Elements of the Progression of Learning in Secondary School

Mathematics

Secondary 4

CST

March 2017

Adapted from the **Progression of Learning in Secondary School: Mathematics**
August 2016

Arithmetic

Understanding real numbers	CST
10. Defines the concept absolute value in context (e.g. difference between two numbers, distance between two points) **Note**: In Cycle One and Secondary III, the concept of absolute value is introduced informally, using examples.	★
12. Estimates the value of the power of an exponential expression with respect to its components: base (between 0 and 1, greater than 1), exponent (positive or negative, integral or fractional) **Note:** The same applies for a logarithmic expression in TS and SN.	★

Algebra

Understanding and manipulating algebraic expressions	CST
D. Analyzing situations using systems of equations or inequalities	
3. Solves a system b. of first-degree equations in two variables **Note**: The student chooses the method.	★
5. Validates the solution, with or without technological tools	★
6. Interprets the solution or makes decisions if necessary, depending on the context	★
Understanding dependency relationships	**CST**
B. Analyzing situations using real functions[1]	
Note: Statements 1 to 9 apply to the functions listed below. 1. Models a situation verbally, algebraically, graphically, using a table of values or a scatter plot 2. Finds the rule of a function or its inverse, depending on the context 3. Represents and interprets the inverse 4. Interprets parameters (multiplicative or additive) and describes the effect of changing their value, if necessary 5. Describes the properties of real functions: domain, range, interval within which the function is increasing or decreasing, sign, extrema, *x*-intercept and *y*-intercept **Note**: In Secondary III, students are informally introduced to the study of properties, always in relation to a context. In CST, students use a graphical representation to describe the context. 6. Determines values or data by solving equations and inequalities 7. Interpolates and extrapolates data, if applicable 8. Compares situations or graphical representations 9. Makes decisions, if necessary, depending on the context b. Second-degree polynomial functions i. $f(x) = ax^2$	★
e. Exponential functions i. $f(x) = ac^x$	★
g. Piecewise functions **Note**: In Secondary III, students are introduced to this type of function informally.	★
i. Step functions	★
k. Functions i. Modelling periodic occurrences (e.g. natural phenomena such as tides or sound, medical or electrical phenomena) **Note**: The analysis is based on a graphical representation. In this context, students are not required to determine the rule.	★

1. Functions are introduced using contexts adapted to Secondary III and the various options, with or without the use of technological tools.

Statistics

Analyzing and making decisions about one- or two-variable distributions, using statistical tools	CST
A. One-variable distributions	
6. Organizes and presents data using d. a stem-and-leaf diagram	★
11. Determines and interprets b. measures of dispersion: iii. mean deviation	★
c. measures of position: ii. percentile **Note**: Percentile is determined using a sufficient number of data. Students can also determine corresponding data from a percentile.	★
B. Two-variable distributions	
2. Represents data using a scatter plot or a double-entry (two-variable) distribution table	★
3. Associates the most appropriate functional model with a scatter plot : a. first-degree polynomial function	★
4. Describes and interprets the relationship between two variables, if any	★
5. Gives a qualitative assessment of a linear correlation **Note**: In TS, qualitative assessment should be used for nonlinear models.	★
6. Approximates and interprets the linear correlation coefficient **Note**: If necessary, technological tools can be used to determine the value of the correlation coefficient for the models under study.	★
7. Draws a curve associated with the chosen model	★
8. Represents a regression line algebraically or graphically **Note**: In addition to drawing this line freehand, students may use other methods, such as the median-median line or the Mayer line method.	★
9. Interpolates or extrapolates values using a. a regression line	★
10. Compares two-variable distributions	★

Geometry

Spatial sense and analyzing situations involving geometric figures	CST
D. Congruent, similar or equivalent figures	
5. Determines the minimum conditions required to conclude that triangles are congruent or similar **Note**: See Avenues of Exploration in Appendix E of the Secondary Cycle Two Mathematics program	★
6. Demonstrates the congruence or similarity between triangles or finds unknown measurements using minimum conditions	★
Analyzing situations involving measurements[1]	**CST**
G. Metric or trigonometric relations	
2. Finds unknown measurements in various situations a. in a right triangle rectangle using ii. the following metric relations – The length of a leg of a right triangle is the geometric mean between the length of its projection on the hypotenuse and the length of the hypotenuse. – The length of the altitude to the hypotenuse of a right triangle is the geometric mean between the lengths of the segments of the hypotenuse. – The product of the lengths of the legs of a right triangle is equal to the product of the length of the hypotenuse and the length of the altitude to the hypotenuse.	★
iii. trigonometric ratios: sine, cosine, tangent	★
b. in any triangle using i. sine law	★
iii. Hero's formula **Note**: In TS and SN, this formula may be provided and used, if necessary.	★
3. Calculates the area of a triangle given the measure of an angle and the lengths of two sides or given the measures of two angles and the length of one side	★
5. Justifies statements concerning b. metric or trigonometric relations	★

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	CST
B. Straight lines and half-planes	
1. Uses the concept of change to a. calculate the distance between two points	★
b. determine the coordinates of a point of division using a given ratio (including the coordinates of a midpoint)	★
c. calculate and interpret a slope	★
2. Determines the relative position of two straight lines using their respective slope (intersecting at one point, perpendicular, non-intersecting parallel or coincident)	★
3. Models, with or without technological tools, a situation involving a. straight lines: graphically and algebraically **Note**: The different forms of equations of a line (standard, general and symmetric) are explored in the various options. The symmetric form of the equation of a line is not covered in CST; it is optional in TS and compulsory in SN. The general form of the equation of a line is optional in CST.	★
c. parallel lines and perpendicular lines	★
4. Determines the equation of a line using the slope and a point or using two points **Note:** The general form of the equation of a line is optional in CST.	★
5. Determines the equation of a line parallel or perpendicular to another **Note:** The general form of the equation of a line is optional in CST.	★