Mathematics
Quadratic Function

Québec ⬚⬚

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Quadratic Function

1. INTRODUCTION

This Definition of the Domain for Summative Evaluation describes and classifies the essential and representative elements of the secondary-level adult education Mathematics program and, more specifically, of the course entitled Quadratic Functions. As such, it gives an overview of the program, but should by no means replace the program itself. The purpose of defining the domain is to ensure that all summative evaluation instruments are consistent with the overall program.

The Definition of the Domain for Summative Evaluation for each course in this program is organized in a similar manner; however, the content of this definition of the domain is specific to the course entitled Quadratic Functions.

The goal of the Definition of the Domain for Summative Evaluation is to prepare examinations that are valid from one version to another or from one school board to another, taking into account the responsibilities shared by the Ministère de l'Éducation and the school boards.

2. PROGRAM ORIENTATIONS AND CONSEQUENCES FOR SUMMATIVE EVALUATION

ORIENTATIONS	CONSEQUENCES
The main objective of the secondary-level adult education Mathematics program is to help students fully understand mathematical concepts.	Evaluation should involve verifying whether the student has fully understood the different concepts.
The program is designed to help students master the use of certain mathematical tools used in the field of science and technology or in different trades.	Evaluation items should pertain to situations in the field of science and technology or to situations related to trades.
The program aims to provide students with the skills they need to process information by applying mathematical models and appropriate strategies for solving problems.	Evaluation items should involve performing tasks that require the students to classify information, use mathematical models and solve problems.
The program also aims to improve the students' ability to clearly relate information using mathematical language.	Evaluation items should involve performing tasks that require the use of mathematical language. The appropriateness and clarity of the language used should be taken into account in the marking process.
The program is intended to help students develop a systematic work method.	Evaluation items should require the students to present their work in a clear and structured manner. This should be taken into account in the marking process.
The program will help students master the use of technological tools.	The use of a scientific calculator is permitted for the examinations related to this course.

3. CONTENT OF THE PROGRAM FOR PURPOSES OF SUMMATIVE EVALUATION

Concepts

Second-degree equations of the form $y = ax^2 + bx + c$, where $y = 0$
- given a word problem
- finding a solution using the quadratic formula
- finding a solution using an appropriate factoring method
- the value of the discriminant and its link to the number of zeros
- problem that involves finding the zeros

Second-degree equations of the form $y = ax^2 + bx + c$, where $y \neq 0$
- given the graph, determining the characteristics of the vertex, axis of symmetry, maximum or minimum, zeros and *y*-intercept
- given a word problem and a partially completed table of values
- graphic representation
- problem that involves finding the coordinates of the maximum point or the minimum point

Skills

Each skill is defined within the context of a mathematics program.

Structuring	Being familiar with the fundamentals of mathematics, understanding some mathematical concepts and establishing simple relations among them.
	Possible actions: to associate, classify, compare, complete, describe, define, contrast, distinguish, state, enumerate, group, name, rank, organize, recognize, arrange, and so on.
Mathematizing	Interpreting a given situation using a mathematical model (arithmetic, algebraic or graphical).
	Possible actions: to formalize, illustrate, represent, schematize, symbolize, translate, transpose, and so on.
Operating	Performing a given operation or transformation.
	Possible actions: to calculate, construct, break down, perform, estimate, evaluate, isolate, measure, reconstruct, solve, draw, transform, verify, and so on.
Analyzing	Demonstrating, in an organized fashion, the complex connections between concepts or definitions and their related actions and illustrations.
	Possible actions: to conclude, correct, deduce, derive, demonstrate, explain, extrapolate, infer, justify, and so on.
Synthesizing	Effectively integrating a variety of concepts and skills to solve a problem.
	Possible actions: to solve a problem.

4. TABLE OF DIMENSIONS

CONCEPTS / SKILLS	EQUATIONS OF THE FORM $y = ax^2 + bx + c$, where $y = 0$ 45%	EQUATIONS OF THE FORM $y = ax^2 + bx + c$, where $y \neq 0$ 55%
STRUCTURING 5%		Given the graph of a second-degree equation, determine the vertex, axis of symmetry, maximum or minimum, zeros and *y*-intercept. 6 5%
MATHEMATIZING 15%	Find the second-degree equation corresponding to a word problem. 1 5%	Given a word problem and a partially completed table of values illustrating this situation, complete the table and find the second-degree equation corresponding to this situation. 7 10%
OPERATING 45%	Solve two second-degree equations using the quadratic formula. 2 10% Solve a second-degree equation using an appropriate factoring method. 3 5%	Graph three second-degree equations. The coordinates of the vertex, the *y*-intercept, the point symmetric with the *y*-intercept and the zeros (if applicable) must be indicated along with the axis of symmetry and its equation. 8 30%
ANALYZING 5%	Determine whether statements describing the value of the discriminant and its link to the number of zeros in a quadratic equation are true or false. 4 5%	
SYNTHESIZING 30%	Solve two problems that involve a second-degree equation and finding the zeros. 5 20%	Solve a problem that involves a second-degree equation and that requires finding the coordinates of the maximum point or of the minimum point. 9 10%

5. OBSERVABLE BEHAVIOURS

Examination items should be formulated on the basis of the observable behaviours listed below. The requirements and restrictions specified in the dimensions and the objectives of the program must be observed.

Dimension 1

Given a word problem, find the second-degree equation of the form $ax^2 + bx + c = 0$ that corresponds to this situation. Terms a, b and c are rational numbers and $a \neq 0$.
(mathematizing)   /5

Dimension 2

Solve two second-degree equations of the form $ax^2 + bx + c = 0$ using the quadratic formula. Terms a, b and c are rational numbers and $a \neq 0$. The students must clearly show all their work.
(operating)   /10

Dimension 3

Solve a second-degree equation of the form $ax^2 + bx + c = 0$ using an appropriate factoring method. Terms a, b and c are rational numbers and $a \neq 0$. The students must clearly show all their work.
(operating)   /5

Dimension 4

Determine whether statements describing the value of the discriminant and its link to the number of zeros in a quadratic equation are true or false.
(analyzing)   /5

Dimension 5

Solve two problems involving a second-degree equation of the form $y = ax^2 + bx + c$. To solve the problems, students must find the zeros of the equation. The terms a, b and c are rational numbers and $a \neq 0$. The students must clearly show all their work.
(synthesizing)   /20

Dimension 6

Given the graph of a second-degree equation of the form $y = ax^2 + bx + c$, determine the following characteristics: the coordinates of the vertex, the maximum or the minimum, the zeros (if applicable), the *y*-intercept and the equation of the axis of symmetry. Terms a, b and c are rational numbers and $a \neq 0$.
(structuring)   /5

Dimension 7

Given a word problem and a partially completed table of values illustrating this situation, complete the table and find the second-degree equation of the form $y = ax^2 + bx + c$ that corresponds to this situation. Terms a, b and c are rational numbers and $a \neq 0$.
(mathematizing)   /10

Dimension 8

Graph three second-degree equations of the form $y = ax^2 + bx + c$. Terms a, b and c are rational numbers and $a \neq 0$. Students must clearly indicate the coordinates of the vertex, the coordinates of the *y*-intercept, the coordinates of the point symmetric with the *y*-intercept and, if necessary, the coordinates of the zeros of this equation as well as the axis of symmetry and its equation.
(operating)   /30

Dimension 9

Solve a problem involving a second-degree equation of the form $y = ax^2 + bx + c$, by finding the coordinates of the maximum point or of the minimum point. Terms a, b and c are rational numbers and $a \neq 0$. The students must clearly show all their work.
(synthesizing)   /10

6. JUSTIFICATION OF CHOICES

In the examination, 5% of the items test the students' **STRUCTURING** skills by verifying their understanding of certain concepts:
– knowledge of the characteristics of a graph of a second-degree equation

In the examination, 15% of the items test the students' **MATHEMATIZING** skills by verifying whether they are able to translate a given situation into a mathematical model:
– finding the second-degree equation corresponding to a word problem
– finding the second-degree equation corresponding to a word problem and a partially completed table of values

In the examination, 45% of the items test the students' **OPERATING** skills by verifying whether they have mastered certain operations or transformations:
– solving a second-degree equation using the quadratic formula
– solving a second-degree equation using an appropriate factoring method
– graphing a second-degree equation

In the examination, 5% of the items test the students' skill in **ANALYZING** information; they involve verifying whether the students have the ability to make connections:
– between the value of the discriminant and the number of zeros

In the examination, 30% of the items test the students' **SYNTHESIZING** skills by verifying their ability to:
– solve problems
– use a rigorous work method
– communicate clearly using mathematical language

7.   DESCRIPTION OF THE EXAMINATION

A.   TYPE OF EXAMINATION

The summative examination will be a written examination consisting of short- or extended-response items.

The items should take into account the restrictions and the requirements specified in the dimensions and the objectives of the program. The weighting of marks should be consistent with the percentages set out in the table of dimensions.
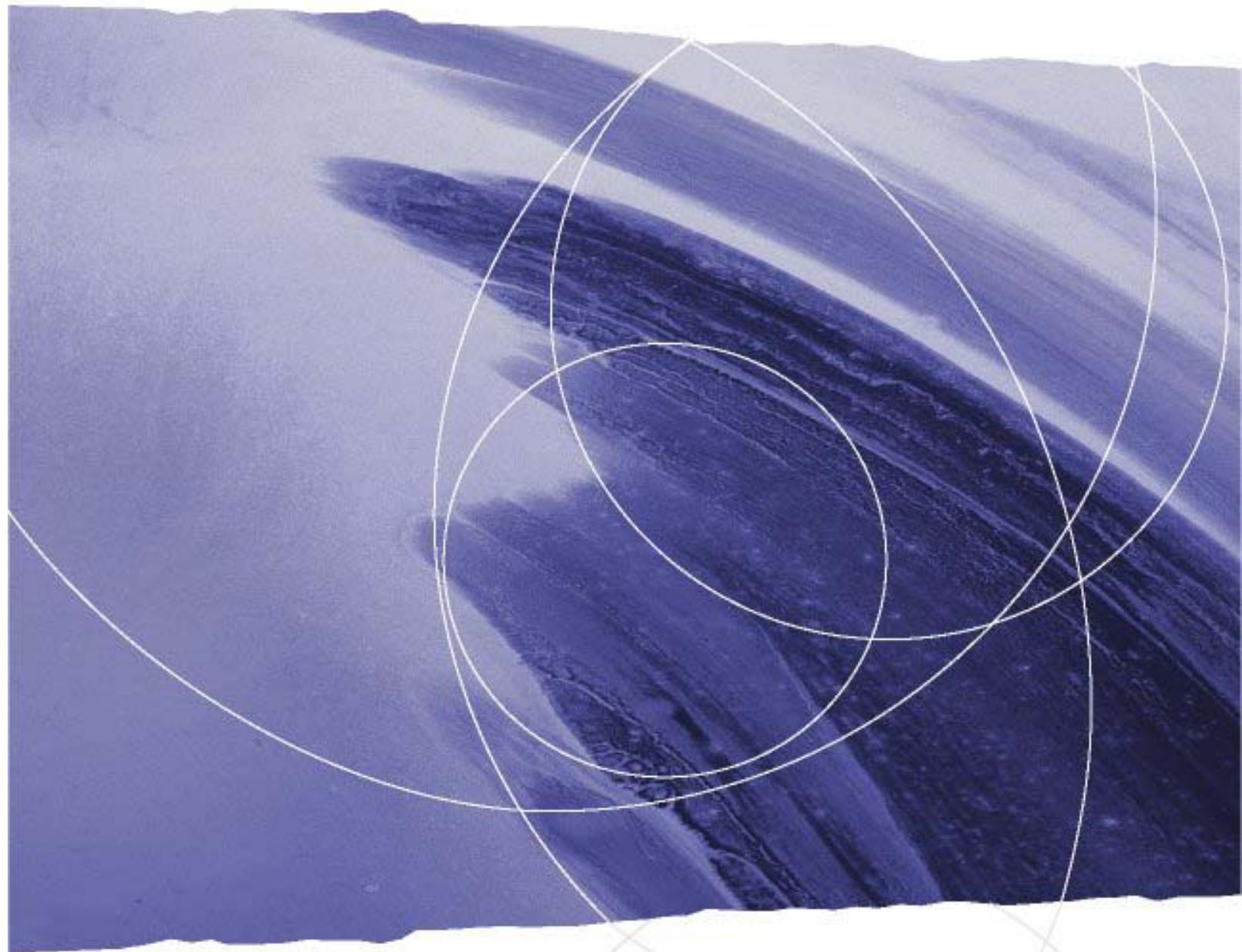
B.   CHARACTERISTICS OF THE EXAMINATION

The examination will be administered in a single session lasting no more than two and a half hours.

Students are permitted to use a scientific calculator; however, they are not permitted to use a graphing calculator.

C.   PASS MARK

The pass mark is set at 60 out of 100.