Definition of the Domain for Summative Evaluation

MTH-4109-1

Mathematics
Sets, Relations and Functions

Québec

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Formation professionnelle et technique
et formation continue

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des adultes

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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 Sets, Relations and 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 Sets, Relations and 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 or graphing calculator is permitted for the examinations related to this course.

3. CONTENT OF THE PROGRAM FOR PURPOSES OF SUMMATIVE EVALUATION

Concepts

Sets
- performing set operations on sets of numbers graphed on a number line or described by means of set-builder or interval notation

Relations
- defining a relation graphed in $\mathbb{R} \times \mathbb{R}$ by means of a set-builder notation
- graphing a relation defined by means of set-builder notation (the rule of correspondence is expressed as a first-degree inequality in one or two variables)

Functions
- dependent variable and independent variable
- rule of a function of degree 0, 1 or 2
- table of values and graph
- characteristics of a function of degree 0, 1 or 2, given its rule
- characteristics of a function, given its graph
- modes of representation that correspond to the same function
- problems related to real functions
- problems that involve second-degree functions and the rule of the function

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 cognitive 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	SETS 10%	RELATIONS 10%	FUNCTIONS 80%
STRUCTURING **20%**			Determine the dependent variable or the independent variable, given a functional situation expressed in the form of a written statement. **5** **5%**
			Given the rule of a function of degree 0 or 1, determine two or three of its characteristics. **6** **5%**
			Given the rule of a second-degree function, determine two or three of its characteristics. **7** **5%**
			Determine certain characteristics of a function, given its graph. **8** **5%**
MATHEMATIZING **5%**		Given a relation graphed in $\mathbb{R} \times \mathbb{R}$, define it by means of set-builder notation. **3** **5%**	
OPERATING **25%**	Perform two set operations on two or three sets of numbers graphed on a number line or described by means of set-builder notation. **1** **5%**	Graph a relation defined by means of set-builder notation. The rule of correspondence is expressed as a first-degree inequality in one or two variables. **4** **5%**	Complete a table of values, draw a graph and determine the characteristics of a function, given a written statement. **9** **10%**
	Perform two set operations on two or three sets of numbers graphed on a number line or described by means of interval notation. **2** **5%**		
ANALYZING **20%**			Determine which representations describe the same function. **10** **10%**
			From the graph of a functional situation, determine which statements describe the characteristics of this graph. **11** **5%**
			Given certain characteristics of a function and several graphs, determine which graph could represent the function. **12** **5%**
SYNTHESIZING **30%**			Solve two problems by comparing functional situations. **13** **20%**
			Solve a problem that involves a second-degree function and determine the rule of the function. **14** **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

Perform two set operations on two or three sets of real numbers graphed on a number line or described by means of set-builder notation. The solution must described by means of interval notation.
(operating) /5

Dimension 2

Perform two set operations on two or three sets of real numbers graphed on a number line or described by means of interval notation. The solution must described by means of set-builder notation.
(operating) /5

Dimension 3

Given a relation graphed in $\mathbb{R} \times \mathbb{R}$, define it by means of set-builder notation. The rule of correspondence must be expressed as a first-degree inequality in one or two variables.
(mathematizing) /5

Dimension 4

Graph a relation defined by means of set-builder notation in $\mathbb{R} \times \mathbb{R}$. The rule of correspondence must be expressed as a first-degree inequality in one or two variables. Find the domain and range of the relation.
(operating) /5

Dimension 5

Determine the dependent variable and the independent variable, given a functional situation expressed in the form of a written statement.
(structuring) /5

Dimension 6

Given the rule of a function of degree 0 or 1, determine two or three of its characteristics.
(structuring) /5

Dimension 7

Given the rule of a function of degree 2, determine two or three of its characteristics.
(structuring) /5

Dimension 8

Given the graph of a functional situation in a given interval, determine certain characteristics of this function. The situation may be described by a combination of two or more functions over consecutive intervals. The function is not a first- or second-degree polynomial function.
(structuring) /5

Dimension 9

Given a written statement describing a functional situation, complete a table of values and draw a graph of the situation. In addition, determine certain characteristics of the function such as the rate and type of change involved, whether it is increasing or decreasing and the relationship between the changes in the values of the domain and the values of the range. The statement may or may not include the rule describing the functional situation, which should be linked to a simple exponential function, an inverse variation function, a second-degree function or a square root function. The students must clearly show all their work.
(operating) /10

Dimension 10

Given six representations of functions having certain characteristics in common, determine which representations correspond to the same functions. The functions are represented by a written statement, a graph, a rule or a table of values.
(analyzing) /10

Dimension 11

From a graph of a functional situation in a given interval, determine which statements describe the characteristics of the function represented by this graph.
(analyzing) /5

Dimension 12

Given a description of certain characteristics of a function and several graphs, determine which graph could represent this function.
(analyzing) /5

Dimension 13

Solve two problems involving real functions. Solving the problem requires performing a comparative analysis of similar functional situations. Each situation must be described as a function presented in the form of a written statement, a table of values, a rule or a graph. With the exception of first-degree functions, if the rule is not provided, it should not be necessary to find it in order to solve the problem. The students must clearly show all their work.
(synthesizing) /20

Dimension 14

Solve two problems involving a second-degree polynomial function. The description of the situation includes a diagram. Solving the problem requires finding the rule of the function, determining the values of the domain or the range and calculating the distance between two points. The zeros and one point or the vertex and one point are given. The students must clearly show all their work.
(synthesizing) /10

6. JUSTIFICATION OF CHOICES

In the examination, 20% of the items test the students' **STRUCTURING** skills by verifying their understanding of certain concepts:
– the characteristics of functions based on their graph or their rule
– the characteristics of a dependent variable or an independent variable

In the examination, 5% of the items test the students' **MATHEMATIZING** skills by verifying whether they are able to translate a given situation into a mathematical model:
– defining a relation using set-builder notation, given a graph of the relation

In the examination, 25% of the items test the students' **OPERATING** skills by verifying whether they have mastered certain operations or transformations:
– performing set operations on sets of numbers
– graphing relations
– completing a table of values, drawing a graph and determining the characteristics of a function, given a written statement

In the examination, 20% of the items test the students' skill in **ANALYZING** information; they involve verifying whether the students have the ability to make connections:
– between the characteristics of a function and its graph
– between the various modes of representation of a function

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 multiple-choice, short-response 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.

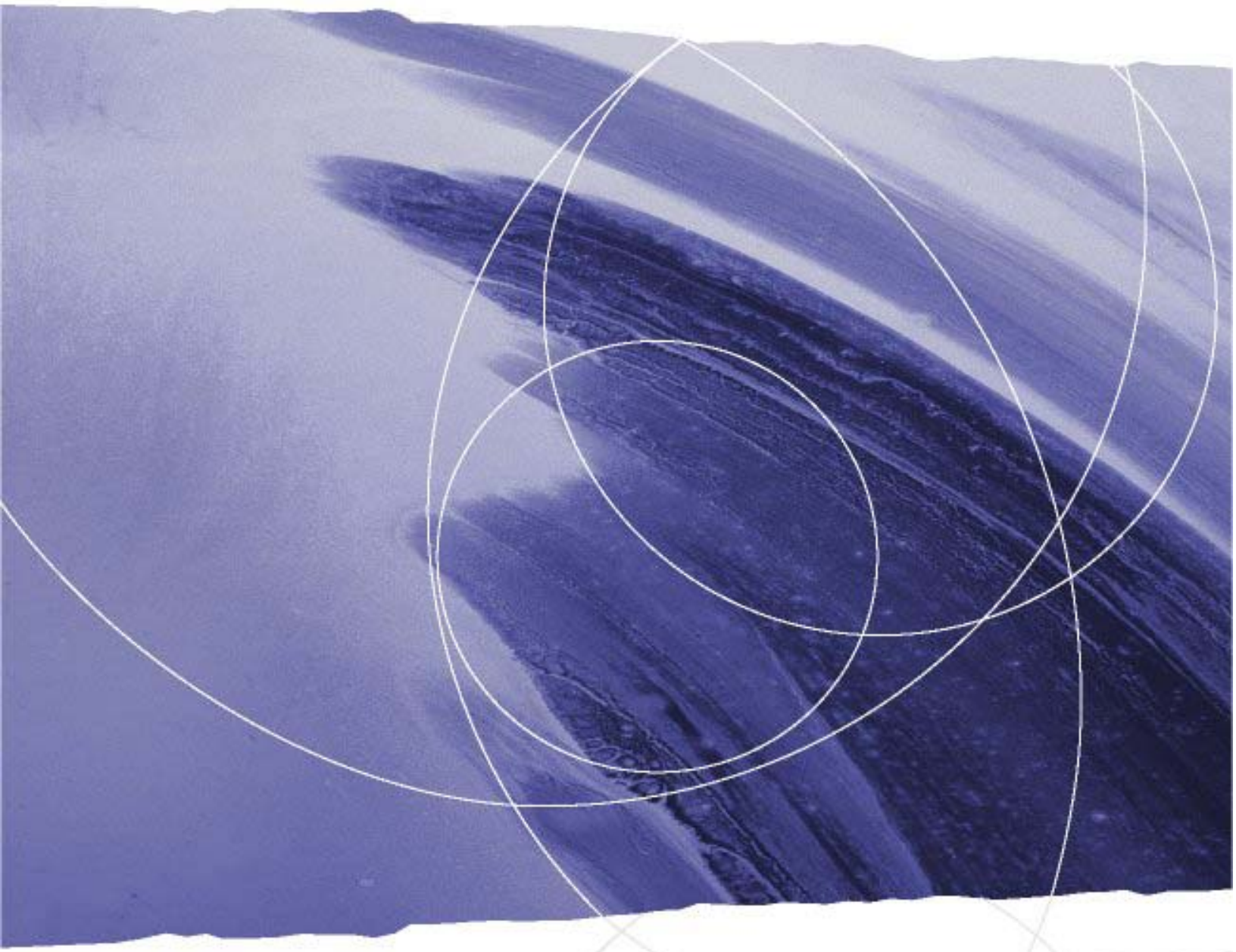
B. CHARACTERISTICS OF THE EXAMINATION

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

Students are permitted to use both a scientific calculator or a graphing calculator.

C. PASS MARK

The pass mark is set at 60 out of 100.



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