on the line and its relationship to another line.
10. *solve problems involving the gradient of parallel and perpendicular lines*;	
11. *determine* from co-ordinates *on* a line segment: *(a)* the length; (b) the co-ordinates of the midpoint;	*The concept of magnitude or length, concept of midpoint.*
12. *solve* graphically a system of two linear equations in two variables;	
13. *represent* the solution of linear inequalities in one variable using: (a) set notation; (b) the number line; (c) graph;	
14. *draw* a graph to represent a linear inequality in two variables;	

RELATIONS, FUNCTIONS AND GRAPHS (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
15. *use* linear programming techniques to solve problems involving two variables;	***Optional Specific Objective.***
16. *derive* composite functions;	Composite function, for example, fg, f^2 given f and g. Non-commutativity of composite functions ($fg \neq gf$).
17. *state the relationship between a function and its inverse;*	*The concept of the inverse of a function.*
18. *derive* the inverse of a function;	f^{-1}, $(fg)^{-1}$
19. *evaluate* f(a), $f^{-1}(a)$, fg(a), $(fg)^{-1}(a)$;	Where $a \in \Re$.
20. *use* the relationship $(fg)^{-1} = g^{-1} f^{-1}$;	*The concept of the inverse of a function, determining the inverse of a given function.*
21. *draw and interpret graphs of a quadratic function to determine:* (a) *the elements of the domain that have a given image;* (b) *the image of a given element in the domain;* (c) *the maximum or minimum value of the function;* (d) *the equation of the axis of symmetry;*	*Concepts of gradient of a curve at a point, tangent, turning point. Roots of the equation.*

RELATIONS, FUNCTIONS AND GRAPHS (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
draw and interpret graphs of a quadratic function to determine: (cont'd)	
(e) *the interval of the domain for which the elements of the range may be greater than or less than a given point;*	
(f) *an estimate of the value of the gradient at a given point;*	
(g) *intercepts of the function;*	
22. *determine* the axis of symmetry, maximum or minimum value of a quadratic function expressed in the form $a(x + h)^2 + k$;	***Optional Specific Objective.***
23. *sketch* graph of quadratic function expressed in the form $a(x+h)^2 + k$ and determine number of roots;	***Optional Specific Objective.***
24. *draw and interpret the graphs of other non-linear functions;*	***Optional Specific Objective.*** $y=ax^n$ where n = -1,-2 and +3.
25. *draw and interpret distance-time graphs and speed-time graphs (straight line only) to determine:* (a) *distance;* (b) *time;* (c) *speed;* (d) *magnitude of acceleration.*	***Optional Specific Objective.***

♦ SECTION 9 - GEOMETRY AND TRIGONOMETRY

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *appreciate the notion of* space as a set of points with subsets of that set (space) having properties related to other mathematical systems;

2. *understand the* properties and *relationship among* geometrical objects;

3. *understand* the properties of transformations;

4. *demonstrate the ability to use geometrical concepts to model and solve real world problems;*

5. appreciate the power of trigonometrical methods in solving authentic problems.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *explain* concepts relating to geometry;	Point, line, parallel lines, intersecting lines and perpendicular lines, line segment, ray, curve, plane, angle (acute, obtuse, reflex, right angle, straight angle), face, edge, vertex.
2. *draw and measure* angles and line segments accurately using appropriate geometrical instruments;	
3. *construct* lines, angles, and polygons using appropriate geometrical instruments;	Parallel and perpendicular lines. Triangles, quadrilaterals, regular and irregular polygons. Angles to be constructed include 30, 45, 60, 90, 120.
4. *identify* the type(s) of symmetry possessed by a given plane figure;	Line(s) of symmetry, rotational symmetry, order of rotational symmetry.
5. *solve* geometric problems using properties of:	Vertically opposite angles, alternate angles, adjacent angles, corresponding angles, co-interior angles, angles at a point, complementary angles, supplementary angles. Parallel lines and transversals. Equilateral, right, and isosceles triangles.
(a) lines, angles, and polygons;	
(b) circles;	Square, rectangle, rhombus, kite, parallelogram, trapezium.

GEOMETRY AND *TRIGONOMETRY* (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
solve geometric problems using properties of: (cont'd)	
(c) congruent triangles;	
(d) similar figures;	
(e) faces, edges and vertices of solids;	
(f) classes of solids;	Prisms, pyramids, cylinders, cones, sphere.
6. *represent* translations in the plane using vectors;	Column matrix notation $\begin{pmatrix} x \\ y \end{pmatrix}$.
7. *determine and represent* the location of : (a) the image of an object ; (b) an object given the image under a transformation;	A *translation* in the plane; a *reflection* in a line in that plane; a *rotation* about a point (the centre of rotation) in that plane; an *enlargement or reduction* in that plane.
8. *identify* the relationship between an object and its image in the plane after a geometric transformation;	Similarity; Congruency.
9. *describe* a transformation given an object and its image;	A *translation* in the plane; a *reflection* in a line in that plane; a *rotation* about a point (the centre of rotation) through an angle in the plane; an *enlargement or reduction* in that plane about a center.
10. *locate* the image of a set of points under a combination of transformations;	Combination of any two of enlargement/reduction, translation, rotation, reflection, glide reflection.
11. *state* the relations between an object and its image as the result of a combination of two transformations;	

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
12. use Pythagoras' theorem to solve problems;	
13. *determine* the trigonometric ratios of acute angles in a right-angled triangle;	
14. use trigonometric ratios in the solution of right angled-triangles;	Practical geometry and scale drawing, bearing.
15. *use* trigonometric ratios to solve problems based on measures in the physical world;	Heights and distances; angles of elevation and depression.
16. *use* the sine and cosine rules in the solution of problems involving triangles;	
17. *represent* the relative position of two points given the bearing of one point with respect to the other;	
18. *determine* the bearing of one point relative to another point given the position of the points.	
19. *solve* problems involving bearings;	
20. *solve* practical problems involving heights and distances in three dimensional situations;	***Optional Specific Objective***.

GEOMETRY AND *TRIGONOMETRY* (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
21. *solve* geometric problems using properties of circles and circle theorems.	*The angle which an arc of a circle subtends at the centre of a circle is twice the angle it subtends at any point on the remaining part of the circumference.* *The angle in a semicircle is a right angle.* *Angles in the same segment of a circle and subtended by the same arc are equal.* *The opposite angles of a cyclic quadrilateral are supplementary.* *The exterior angle of a cyclic quadrilateral is equal to the interior opposite angle.* *A tangent of a circle is perpendicular to the radius of that circle at the point of contact.* *The lengths of two tangents from an external point to the points of contact on the circle are equal.* *The angle between a tangent to a circle and a chord through the point of contact is equal to the angle in the alternate segment.* *The line joining the centre of a circle to the midpoint of a chord is perpendicular to the chord.*

♦ SECTION 10 - VECTORS AND MATRICES

GENERAL OBJECTIVES

On completion of this Section, students should:

1. *demonstrate the ability to use vector notation and concepts to model and solve real-world problems;*

2. *develop awareness of the existence of certain mathematical objects, such as matrices, that do not satisfy the same rules of operation as the real number system;*

3. *demonstrate* how matrices can be used to represent certain types of linear transformation in the plane.

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
1. *explain* concepts associated with vectors;	Concept of a vector, magnitude, direction, line segment, scalar.
2. *combine* vectors;	Triangle law, or parallelogram laws 2x1 Column matrices, for example, $\begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} a+c \\ b+d \end{pmatrix}$ Vector algebra.
3. *express a point P(a,b) as a position vector* $\vec{OP} = \begin{pmatrix} a \\ b \end{pmatrix}$ where O is the origin (0, 0);	*Displacement and position vectors; co-ordinates.*
4. *determine* the magnitude of a vector;	*Including unit vectors.*
5. use vectors to solve problems in Geometry;	*Collinearity, parallel.*
6. *explain* concepts associated with matrices;	*Concept of a matrix, row, column, order, types of matrices, practical use.*

VECTORS AND MATRICES (cont'd)

SPECIFIC OBJECTIVES	CONTENT
Students should be able to:	
7. *perform* addition, subtraction and multiplication of matrices *and* multiplication of matrices by a scalar;	Non-commutativity of *matrix multiplication.*
8. *evaluate* the determinant of a '2 x 2' matrix;	
9. *solve* problems involving a '2 x 2' singular matrix;	
10. obtain the inverse of a non-singular '2 x 2' matrix;	*Determinant and adjoint of a matrix.*
11. *determine a* '2 x 2' matrix associated with specified transformations;	
12. *determine* a '2 x 2' matrix representation of the single transformation which is equivalent to the composition of two linear transformations in a plane (where the origin remains fixed);	
13. *use* matrices to solve simple problems in *Arithmetic, Algebra and Geometry* .	Use of matrices to solve linear simultaneous equations. (Matrices of order greater than '3 x 3' will **<u>not</u>** be set.)

♦ RECOMMENDED TEXTS

Buckwell, G., Solomon, R., and Chung Harris, T. — *CXC Mathematics for Today 1*, Oxford: Macmillan Education, 2005.

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Golberg, N. — *Mathematics for the Caribbean 4,* Oxford: Oxford University Press, 2006.

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Layne, Ali, Bostock, Chandler, Shepherd and Ali. — *STP Caribbean Mathematics for CXC Book 4*, United Kingdom: Nelson Thorness Limited, 2005.

Toolsie, R. — *Mathematics, A Complete Course Volume 1,* Caribbean Educational Publisher Limited, 2006.

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Websites

http://mathworld.wolfram.com/
http://plus.maths.org/
http://nrich.maths.org/public/
http://mathforum.org/
http://www.ies.co.jp/math/java/

♦ GLOSSARY

WORDS	MEANING
Acute Angle	An angle whose measure is less than 90 degrees.
Adjacent Angles	Two angles that share a ray, thereby being directly next to each other.
Algorithm	An organized procedure for performing a given type of calculation or solving a given type of problem. An example is long division.
Alternate Exterior Angles	Angles located outside a set of parallel lines and on opposite sides of the transversal.
Alternate Interior Angles	Angles located inside a set of parallel lines and on opposite sides of the transversal.
Angle Bisector	A ray that divides an angle into two congruent angles.
Arithmetic Mean	See mean.
Arithmetic Sequence	A sequence of elements, a_1, a_2, a_3,....., such that the difference of successive terms is a constant $a_{i+1} - a_i = k$; for example, the sequence {2, 5, 8, 11, 14, ...} where the common difference is 3.
Associative Property	This property applies both to multiplication and addition and states that you can group several numbers that are being added or multiplied (not both) in any way and yield the same value. In mathematical terms, for all real numbers a, b, and c, $(a+b)+c=a+(b+c)$ or $(ab)c=a(bc)$.
Asymptotes	Straight lines that have the property of becoming and staying arbitrarily close to the curve as the distance from the origin increases to infinity. For example, the x-axis is the only asymptote to the graph of sin (x)/x.
Bar Graph	A diagram showing a system of connections or interrelations between two or more things by using bars.
Base Depth of the Triangular Prism	The perpendicular distance from the base of the triangle to the top of the triangle.
Base of Triangular Prism	The triangular end of the prism.
Bimodal	Having two modes, which are the most frequently occurring number in a list.

WORDS	MEANING
Binomial	In algebra, an expression consisting of the sum or difference of two monomials (see definition of monomial, such as 4a-8b.
Class Interval	In plotting a histogram, one starts by dividing the range of all values into non-overlapping intervals, called class intervals, in such a way that every piece of data is contained in some class interval.
Coefficients	The constant multiplicative factor of a mathematical object. Objects include variables, vectors, functions, matrices etc. For example, in the expression: $4d+5t^2+3s$, the 4, 5, and 3 are coefficients for the variables d, t^2, and s respectively.
Commutative Property	A binary operation * on a given set S is said to be commutative if for every pair of elements a and b that are elements of S, a * b = b * a. The operations of addition (+) and multiplication (x) are commutative on the set of real numbers. This property means that you can rearrange the order of the object being added or reorder numbers being multiplied without changing the value of the expression. In mathematical terms, for all real numbers a and b, a+b=b+a and ab=ba.
Complementary Angles	Two angles that have a sum of 90 degrees.
Congruent	Two shapes in the plane or in space are congruent if there is a rigid motion that identifies one with the other (see the definition of rigid motion).
Conjecture	A proposition which fits with established data but which has not yet been verified or refuted. An educated guess or hypothesis.
Continuous Graph	In a graph, a continuous line with no breaks in it forms a continuous graph.
Coordinate Plane	A plane with a point selected as an origin, some length selected as a unit of distance, and two perpendicular lines that intersect at the origin, with positive and negative direction selected on each line. Traditionally, the lines are called x (drawn from left to right, with positive direction to the right of the origin) and y (drawn form bottom to top, with positive direction upward of the origin). Coordinates of a point are determined by the distance of this point from the lines, and the signs of the coordinates are determined by whether the point is in the positive or in the negative direction from the origin.

WORDS	MEANING
Coordinates	A unique ordered pair of numbers that identifies a point on the coordinate plane. The first number in the ordered pair identifies the position with regard to the horizontal (x-axis) while the second number identifies the position relative to the vertical (y-axis).
Coordinate System	A rule of correspondence by which two or more quantities locate points unambiguously and which satisfies the further property that points unambiguously determine the quantities, for example, the usual Cartesian coordinates x, y in the plane.
Corresponding Angles	Two angles in the same relative position on two lines when those lines are cut by a transversal.
Cosine	Cos(q) is the x-coordinate of the point on the unit circle so that the ray connecting the point with the origin makes a angle of q with the positive x-axis. When q is an angle of a right triangle, then Cos(q) is the ratio of the adjacent side with the hypotenuse.
Decimal Number	A fraction where the denominator is a power of ten and is therefore expressed using a decimal point. For example, 0.37 is the decimal equivalent of $\frac{37}{100}$.
Degrees	A circle is measured in units called degrees. The entire circle is 360 degrees, half a circle is 180 degrees, and one quarter of a circle is 90 degrees. The "L" shaped 90 degree circle forms what is called a right angle. When examining circular objects, such as spinners, the size of each segment in the circle can be described in degrees.
Discontinuous Graph	A line in a graph that is interrupted, or has breaks in it forms a discontinuous graph.
Disjoint Events	Two events are disjoint if they can't both happen at the same time (in other words, if they have no outcomes in common). Equivalently, two events are disjoint if their intersection is the empty set.
Distributive Property	Summing two numbers and then multiplying by another number yields the same value as multiplying both values by the other value and then adding. In mathematical terms, for all real numbers a, b, and c, a(b+c)=ab+ac.
Domain of the function f	The set of numbers x for which f(x) is defined.

WORDS	MEANING
Element	A member of or an object in a set.
Empty Set	The empty set, Ø, is the set that has no members.
Equally Likely	In probability, when there are the same chances for more than one event to happen, the events are equally likely to occur. For example, if someone flips a coin, the chances of getting heads or tails are the same. There are equally likely chances of getting heads or tails.
Estimate	The best guess for an unknown quantity arrived at after considering all the information given in a problem.
Event	In probability, an event is an occurrence or the possibility of an occurrence that is being investigated.
Expanded Form	The expanded form of an algebraic expression is the equivalent expression without parentheses. For example, the expanded form of $(a+b)^2$ is $a^2+2ab+b^2$.
Expected Value	The amount that is predicted to be gained, using the calculation for average expected payoff.
Experimental Probability	The chances of something happening, based on repeated testing and observing results. It is the ratio of the number of times an event occurred to the number of times tested. For example, to find the experimental probability of winning a game, one must play the game many times, then divide by the number of games won by the total number of games played.
Exponent	The power to which a number of variable is raised (the exponent may be any real number).
Exponential Function	A function commonly used to study growth and decay. It has the form $y=a^x$ with a positive.
Factors	Any of two or more quantities that are multiplied together. In the expression 3.712 x 11.315, the factors are 3.712 and 11.315.
Frequency	The number of items occurring in a given category.
Function	A correspondence in which values of one variable determine the values of another.
Graph	A visual representation of data that displays the relationship among variables, usually cast along x and y axes.

WORDS	MEANING
Histogram	A vertical block graph with no spaces between the blocks. It is used to represent frequency data in statistics.
Hypotenuse	The side of the triangle that is opposite the right angle.
Identity	A number that when an operation is applied to a given number yields that given number. For multiplication, the identity is one and for addition the identity is zero.
Inequality	A relationship between two quantities indicating that one is strictly less than or less than or equal to the other.
Integers	The set consisting of the positive and negative whole numbers and zero, for example, {... -2, -1, 0, 1, 2,...}.
Irrational Number	A number that cannot be represented as an exact ratio of two integers. For example, the square root of 2 or π .
Input	The number or value that is entered, for example, into a function machine. The number that goes into the machine is the input.
Intercept	See x-intercept or y-intercept.
Intersection of Sets	The intersection of two or more sets is the set of elements that all the sets have in common, in other words, all the elements contained in every one of the sets. The mathematical symbol for intersection is $\cap$.
Inverse, Additive	A number when added to a given number yields zero. See also identity.
Inverse, Multiplicative	A number when multiplied by a given number yields one. See also identity
Isosceles Triangle	A triangle that has at least two congruent sides.
Limit	The target value that terms in a sequence of numbers are getting closer to. This limit is not necessarily ever reached, the numbers in the sequence eventually get arbitrarily close to the limit.
Line Graph	A diagram showing a system of connections or interrelations between two or more things by using lines.
Line Segment	A piece of a line with endpoints at both ends.

WORDS	MEANING
Line symmetry	If a figure is divided by a line and both divisions are mirrors of each other, the figure has line symmetry. The line that divides the figure is the line of symmetry.
Linear Equation	An equation containing linear expressions.
Linear Expression	An expression of the form ax+b where x is variable and a and b are constants, or in more variables, an expression of the form ax+by+c, ax+by+cz+d.
Mean	In statistics, the average obtained by dividing the sum of two or more quantities by the number of these quantities.
Median	In statistics, the quantity designating the middle value in a set of numbers.
Mode	In statistics, the value that occurs most frequently in a given series of numbers.
Modulus	A unit of measure. For example, when measuring days, a modulus could be 24 for the number of hours in a day. 75 hours would be divided by 24 to give 3 remainder 3, or 3 days and 3 hours. See also modular arithmetic.
Multimodal distribution	A distribution with more than one mode. The histogram of a multimodal distribution has more than one "bump".
Multiples	The product of multiplying a number by a whole number. For example, multiples of 5 are 10, 15, 20 or any number that can be evenly divided by 5.
Natural Numbers	The set of the counting numbers, that is, 1, 2, 3, 4... In graphing, numbers to the right of zero.
Negative Numbers	Numbers less than zero. In graphing, numbers to the left of zero. Negative numbers are represented by placing a minus sign (-) in front of the number.
Obtuse Angle	An angle whose measure is greater than 90 degrees.
Origin	In the Cartesian coordinate plane, the origin is the point at which the horizontal and vertical axes intersect, at zero (0,0).
Outcome space	The outcome space is the set of all possible outcomes of a given experiment.

WORDS	MEANING
Output	The number or value that comes out from a process. For example, in a function machine, a number goes in, something is done to it, and the resulting number is the output.
Parallel	Given distinct lines in the plane that are infinite in both directions, the lines are parallel if they never meet. Two distinct lines in the coordinate plane are parallel if and only if they have the same slope.
Parallelogram	A quadrilateral that contains two pairs of parallel sides
Pattern	Characteristic(s) observed in one item that may be repeated in similar or identical manners in other items.
Percent	A ratio that compares a number to one hundred. The symbol for percent is %.
Pi	The designated name for the ratio of the circumference of a circle to its diameter.
Pie Chart	A chart made by plotting the numeric values of a set of quantities as a set of adjacent circular wedges where the arc lengths are proportional to the total amount. All wedges taken together comprise an entire disk.
Pie Graph	A diagram showing a system of connections or interrelations between two or more things by using a circle divided into segments that look like pieces of pie.
Polygon	A closed plane figure formed by three or more line segments that do not cross over each other.
Polyhedra	Any solid figure with an outer surface composed of polygon faces.
Polynominal	An algebraic expression involving a sum of powers in one or more variables that are multiplied by co-efficients. For example, a polynomial in one variable with constant co-efficients is given by $a_nx^n + a_{n-1}x^{n-1} + \ldots + a_2x^2 + a_1x^1 + a_0$.
Prime	A natural number p greater than 1 is prime if and only if the only positive integer factors of p are 1 and p. The first seven primes are 2, 3, 5, 7, 11, 13, 17.
Probability	The measure of how likely it is for an event to occur. The probability of an event is always a number between zero and 1. The meaning (interpretation) of probability is the subject of theories of probability. However, any rule for assigning probabilities to events has to satisfy the axioms of probability.

WORDS	MEANING
Proportion	A relationship between two ratios in which the first ratio is always equal to the second.
Protractor	An instrument for laying down and measuring angles on paper, used in drawing and plotting.
Pythagorean Theorem	Used to find side lengths of right triangles, the Pythagorean Theorem states that the square of the hypotenuse is equal to the squares of the two sides, or $A^2+B^2=C^2$, where c is the hypotenuse.
Quadrant	The four parts of a grid divided by the axes. Each of these quadrants has a number designation. First quadrant – contains all the points with positive x and positive y coordinates. Second quadrant - contains all the points with negative x and positive y coordinates. Fourth quadrant – contains all the points with positive x and positive y coordinates.
Quadratic Function	A function given by a polynomial of degree 2.
Quadrilateral	A polygon that has four sides.
Quotient	When performing division, the number of times one value can be multiplied to reach the other value represents the quotient. For example, when dividing 7 by 3, 3 can be multiplied twice, making 6, and the remainder is 1, so the quotient is 2.
Range	The range of a set of numbers is the largest value in the set minus the smallest value in the set. Note that the range is a single number, not many numbers.
Range of Function f	The set of all the numbers f(x) for x in the domain of f.
Ratio	A comparison expressed as a fraction. For example, there is a ratio of threes boys to two girls in a class ($\frac{3}{2}$, 3:2).
Rational Numbers	Numbers that can be expressed as the quotient of two integers, for example, $\frac{7}{3}$, $\frac{5}{11}$, $\frac{-5}{13}$, $7 = \frac{7}{1}$.
Ray	A straight line that begins at a point and continues outward in one direction.
Reflection	The reflection through a line in the plane or a plane in space is the transformation that takes each point in the plane to its mirror image with respect to the line or its mirror image with respect to the plane in space. It produces a mirror image of a geometric figure.

WORDS	MEANING
Real Numbers	The union of the set of rational numbers and the set of irrational numbers. Also called the continuum.
Regular Polygon	A polygon whose side lengths are all the same and whose interior angle measures are all the same.
Rhombus	A parallelogram with four congruent sides.
Right Angle	An angle of 90 degrees.
Right Triangle	A triangle containing an angle of 90 degrees.
Rotate	The turning of an object (or co-ordinate system) by an angle about a fixed point.
Scientific Notation	A shorthand way of writing very large or very small numbers. A number expressed in scientific notation is expressed as a decimal number between 1 and 10 multiplied by a power of 10 (for example, $7000 = 7 \times 10^3$ or $0.0000019 = 1.9 \times 10^{-6}$).
Sector	A piece of an object. In the spinner, any of the numbered segments is a "sector".
Sequence	An ordered set whose elements are usually determined based on some function of the counting numbers.
Set	A set is a collection of things, without regard to their order.
Significant Digits	The number of digits to consider when using measuring numbers. There are three rules in determining the number of digits considered significant in a number: - All non-zeros are significant. - Any zeros between two non-zeros are significant. - Only trailing zeros behind the decimal are considered significant.
Similarity	Two figures are said to be similar when all corresponding angles are equal and all distances are increased (or decreased) in the same ratio.
Sine	Sin (q) is the y-coordinate of the point on the unit circle so that the ray connecting the point with the origin makes an angle of q with the positive x-axis. When q is an angle of a right triangle, the sin (q) is the ratio of the opposite side with the hypotenuse.

WORDS	MEANING
Square Root	The square roots of n are all the numbers m so that m^2 = n. The square roots of 16 are 4 and -4. The square roots of -16 are 4i and -4i.
Subset	A subset of a given set is a collection of things that belong to the original set. For example, A={a,b}, could include, a, b, a and b, or the null set (neither).
Surface Area	A measure of the number of square units needed to cover the outside of a figure.
Symmetry	A symmetry of a shape S in the plane or space is a rigid motion T that takes S onto itself (T(S)=S). For example, reflection through a diagonal and a rotation through a right angle about the centre are both symmetries of the square.
System of Linear Equations	Set of equations of the first degree (for example, x+y=7 and x-y=1). A solution of a set of linear equations is a set of numbers a, b, c,..... so that when the variables are replaced by the numbers all the equations are satisfied. For example, in the equations above, x = 4 and y = 3 is the solution.
Translate	In a tessellation, to translate an object means repeating it by sliding it over a certain distance in a certain direction.
Translation	A rigid motion of the plane or space of the form X goes to X + V for a fixed vector V.
Transversal	In geometry, given two or more lines in the plane a transversal is a line distinct from the original lines and intersects each of the given liens in a single point.
Tessellation	A tessellation is a repeated geometric design that covers a plane without gaps or overlaps.
Theoretical Probability	The chances of events happening as determined by calculating results that would occur under ideal circumstances. For example, the theoretical probability of rolling a 4 on a four-sided die is ¼ or 25%, because there is one chance in four to roll a 4, and under ideal circumstances one out of every four rolls would be a 4. Contrast with experimental probability.
Trapezoid	A quadrilateral with exactly one pair of parallel sides.
Union of Sets	The union of two or more sets is the set of all the objects contained by at least one of the sets. The symbol for union is U.

WORDS	MEANING
Variable	A placeholder in algebraic expression, for example, in $3x + y = 23$, x and y are variables.
Vector	Quantity that has magnitude (length) and direction. It may be represented as a directed line segment.
Velocity	The rate of change of position overtime is velocity, calculated by dividing distance by time.
Venn Diagram	A diagram where sets are represented as simple geometric figures, with overlapping and similarity of sets represented by intersections and unions of the figures.
Volume	A measure of the number of cubic units needed to fill the space inside an object.
X-intercept	The x-coordinate of the point where the line crosses the x-axis.
Y-intercept	The y-coordinate of the point where the line crosses the y-axis.

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