

MIDDLE SCHOOL



MINISTRY OF EDUCATION
DEPARTMENT OF EDUCATION

Essential Curriculum

2008

Curriculum and Instructional Leadership
Performance Standards Summary

MATHEMATICS



PERFORMANCE STANDARDS ARE LEARNING EXPECTATIONS

“THE ESSENTIAL CURRICULUM”

The mission of the Bermuda Public School System (BPSS) is *to be the first choice in education by providing rigorous and stimulating learning experiences in safe, responsive environments from which our students emerge confident and prepared to compete and contribute locally and globally.*

Performance Standards are statements of what students should know and be able to do and how they should demonstrate their knowledge and skills at the end of each year. Included within the Performance Standards document are **strands, performance statements** and **assessment indicators** for English language arts, mathematics, science and social studies. It is important to note that the assessment indicators listed in this booklet represents the “Essential Curriculum.” They are the critical guidelines for ongoing and island-wide curriculum based assessment. They are guideposts in the journey our students make from the time they enter our schools to the time they graduate *confident and prepared to compete and contribute locally and globally.*



Serving as guideposts, performance standards establish shared expectations for the:

- completion of each year of our school system,
- guidance in terms of how we may need to redirect our efforts during any given year of our school system
- direction in terms of what we should be able to expect of students entering each subsequent year of our school system.

As they serve as guideposts for teachers responsible for maximizing students' learning experiences, performance standards tell us not only the *ultimate* goals for each year level but also provide direction towards achievement of the goals *during* each year.

Bermuda Performance Standards will be used to:

- emphasize the concepts and processes all students should learn with understanding.
- provide explicit goals for student expectation at the end of each year.
- guide Bermuda Criterion Reference and classroom assessments

Bermuda Public School System Performance Standards

Mathematics (MT)

Number and Number Operations (N)

Patterns, Functions and Algebra (A)

Geometry (G)

Measurement (M)

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M1 MATHEMATICS (MT)

Introduction to Bermuda Mathematics Performance Standards.....7

- Mathematical Processing Skills

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- A3 Algebraic Reasoning

Geometry (G)14

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- D1 Data Collection and Organization
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- D3 Analysis and Interpretation
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M2 MATHEMATICS (MT)

Introduction to Bermuda Mathematics Performance Standards.....7

- Mathematical Processing Skills

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Number and Number Operations (N).....19

- N1 Numerical Representation
- N2 Numerical Operations
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Patterns, Functions and Algebra (A)21

- A1 Pattern and Functions
- A2 Algebraic Representation
- A3 Algebraic Reasoning

Geometry (G)22

- G1 Classification
- G2 Spatial Reasoning
- G3 Transformations

Measurement (M)23

- M1 Tools and Units
- M2 Measuring

Data Handling (D)24

- D1 Data Collection and Organization
- D2 Representation
- D3 Analysis and Interpretation
- D4 Probability

M3 MATHEMATICS (MT)

Introduction to Bermuda Mathematics Performance Standards.....7

- Mathematical Processing Skills

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Number and Number Operations (N).....27

- N1 Numerical Representation
- N2 Numerical Operations
- N3 Numerical Relationships

Patterns, Functions and Algebra (A)29

- A1 Pattern and Functions
- A2 Algebraic Representation
- A3 Algebraic Reasoning

Geometry (G)30

- G1 Classification
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- G3 Transformations

Measurement (M)31

- M1 Tools and Units
- M2 Measuring

Data Handling (D)32

- D1 Data Collection and Organization
- D2 Representation
- D3 Analysis and Interpretation
- D4 Probability



BERMUDA MATHEMATICS PERFORMANCE STANDARDS (MT)

Many of the elementary terms and concepts of mathematics have concrete applications and examples in the world. For they are part of a language developed to describe the physical (and social) world.

(Ernest, 1991, p.56)

“Improving mathematics education is not a matter of adding a little spice to a dull subject or of making a few minor changes in content or approach. It requires no less than a redefinition of mathematics (instruction) and an understanding that (its) goal must be the development of mathematical power in all students” (Parker, 1993, p. xi). From as early as preschool, we attempt to present the students with a balance of conceptual understanding, skills and problem solving. Mathematics is no longer viewed as the subject to be mastered by the chosen few. *Principles and Standards for School Mathematics*, published by the National Council of Teachers of Mathematics (NCTM 2000, p.4) states that the need to understand and be able to use mathematics in everyday life and in the workplace has never been greater and will continue to increase. While some careers are considered mathematics intensive, all will require fundamental mathematical skills, procedures and understandings.

The *Bermuda Mathematics Performance Standards* were developed from standards defined by the *National Council of Teachers of Mathematics* and from various jurisdictions including the United Kingdom and Canada. The *Bermuda Mathematics Performance Standards* support the Bermuda Mathematics Curriculum. The curriculum identifies the distribution of mathematics content over a 14-year period. It advises when enduring understandings and procedural knowledge should be introduced, reinforced and/or developed. The *Standards* provide a framework for assessing the understandings and applications of essential mathematical ideas, that is, what students should know and be able to do. The assessment indicators listed in the *Standards* define the critical elements of the mathematics programme that will be formally assessed at the end of each year level from Primary 3 through Senior 2. The assessment instruments will be comprised of selected- and constructed-response items with an emphasis on reasoning and problem solving. Students will be required to produce evidence that they are able to use, represent and explain the fundamental components of the mathematics programme. The *Standards* include these conceptual areas:

NUMBER AND NUMBER OPERATIONS (N)

A sense of number implies an ability to describe and apply relationships among numbers including their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

- N1. **Numerical Representation** - The positions of the digits in numbers determine what they represent, that is, which size group they count, measure or order and these numbers are best understood in terms of familiar real-world experiences, such as budgeting, cooking, carpentry, etc.
- N2. **Numerical Operations** - Numerical operations consist of taking apart and combining numbers using a variety of strategies which require an understanding of the properties of the operations. Manipulatives and diagrams are used to model these operations and their inverses and to relate them to their symbolic expressions. The mathematical models or representations are also used to assist with solving contextual problems.
- N3. **Numerical Relationships** - Equal shares or equal-sized portions of a whole or unit are compared using a variety of representations. Fractions, decimals and percents can be used interchangeably and equivalent fractions are ways of describing the same amount by using different-sized fractional parts. Ratio and proportion are used to represent relationships between quantities and measures as applied in problem solving

PATTERNS, FUNCTIONS AND ALGEBRA (A)

The generalization of patterns, relationships and change are expressed by means of symbolic notation, algebraic equations and graphical representations. Reasoning is used to generalize, formalize and communicate patterns and regularity in all aspects of mathematics.

- A1. **Patterns and Functions** - Patterns are regular and predictable changes. They are found in nature, and numbers, as well as in physical and geometrical situations. Patterns show relationships among variables and can be recognized, extended or generalized.
- A2. **Algebraic Representation** - Symbols are used to represent variables and equations. They assist us with understanding the patterns and relationships among forms of representations -

words, tables, graphs and rules. Variables are symbols used to represent quantities that change - time, temperature, distance traveled.

- A3. **Algebraic Reasoning** consists of a variety of formats used to assist with understanding, justifying or presenting solutions to problems. Equations and inequalities are used to express the relationships.

GEOMETRY (G)

Spatial sense involves the application of the properties and relationships of points, lines, angles, planes and curves of shapes and solids. The space around us and the measurement of the objects and shapes in that space are defined and categorized according to a specific set of assumptions.

- G1. **Classification** - Both two-dimensional and three-dimensional shapes can be described, analysed and classified in a variety of ways and according to their properties and relationships.
G2. **Spatial Reasoning** - Geometric properties, reasoning and visualization can be used to solve problems.
G3. **Transformations** - Draw shapes and build models

MEASUREMENT (M)

Measuring requires the use of tools and units to determine, describe and compare attributes. These measurements encompass the dimensions, size, quantity, length, or capacity of substances or figures as well as sequential relationships such as time and temperature.

- M1. **Tools and Units** - Standard mathematical measurement tools and units depend on the real world situation.
M2. **Measuring** - The comparison of an item with a unit (length, time, volume, etc.)

DATA HANDLING (D)

Data may be presented in a variety of representations including graphs to show logical relationships between various quantities and to assist with decision-making. The collection and analysis of data is identified as either statistics or probability. Statistics is the mathematics used for collecting, organizing, and studying data while probability is the measure of the likelihood of an event.

- D1. **Data Collection and Organization** - Data are collected and organised to help with the making of decisions, the drawing of inferences or the development of new ideas.
D2. **Representation** - Appropriate representations of data depend on characteristics of that data.
D3. **Analysis and Interpretation** - Provides information on the attributes of data
D4. **Probability** - The occurrence or non-occurrence of an event is characterized as impossible, less likely, equally likely, more likely or certain. The likelihood of an event or its probability is quoted as a ratio between 0 and 1 inclusive.

Mathematics processes are the means by which students use mathematical ideas and procedures to communicate, represent, connect, reason and solve problems. These skills assist in the acquisition of knowledge and the application of ideas. Students are required to use a variety of techniques to understand and solve problems, reason and construct proofs as well as communicate and make connections. They express and extend their mathematical ideas using correct notations, generalizations, inferences and rigorous arguments leading to notions of proof. The solutions involve a process as well as a product.

The use of mathematical process skills are categorized as follows:

- 1. Mathematical processes are used to identify and explain everyday experiences, in and outside of school, and to make connections with other disciplines.**
 - a) use reasoning ability to analyze, perceive patterns, identify relationships and formulate questions for further exploration
 - b) formulate a problem and set limits for acceptable solutions
- 2. Mathematical reasoning and problem solving provide a means for making sense of, investigating, evaluating and justifying the solution to problems.**
 - a) systematically apply a model (plan) for problem solving - understand the problem, select a strategy, implement the strategy, evaluate the solution.
 - b) select or develop an appropriate problem-solving strategy
 - c) analyze problems using appropriate processes such as modelling, simplifying, generalizing, etc
 - d) validate conclusions using mathematical properties and relationships

3. Appropriate mathematical representations and technology tools are used to illustrate and assist with the solution process.

- a) determine the most efficient manner to solve problems
- b) design representations of the problem using technology and appropriate mathematical discourse (terminology, symbols and drawings)
- c) select mathematical ideas and tools to support the reasoning process

4. Ideas and solutions are communicated mathematically using language and symbols, efficient tools, appropriate units and graphical, numerical, physical or algebraic models.

- a) communicate logical arguments clearly to show why the solution makes sense

Using the Standards as a framework, the assessment results will provide teachers with information on how well the students perform procedures, understand concepts, solve problems and communicate their reasoning. Administrators will be able to analyze and compare data to ascertain trends in student performance over time. The Bermuda Mathematics Performance Standards define the framework for assessing the depth and breadth our students are engaging in mathematical thinking and are confidently using quantitative and spatial information to make decisions.

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Number and Number Operations (N)

A sense of number implies an ability to describe and apply relationships among numbers, their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

Students will explore and make sense of the meaning, relationship and application of numbers, number systems and number operations. They will extend their estimation and computation skills, develop procedural fluency and represent their conceptual understanding using words, formulas, diagrams, charts and graphs.

N1 - Numerical Representation:

The positions of the digits in numbers determine what they represent, that is, which size group they count, measure or order and these numbers are best understood in terms of familiar real-world experiences, such as budgeting, cooking, carpentry, etc.

N2 - Numerical Operations:

Numerical operations consist of taking apart and combining numbers using a variety of strategies which require an understanding of the properties of the operations. Manipulatives and diagrams are used to model these operations and their inverses and to relate them to their symbolic expressions. The mathematical models or representations are also used to assist with solving contextual problems.

MT.M1.N1

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- apply equivalent representations of the same number and generate them by decomposing and composing numbers including expanded notation ($1,023,000 = 1,000,000 + 20,000 + 3000$)
- represent and use whole numbers, integers, fractions, decimals, percents and exponentials (scientific notation) in a variety of equivalent forms in real world and problem situations
- understand that numbers and their negatives are at equal distance from 0 on a number line
- know and apply the properties of special numbers, 0 and 1
- apply in context the concept of negative numbers (e.g. temperature)

MT.M1.N2

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- apply the four operations and the relationship between them to problem solving
- apply properties of operations including order of operations to positive rational numbers
- apply number theory concepts (factors, multiples, odd numbers, divisibility) in real-world problem situations
- apply the inverse relationship between addition/ subtraction and multiplication/ division
- use a variety of methods to check results and to determine reasonableness of the solution
- apply estimation strategies and identify when an estimate is more appropriate than an exact answer
- apply appropriate problem solving strategies

Number and Number Operations (N) (continued)

A sense of number implies an ability to describe and apply relationships among numbers, their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

Students will explore and make sense of the meaning, relationship and application of numbers, number systems and number operations. They will extend their estimation and computation skills, develop procedural fluency and represent their conceptual understanding using words, formulas, diagrams, charts and graphs.

N3 - Numerical Relationships :

Equal shares or equal-sized portions of a whole or unit are compared using a variety of representations. Fractions, decimals and percents can be used interchangeably and equivalent fractions are ways of describing the same amount by using different-sized fractional parts. Ratio and proportion are used to represent relationships between quantities and measures as applied in problem solving.

MT.M1.N3

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- a) use the relative magnitude and relationship among whole numbers, fractions, decimals and mixed numbers (e.g., which is larger?)
- b) order rational numbers and represent them as fractions or terminating decimals where possible and translate between these representations
- c) apply proportional comparisons of fractions, decimals and percentages in the context of everyday situations
- d) solve percent problems of the form $a\%$ of b equals c for any one of the variables a , b , or c

Patterns, Functions and Algebra (A)

The generalization of patterns, relationships and change is expressed by means of symbolic notation, algebraic equations and graphical representations. Reasoning is used to generalise, formalise and communicate patterns and regularity in all aspects of mathematics.

Students will explore and make sense of patterns, functions, symbols and models. They will use symbolic forms to represent and analyze mathematical situations and use mathematical models to analyze change in both real and abstract contexts. Students will create and translate multiple representations of mathematical relationships.

A1 - Patterns and Functions:

Patterns are regular and predictable changes. They are found in nature, and numbers, as well as in physical and geometrical situations. Patterns show relationships among variables and can be recognized, extended or generalized.

A2 - Algebraic Representation:

Symbols are used to represent variables and equations. They assist us with understanding the patterns and relationships among forms of representations - words, tables, graphs and rules. Variables are symbols used to represent quantities that change - time, temperature, distance traveled.

A3 - Algebraic Reasoning:

Algebraic reasoning consists of a variety of formats used to assist with understanding, justifying or presenting solutions to problems. Equations and inequalities are used to express the relationships.

MT.M1.A1

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- analyse and create patterns and functions to represent and solve problems
- apply the basic concept of a function, that is, how change in one quantity or variable results in changes in another (perimeter-side relationship for a square)

MT.M1.A2

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- use symbols to represent patterns in relationship to real world situations (e.g., $c = t/10$ for c the cost of a movie theatre ticket and t the total amount paid for 10 persons)
- graph ordered pairs on a positive coordinate grid

MT.M1.A3

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- model and solve problems set in their natural context using representations such as patterns, graphs, tables and equations

Geometry (G)

Spatial sense involves the application of the properties and relationships of points, lines, angles, planes and curves of shapes and solids. The space around us and the measurement of the objects and shapes in that space are defined and categorized according to a specific set of assumptions.

Students will use a variety of techniques, tools and formulas to analyze characteristics and properties of two- and three-dimensional geometric objects; apply coordinate geometry and graph theory; and solve problems using visualization and spatial reasoning

G1 - Classification:

Both two-dimensional and three-dimensional shapes can be described, analysed and classified in a variety of ways and according to their properties and relationships.

G2 - Spatial Reasoning:

Geometric properties, reasoning and visualization can be used to solve problems.

G3 - Transformations:

Draw shapes and build models.

MT.M1.G1

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) classify and describe planes and solids according to their attributes
- b) measure (to plus or minus one degree) angles and classify them

MT.M1.G2

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) use the properties of two- and three-dimensional shapes to solve mathematical and real-world problems
- b) apply the angle sum of a triangle
- c) estimate the size of an angle with reference to benchmark angles
- d) identify flat patterns (nets) that represent cuboids (rectangular prisms)

MT.M1.G3

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) predict and describe the result of the reflection and rotation (90 and 180 degrees clockwise) of a plane figure on a coordinate grid

Measurement (M)

Measuring requires the use of tools and units to determine, describe and compare attributes. These measurements encompass the dimensions, size, quantity, length or capacity of substances or figures as well as sequential relationships such as time and temperature.

Students will use a variety of techniques, tools and formulae to determine the dimensions or the capacity of shapes and figures. Students will understand the systems of units for measuring perimeter, area and volume and will understand how to measure the volume and surface area of solid figures.

M1 - Tools and Units:

Standard mathematical measurement tools and units depend on the real world situation.

MT.M1.M1

Students will demonstrate an understanding of measurement by using, representing and explaining. They will:

- a) select appropriate tools and units to measure to a level of accuracy required in a particular setting
- b) convert units, within the same measurement system, to solve problems (linear, capacity)

M2 - Measuring:

The comparison of an item with a unit (length, time, volume, etc.).

MT.M1.M2

Students will demonstrate an understanding of measurement by using, representing and explaining. They will:

- a) estimate measurement and determine the level of accuracy
- b) find the volume of a cuboid (rectangular prism)
- c) determine relationships amongst length, area, and volume
- d) find angle measure, weight, capacity, time and temperature from pictures using scales, protractors, clocks etc. (appropriate units required)
- e) determine elapsed time
- f) solve problems using measurement tools and concepts

Data Handling (D)

Data may be presented in a variety of representations, including graphs to show logical relationships between various quantities and to assist with decision-making. The collection and analysis of data is identified as either statistics or probability. Statistics is the mathematics used for collecting, organizing, and studying data while probability is the measure of the likelihood of an event.

Mathematics instruction will include data analysis, statistics and probability. Students will be given the opportunity to pose questions and collect, organize, represent and interpret data to answer those questions; develop and evaluate predictions and arguments that are based on data; and apply basic notions of chance and probability. Students will use technology tools to investigate large samples, explore graphical representations and simulate events.

D1 - Data Collection and

Organisation:

Data are collected and organised to help with the making of decisions, the drawing of inferences or the development of new ideas.

MT.M1.D1

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- a) create and implement a plan for collection of data when given a problem situation
- b) organise data

D2 - Representation:

Appropriate representations of data depend on characteristics of that data.

MT.M1.D2

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- a) create or choose a variety of data representations (double bar graphs, pie charts)

D3 - Analysis and interpretation:

Provides information on the attributes of data.

MT.M1.D3

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- a) read and interpret line graphs and pie charts

D4 - Probability:

The occurrence or non-occurrence of an event is characterized as impossible, less likely, equally likely, more likely or certain. The likelihood of an event or its probability is quoted as a ratio between 0 and 1 inclusive.

MT.M1.D4

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- a) determine the probability of a simple event (including lists, tree diagrams or constructing a sample space involving all possible results)



Number and Number Operations (N)

A sense of number implies an ability to describe and apply relationships among numbers, their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

Students will explore and make sense of the meaning, relationship and application of numbers, number systems and number operations. They will extend their estimation and computation skills, develop procedural fluency and represent their conceptual understanding using words, formulas, diagrams, charts and graphs.

N1 - Numerical Representation:

The positions of the digits in numbers determine what they represent, that is, which size group they count, measure or order and these numbers are best understood in terms of familiar real-world experiences, such as budgeting, cooking, carpentry, etc.

N2 - Numerical Operations:

Numerical operations consist of taking apart and combining numbers using a variety of strategies which require an understanding of the properties of the operations. Manipulatives and diagrams are used to model these operations and their inverses and to relate them to their symbolic expressions. The mathematical models or representations are also used to assist with solving contextual problems.

MT.M2.N1

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- understand and apply the relationship between squares and square roots
- represent and use whole numbers, integers, fractions, decimals, percents and exponentials (scientific notation) in a variety of equivalent forms in real world and problem situations
- add and subtract negative rational number
- know and apply the properties of special numbers, 0 and 1,

MT.M2.N2

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- apply the four operations and the relationship between them to problem solving
- apply properties of operations including order of operations
- apply the inverse relationship between addition/subtraction and multiplication/division
- use a variety of methods to check results and to determine reasonableness of the solution
- apply estimation strategies and identify when an estimate is more appropriate than an exact answer
- apply appropriate problem-solving strategies

Number and Number Operations (N) (continued)

A sense of number implies an ability to describe and apply relationships among numbers, their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

Students will explore and make sense of the meaning, relationship and application of numbers, number systems and number operations. They will extend their estimation and computation skills, develop procedural fluency and represent their conceptual understanding using words, formulas, diagrams, charts and graphs.

N3 - Numerical Relationships :

Equal shares or equal-sized portions of a whole or unit are compared using a variety of representations. Fractions, decimals and percents can be used interchangeably and equivalent fractions are ways of describing the same amount by using different-sized fractional parts. Ratio and proportion are used to represent relationships between quantities and measures as applied in problem solving.

MT.M2.N3

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- a) use the relative magnitude and relationship among whole numbers, fractions, decimals and mixed numbers
- b) solve percent problems of the form $a\%$ of b equals c for any one of the variables a , b , or c
- c) solve problems involving rates of change (e.g., speed, density)
- d) apply the relationships and applications of ratio, proportion and percentage (gratuuity [tip 15%], customs duty [25%], payroll tax [4.75%], discounts [5% grocery shopping])

Patterns, Functions and Algebra (A)

The generalization of patterns, relationships and change is expressed by means of symbolic notation, algebraic equations and graphical representations. Reasoning is used to generalise, formalise and communicate patterns and regularity in all aspects of mathematics.

Students will explore and make sense of patterns, functions, symbols and models. They will use symbolic forms to represent and analyze mathematical situations and use mathematical models to analyze change in both real and abstract contexts. Students will create and translate multiple representations of mathematical relationships.

A1 - Patterns and Functions:

Patterns are regular and predictable changes. They are found in nature, and numbers, as well as in physical and geometrical situations. Patterns show relationships among variables and can be recognized, extended or generalized.

A2 - Algebraic Representation:

Symbols are used to represent variables and equations. They assist us with understanding the patterns and relationships among forms of representations - words, tables, graphs and rules. Variables are symbols used to represent quantities that change - time, temperature, distance traveled.

A3 - Algebraic Reasoning:

Algebraic reasoning consists of a variety of formats used to assist with understanding, justifying or presenting solutions to problems. Equations and inequalities are used to express the relationships.

MT.M2.A1

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- analyse and create patterns, functions and graphs to represent and solve problems
- apply and explain simple functions (area-side relationship for a square)
- use different methods of presenting a pattern (sequences, tables, graphs, verbal rules, open sentences, equations)
- analyze functional relationships to explain how a change in one quantity results in a change in another

MT.M2.A2

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- represent situations as algebraic expressions
- add and subtract simple algebraic expressions of the first degree including integer coefficients
- combine like terms and substitute for unknowns in a given expression
- graph ordered pairs in all quadrants

MT.M2.A3

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- model and solve problems set in their natural context using representations such as patterns, graphs, tables and equations
- solve two-step linear equations

Geometry (G)

Spatial sense involves the application of the properties and relationships of points, lines, angles, planes and curves of shapes and solids. The space around us and the measurement of the objects and shapes in that space are defined and categorized according to a specific set of assumptions.

Students will use a variety of techniques, tools and formulas to analyze characteristics and properties of two- and three-dimensional geometric objects; apply coordinate geometry and graph theory; and solve problems using visualization and spatial reasoning

G1 - Classification:

Both two-dimensional and three-dimensional shapes can be described, analysed and classified in a variety of ways and according to their properties and relationships.

G2 - Spatial Reasoning:

Geometric properties, reasoning and visualization can be used to solve problems.

G3 - Transformations:

Draw shapes and build models.

MT.M2.G1

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) identify lines, angles and parts of a circle (arc, sector)
- b) classify triangles according to their properties

MT.M2.G2

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) use the properties of two- and three-dimensional shapes to solve mathematical and real-world problems
- b) apply the relationship between the number of sides and the sums of the angle measures of polygons
- c) determine the size of angles formed by intersecting lines
- d) identify flat patterns (nets) that represent cuboids (rectangular prisms)

MT.M2.G3

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) predict and describe the result of the translation of a plane figure on a coordinate grid

Measurement (M)

Measuring requires the use of tools and units to determine, describe and compare attributes. These measurements encompass the dimensions, size, quantity, length or capacity of substances or figures as well as sequential relationships such as time and temperature.

Students will use a variety of techniques, tools and formulae to determine the dimensions or the capacity of shapes and figures. Students will understand the systems of units for measuring perimeter, area and volume and will understand how to measure the volume and surface area of solid figures.

M1 - Tools and Units:

Standard mathematical measurement tools and units depend on the real world situation.

MT.M2.M1

Students will demonstrate an understanding of measurement by using, representing and explaining. They will:

- a) select appropriate tools and units to measure to a level of accuracy required in a particular setting
- b) describe how a change in one measure affects the others (use a visual aid) (e.g., Area of a rectangle is 24 sq. units. The length is 4 and the width is 6. If the length is doubled and the area stays the same, what will be the new width?)

M2 - Measuring:

The comparison of an item with a unit (length, time, volume, etc.).

MT.M2.M2

Students will demonstrate an understanding of measurement by using, representing and explaining. They will:

- a) compute the circumference and the area of a circle.
- b) solve problems including the volume of a cuboid (rectangular prism)
- c) solve problems using measurement tools and concepts

Data Handling (D)

Data may be presented in a variety of representations, including graphs to show logical relationships between various quantities and to assist with decision-making. The collection and analysis of data is identified as either statistics or probability. Statistics is the mathematics used for collecting, organizing, and studying data while probability is the measure of the likelihood of an event.

Mathematics instruction will include data analysis, statistics and probability. Students will be given the opportunity to pose questions and collect, organize, represent and interpret data to answer those questions; develop and evaluate predictions and arguments that are based on data; and apply basic notions of chance and probability. Students will use technology tools to investigate large samples, explore graphical representations and simulate events.

D1 - Data Collection and

Organisation:

Data are collected and organised to help with the making of decisions, the drawing of inferences or the development of new ideas.

D2 - Representation:

Appropriate representations of data depend on characteristics of that data.

D3 - Analysis and interpretation:

Provides information on the attributes of data.

D4 - Probability:

The occurrence or non-occurrence of an event is characterized as impossible, less likely, equally likely, more likely or certain. The likelihood of an event or its probability is quoted as a ratio between 0 and 1 inclusive.

MT.M2.D1

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- create and implement a plan for collection of data when given a problem situation
- organise data, including sampling methods

MT.M2.D2

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- create or choose a variety of data representations (line graphs)

MT.M2.D3

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- study data to make predictions and draw conclusions (double bar graphs, pie charts)
- compare related data sets
- find measure of central tendency (mean, median, mode and range) to describe a set of data

MT.M2.D4

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- determine the probability of a simple event
- use theoretical probabilities and experimental results to make predictions and decisions



Number and Number Operations (N)

A sense of number implies an ability to describe and apply relationships among numbers, their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

Students will explore and make sense of the meaning, relationship and application of numbers, number systems and number operations. They will extend their estimation and computation skills, develop procedural fluency and represent their conceptual understanding using words, formulas, diagrams, charts and graphs.

N1 - Numerical Representation:

The positions of the digits in numbers determine what they represent, that is, which size group they count, measure or order and these numbers are best understood in terms of familiar real-world experiences, such as budgeting, cooking, carpentry, etc.

N2 - Numerical Operations:

Numerical operations consist of taking apart and combining numbers using a variety of strategies which require an understanding of the properties of the operations. Manipulatives and diagrams are used to model these operations and their inverses and to relate them to their symbolic expressions. The mathematical models or representations are also used to assist with solving contextual problems.

MT.M3.N1

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- understand and apply the relationship between squares and square roots to solve problems
- represent and use whole numbers, integers, fractions, decimals, percents and exponentials (scientific notation) in a variety of equivalent forms in real world and problem situations
- multiply and divide negative rational numbers
- know and apply the properties of special numbers, 0, 1 and Π

MT.M3.N2

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- apply the four operations and the relationship between them to problem solving
- apply properties of operations including order of operations
- understand and use the inverse relationship between exponents and roots
- use a variety of methods to check results and to determine reasonableness of the solution, including estimation and inverse operations
- apply estimation strategies and identify when an estimate is more appropriate than an exact answer
- apply appropriate problem solving strategies

Number and Number Operations (N) (continued)

A sense of number implies an ability to describe and apply relationships among numbers, their uses and their representations. These numbers are effectively used for various purposes such as counting, measuring, estimating and problem solving. A range of methods of computation is applied to practical tasks, in real-life situations and within mathematics itself.

Students will explore and make sense of the meaning, relationship and application of numbers, number systems and number operations. They will extend their estimation and computation skills, develop procedural fluency and represent their conceptual understanding using words, formulas, diagrams, charts and graphs.

N3 - Numerical Relationships :

Equal shares or equal-sized portions of a whole or unit are compared using a variety of representations. Fractions, decimals and percents can be used interchangeably and equivalent fractions are ways of describing the same amount by using different-sized fractional parts. Ratio and proportion are used to represent relationships between quantities and measures as applied in problem solving.

MT.M3.N3

Students will demonstrate an understanding of numbers, by using, representing and explaining. They will:

- a) use the relative magnitude and relationship among whole numbers, fractions, decimals and mixed numbers
- b) solve simple proportion problems using such methods as unit rate, scaling and finding the proportion equation $a/b = c/d$
- c) apply the relationships and applications of ratio, proportion and percentage (gratuity/tip [15%], customs duty [25%], payroll tax [4.75%], discounts [5% grocery shopping])

Patterns, Functions and Algebra (A)

The generalization of patterns, relationships and change is expressed by means of symbolic notation, algebraic equations and graphical representations. Reasoning is used to generalise, formalise and communicate patterns and regularity in all aspects of mathematics.

Students will explore and make sense of patterns, functions, symbols and models. They will use symbolic forms to represent and analyze mathematical situations and use mathematical models to analyze change in both real and abstract contexts. Students will create and translate multiple representations of mathematical relationships.

A1 - Patterns and Functions:

Patterns are regular and predictable changes. They are found in nature, and numbers, as well as in physical and geometrical situations. Patterns show relationships among variables and can be recognized, extended or generalized.

A2 - Algebraic Representation:

Symbols are used to represent variables and equations. They assist us with understanding the patterns and relationships among forms of representations - words, tables, graphs and rules. Variables are symbols used to represent quantities that change - time, temperature, distance traveled.

A3 - Algebraic Reasoning:

Algebraic reasoning consists of a variety of formats used to assist with understanding, justifying or presenting solutions to problems. Equations and inequalities are used to express the relationships.

MT.M3.A1

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- analyse and create patterns, functions and graphs to represent and solve problems
- compare properties of linear functions between or among tables, graphs and equations
- explain how change in one variable affects the change in another variable, such as, $C = \pi d$, Area of triangle = $\frac{1}{2}bh$ or if speed remains constant, an increase in time results in an increase in distance

MT.M3.A2

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- add, subtract and multiply simple algebraic expressions
- represent mathematical expressions and relationships through numbers and symbols, such as $(5x + 3)$ and $4(y + 1)$
- graph ordered pairs in all quadrants
- analyze the nature of change in quantities in linear relationships (e.g., slope and intercepts)

MT.M3.A3

Students will demonstrate an understanding of algebra, by using, representing and explaining. They will:

- model and solve problems set in their natural context using representations such as patterns, graphs, tables and equations
- solve two-step linear equations
- model inequalities concretely, pictorially (e.g., graphs and tables) and abstractly

Geometry (G)

Spatial sense involves the application of the properties and relationships of points, lines, angles, planes and curves of shapes and solids. The space around us and the measurement of the objects and shapes in that space are defined and categorized according to a specific set of assumptions.

Students will use a variety of techniques, tools and formulas to analyze characteristics and properties of two- and three-dimensional geometric objects; apply coordinate geometry and graph theory; and solve problems using visualization and spatial reasoning

G1 - Classification:

Both two-dimensional and three-dimensional shapes can be described, analysed and classified in a variety of ways and according to their properties and relationships.

G2 - Spatial Reasoning:

Geometric properties, reasoning and visualization can be used to solve problems.

G3 - Transformations:

Draw shapes and build models.

MT.M3.G1

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) identify lines, angles and parts of a circle (chord, segment, tangent)
- b) classify quadrilaterals according to their properties

MT.M3.G2

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) use the properties of two- and three-dimensional shapes to solve mathematical and real-world problems
- b) apply the relationship between the number of sides and the sums of the angle measures of polygons
- c) determine the size of angles formed by parallel lines and the transversal
- d) identify flat patterns (nets) that represent triangular prisms and cylinders
- e) classify figures in terms of congruence and similarity and apply these relationships to the solution of problems
- f) apply the Pythagorean Theorem

MT.M3.G3

Students will demonstrate an understanding of geometry by using, representing and explaining. They will:

- a) construct circles
- a) predict the results of transformations on the coordinate plane and draw the transformed figure
- b) use transformational geometry to describe motions, patterns, designs and properties of shapes in the real world
- c) use technology or other tools to formulate and test conjectures and to make geometric constructions

Measurement (M)

Measuring requires the use of tools and units to determine, describe and compare attributes. These measurements encompass the dimensions, size, quantity, length or capacity of substances or figures as well as sequential relationships such as time and temperature.

Students will use a variety of techniques, tools and formulae to determine the dimensions or the capacity of shapes and figures. Students will understand the systems of units for measuring perimeter, area and volume and will understand how to measure the volume and surface area of solid figures.

M1 - Tools and Units:

Standard mathematical measurement tools and units depend on the real world situation.

M2 - Measuring:

The comparison of an item with a unit (length, time, volume, etc.).

MT.M3.M1

Students will demonstrate an understanding of measurement by using, representing and explaining. They will:

- select appropriate tools and units to measure to a level of accuracy required in a particular setting
- describe how a change in one measure affects the others (e.g., Area of a rectangle is 24 sq. units. The length is 6 and the width is 4. If the length is increased by 2 and the area stays the same, what will be the new perimeter?)

MT.M3.M2

Students will demonstrate an understanding of measurement by using, representing and explaining. They will:

- find the surface area of cuboids (rectangular prisms) and cylinders
- compute the volumes of cuboids (rectangular prisms, triangular prisms and cylinders)
- solve problems using measurement tools and concepts (use complex figures e.g., subdividing)

Data Handling (D)

Data may be presented in a variety of representations, including graphs to show logical relationships between various quantities and to assist with decision-making. The collection and analysis of data is identified as either statistics or probability. Statistics is the mathematics used for collecting, organizing, and studying data while probability is the measure of the likelihood of an event.

Mathematics instruction will include data analysis, statistics and probability. Students will be given the opportunity to pose questions and collect, organize, represent and interpret data to answer those questions; develop and evaluate predictions and arguments that are based on data; and apply basic notions of chance and probability. Students will use technology tools to investigate large samples, explore graphical representations and simulate events.

D1 - Data Collection and

Organisation:

Data are collected and organised to help with the making of decisions, the drawing of inferences or the development of new ideas.

D2 - Representation:

Appropriate representations of data depend on characteristics of that data.

D3 - Analysis and interpretation:

Provides information on the attributes of data.

D4 - Probability:

The occurrence or non-occurrence of an event is characterized as impossible, less likely, equally likely, more likely or certain. The likelihood of an event or its probability is quoted as a ratio between 0 and 1 inclusive.

MT.M3.D1

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- create and implement a plan for collection of data when given a problem situation
- organise data, include sampling methods

MT.M3.D2

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- create or choose a variety of data representations

MT.M3.D3

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- study data to make predictions and draw conclusions (pie charts, line graphs)
- compare related data sets
- find and select the appropriate measure of central tendency (mean, mode, median and range) to describe a set of data for a particular purpose

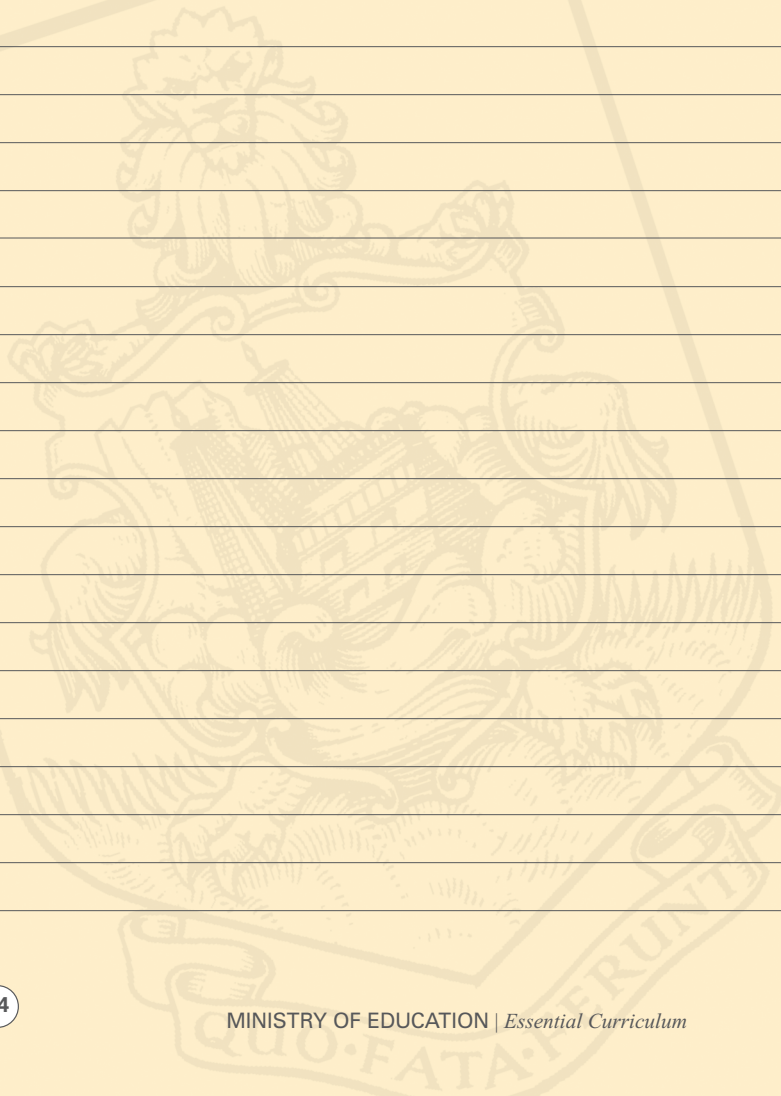
MT.M3.D4

Students will demonstrate an understanding of data handling by using, representing and explaining. They will:

- determine whether or not an event is equally likely or if a game or process is fair
- find the probability of compound events (dependent and independent) (e.g., selection of an item with or without replacement)

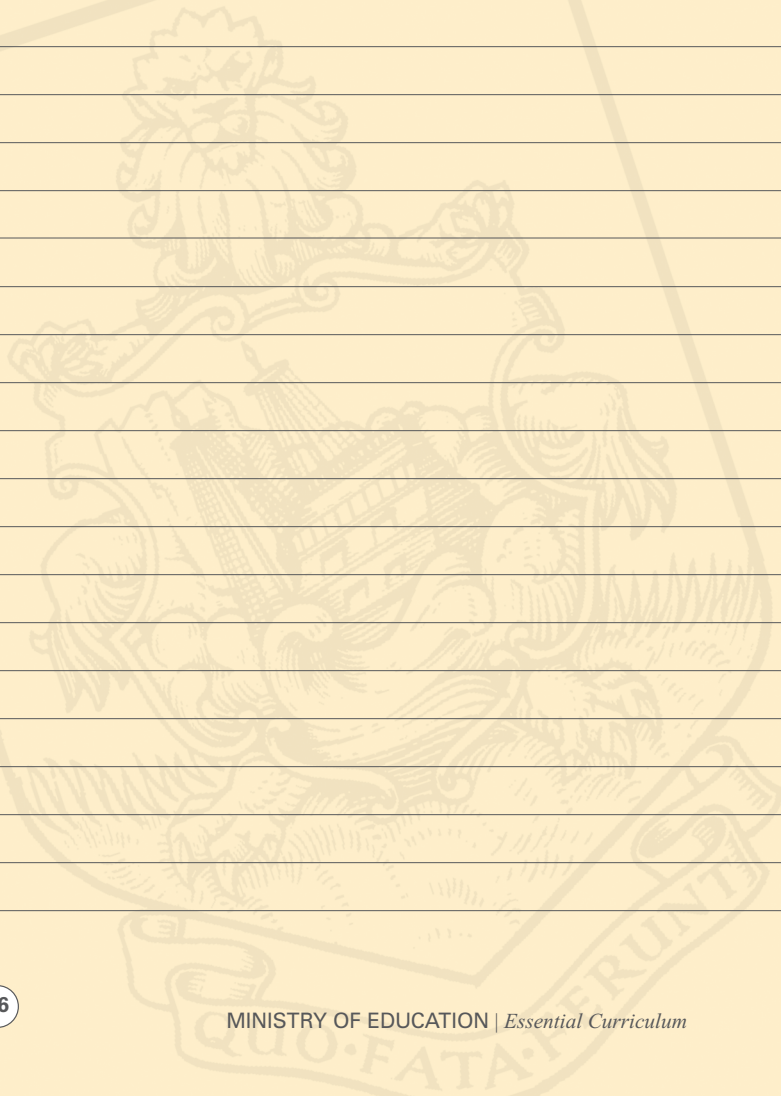
A large, faint, light-colored watermark of the University of Toronto crest is visible in the background of the page. The crest features a shield with a building, a book, and a lion, surrounded by decorative elements and a banner.

PLANNING NOTES



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PLANNING NOTES





MISSION STATEMENT

The mission of the Bermuda Public School System is to be the 1st choice in education by providing rigorous and stimulating learning experiences in safe responsive environments from which our students emerge confident and prepared to compete and contribute locally and globally.



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