Elements of the Progression of Learning in Secondary School

Mathematics

Secondary 4

SN

March 2017

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

Arithmetic

Understanding real numbers	SN
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.	★

Algebra

Understanding and manipulating algebraic expressions	SN
A. Algebraic expressions	
4. Describes the role of components of algebraic expressions : c. parameter **Note**: The concept of parameter is introduced intuitively (although not named as such) in Secondary I, II and III.	★
B. Manipulating algebraic expressions	
4. Multiplies b. algebraic expressions	★
5. Divides c. a polynomial by another polynomial (with or without a remainder)	★
6. Factors polynomials by b. factoring by grouping (polynomials including decomposable second-degree trinomials)	★
c. completing the square (factoring and switching from one type of notation to another)	★
d. using formulas for trinomials of the form $ax^2 + bx + c$: $x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ and $x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$	★
e. substituting second-degree algebraic identities (perfect square trinomial and difference of two squares)	★
7. Manipulates rational expressions **Note**: Rational expressions (algebraic fractions) are part of the algebraic expressions to be covered. When finding the common denominator in order to add two rational expressions, students in TS will deal only with cases in which the denominator of one fraction is the multiple of the denominator of the other fraction.	★
C. Analyzing situations using equations or inequalities	
11. Solves the following types of equations or an inequalities in one variable a. second-degree	★
12. Solves a second-degree equation in two variables	★
14. Solves an inequality graphically and checks the feasible region of a a. first-degree inequality in two variables	★
b. second-degree inequality in two variables	★
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.	★
c. composed of a first-degree equation in two variables and a second-degree equation in two variables	★
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	SN
A. Relations, functions and inverses	
6. Describes, in the functions under study, the role of a. multiplicative parameters	★
b. additive parameters	★
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 iii. $f(x) = ax^2 + bx + c,\ f(x) = a(b(x-h))^2 + k,\ f(x) = a(x-x_1)(x-x_2)$	★
i. Step functions	★
j. Greatest integer functions ii. $f(x) = a[b(x-h)] + k$	★

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	SN
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	★
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	SN
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	★
7. Recognizes equivalent figures (plane figures or solids)	★

Analyzing situations involving measurements[1]	SN
D. Length	
5. Finds the following unknown measurements, using properties of figures and relations: d. segments or perimeters resulting from equivalent figures	★
E. Area	
6. Finds unknown measurements, using properties of figures and relations h. area of equivalent figures	★
F. Volume	
6. Finds unknown measurements using properties of figures and relations d. volume of equivalent solids	★
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	★
ii. cosine law	★
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	SN
B. Straight lines and half-planes	
1. Uses the concept of change to a. calculate the distance between two points **Note**: In Secondary IV, the distance between two parallel lines or from a point to a line or segment is studied using concepts and processes associated with distance and equations systems.	★
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.	★
b. a half-plane: graphically and algebraically	★
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.	★