Elements of the Progression of Learning in Secondary School

Mathematics

Secondary 2

Adapted from the **Progression of Learning in Secondary School: Mathematics**

Arithmetic

Understanding real numbers	
2. Fractions b. Identifies the different meanings of fractions: part of a whole, division, ratio, operator, measurement	★
11. Represents and writes b. squares and square roots	★
c. numbers in exponential notation (integral exponent)	★
15. Compares and arranges in order b. numbers expressed in different ways (fractional, decimal, exponential [integral exponent], percentage, square root, scientific notation) **Note**: Scientific notation is introduced in Secondary III.	★

Operations involving real numbers	
5. Approximates the result of an operation or sequence of operations	★
6. Mentally computes the four operations, especially with numbers written in decimal notation, using equivalent ways of writing numbers and the properties of operations	★
7. Computes, in writing, the four operations[1] with numbers that are easy to work with (including large numbers), using equivalent ways of writing numbers and the properties of operations b. positive numbers written in fractional notation, with or without the use of objects or diagrams	★
11. Switches, as needed, from one way of writing numbers to another **Note**: In Secondary Cycle One, the students should use positive numbers when switching from one type of notation to another. In Secondary Cycle Two, new types of notation are introduced: exponential, scientific notation, etc.	★

1. Students use technological tools for operations in which the divisors or multipliers have more than two digits; however, for written computation, the understanding and mastery of the processes is more important than the ability to do complex calculations.

Understanding and analyzing proportional situations	
1. Calculates b. the value corresponding to 100 per cent	★
2. Recognizes ratios and rates	★
3. Interprets ratios and rates	★
4. Describes the effect of changing a term in a ratio or rate	★
5. Compares a. ratios and rates qualitatively (equivalent rates and ratios, unit rate)	★
b. ratios and rates quantitatively (equivalent rates and ratios, unit rate)	★
6. Translates a situation using a ratio or rate **Note**: Situations involving ratios and rates are enriched in Secondary Cycle Two (similarity ratio, metric relations, etc.).	★
7. Recognizes a proportional situation using the context, a table of values or a graph	★
8. Represents or interprets a proportional situation using a graph, a table of values or a proportion	★
9. Solves proportional situations (direct or inverse variation) by using different strategies (e.g. unit-rate method, factor of change, proportionality ratio, additive procedure, constant product [inverse variation])	★

Algebra

Understanding and manipulating algebraic expressions	
A. Algebraic expressions	
4. Describes the role of components of algebraic expressions: a. unknown **Note**: This concept was introduced in elementary school (although not named as such) when students were asked to find a missing term.	★
b. variable, constant	★
d. coefficient, degree, term, constant term, like terms	★
5. Constructs an algebraic expression using a register (type) of representation	★
6. Interprets an algebraic expression in light of the context	★
7. Recognizes or constructs equivalent algebraic expressions	★
8. Recognizes or constructs a. equalities and equations	★
B. Manipulating algebraic expressions	
1. Calculates the numeric value of an algebraic expression	★
2. Performs the following operations on algebraic expressions, with or without objects or diagrams: addition and subtraction, multiplication and division by a constant, multiplication of first-degree monomials	★
3. Factors out the common factor in numerical expressions (distributive property of multiplication over addition or subtraction)	★
C. Analyzing situations using equations or inequalities	
1. Recognizes whether a situation can be translated by a. an equation	★
2. Recognizes or constructs a. relations or formulas	★
3. Manipulates relations or formulas (e.g. isolates an element)	★
4. Represents a situation using a. first degree equation with one unknown	★
5. Represents a. an equation using another register (type) of representation, if necessary	★
7. Transforms arithmetic equalities and equations to maintain equivalence (properties and rules for transforming equalities) and justifies the steps followed, if necessary	★
9. Uses different methods to solve first-degree equations with one unknown of the form $ax + b = cx + d$: trial and error, drawings, arithmetic methods (inverse or equivalent operations), algebraic methods (balancing equations or hidden terms)	★
13. Validates a solution, with or without technological tools, by substitution	★
15. Interprets solutions or makes decisions, if necessary, depending on the context	★

Understanding dependency relationships	
A. Relations, functions and inverses	
2. Analyzes situations using different registers (types) of representation	★
3. Represents a situation generally using a graph	★

Probability

Understanding data from random experiments	
A. Processing data from random experiments	
7. Conducts or simulates random experiments involving one or more steps (with or without replacement, with or without order)	★
9. Enumerates the possible outcomes of a random experiment using b. networks, tables, diagrams, Venn diagrams **Note**: In developing their probabilistic thinking skills, students are introduced to the language of sets, which is considered to be a comprehension and communication tool.	★
10. Defines the sample space of a random experiment	★
11. Recognizes certain, probable, impossible, simple, complementary, compatible, incompatible, dependent, independents events	★
B. Analyzing probability situations	
3. Distinguishes between theoretical and experimental probability	★
4. Calculates the probability of an event	★
9. Interprets probabilities and makes appropriate decisions	★

Statistics

Analyzing and making decisions about one- or two-variable distributions, using statistical tools	
A. One-variable distributions	
1. Conducts a survey or a census b. Chooses a sampling method: i. simple random, systematic	★
c. Chooses a representative sample	★
2. Recognizes possible sources of bias **Note**: In CST in Secondary IV, students learn to correct the source of bias, if applicable.	★
4. Distinguishes different types of statistical variables: qualitative, discrete or continuous quantitative	★
6. Organizes and presents data using b. a table presenting variables or frequencies, or using a circular graph	★
7. Compares one-variable distributions	★
9. Describes the concept of arithmetic mean (levelling or balance point)	★
10. Calculates and interprets an arithmetic mean **Note**: In Secondary Cycle One, the arithmetic mean is calculated using positive or negative numbers written in decimal or fractional notation.	★
11. Determines and interprets b. measures of dispersion: i. range	★
c. measures of position: i. minimum, maximum	★
12. Chooses the appropriate statistical measures for a given situation	★

Geometry

Spatial sense and analyzing situations involving geometric figures	
A. Plane figures	
6. Decomposes plane figures into circles (sectors), triangles or quadrilaterals	★
7. Describes circles and sectors	★
8. Recognizes and draws main segments and lines a. diagonal, altitude, median, perpendicular bisector, bisector, apothem, radius, diameter, chord	★
9. Identifies the properties of plane figures using geometric transformations and constructions **Note**: See the Secondary Cycle One Mathematics program, p. 219.	★
10. Justifies statements using definitions or properties[1] of plane figures	★
B. Solids	
2. Determines the possible nets of a solid	★
3. Names the solid corresponding to a net	★
4. Describes solids: b. altitude, apothem, lateral face	★
6. Recognizes solids that can be split into a. right prisms, right cylinders, right pyramids	★
C. Geometric constructions and transformations in the Euclidian plane[2]	
2. Identifies properties and invariants resulting from geometric constructions and transformations	★
3. Identifies congruence (translation, rotation and reflection) between two figures	★
4. Constructs the image of a figure under a translation, rotation and reflection	★
5. Recognizes dilatation with a positive scale factor	★
6. Constructs the image of a figure under a dilatation with a positive scale factor	★
D. Congruent, similar or equivalent figures	
2. Recognizes congruent or similar figures	★
3. Recognizes the geometric transformation(s) linking a figure and its image	★
4. Determines the properties and invariants of congruent or similar figures	★
8. Justifies statements using definitions or properties of congruent, similar or equivalent figures, depending on the cycle and year	★

1. In all statements involving justification, the properties used were identified through exploration or have been proven.
2. Geometric transformations in the Cartesian plane are not covered in Secondary Cycle One.

Analyzing situations involving measurements[1]	
B. Time	
4. Distinguishes between duration and position in time **Note**: This includes the concept of negative time, where the start time $t = 0$ is arbitrarily chosen	★
C. Angles	
3. Describes the characteristics of different types of angles: complementary, supplementary, adjacent, vertically opposite, alternate interior, alternate exterior and corresponding	★
4. Determines measures of angles using the properties of the following angles: complementary, supplementary, vertically opposite, alternate interior, alternate exterior and corresponding	★
5. Finds unknown measurements using the properties of figures and relations b. degree measures of central angles and arcs	★
8. Justifies statements using definitions or properties associated with angles and their measures	★
D. Length	
4. Constructs relations that can be used to calculate the perimeter or circumference of figures	★
5. Finds the following unknown measurements, using properties of figures and relations: b. a segment in a plane figure, circumference, radius, diameter, length of an arc, a segment resulting from an isometry or a similarity transformation	★
6. Justifies statements concerning measures of length	★
E. Area	
3. Establishes relationships between SI units of area	★
4. Constructs relations that can be used to calculate the area of plane figures: quadrilateral, triangle, circle (sectors) **Note:**. Using relations established for the area of plane figures and the net of solids, students identify relationships to calculate the lateral or total area of right prisms, right cylinders and right pyramids.	★
6. Finds unknown measurements, using properties of figures and relations a. area of circles and sectors	★
b. area of figures that can be split into circles (sectors), triangles or quadrilaterals	★
c. lateral or total area of right prisms, right cylinders and right pyramids	★
d. lateral or total area of solids that can be split into right prisms, right cylinders or right pyramids	★
e. area of figures resulting from an isometry	★
7. Justifies statements concerning measures of area	★

1. Depending on the context, measurement prefixes (e.g. *nano*, *micro*, *milli*, *deca*, *kilo*, *mega*, *giga*) are introduced.

Analytic Geometry

Analyzing situations using analytic geometry	
A. Locating	
1. Locates objects/numbers on an axis, based on the types of numbers studied **Note**: In Secondary Cycle One, students locate positive or negative numbers written in decimal or fractional notation.	★
2. Locates points in a Cartesian plane, based on the types of numbers studied (*x*- and *y*-coordinates of a point)	★