Definition of the Domain for Summative Evaluation

MTH-5106-1

Mathematics Real Functions and Equations

Québec

Definition of the Domain for Summative Evaluation

MTH-5106-1

Mathematics Real Functions and Equations

Formation professionnelle et technique
et formation continue

Direction de la formation générale
des adultes

ISBN 2-550-43700-4

Legal deposit — Bibliothèque nationale du Québec, 2004

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 Real Functions and Equations. 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 Real Functions and Equations.

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

Functions
- characteristics of a rational or greatest integer function, given its graph and its rule
- algebraic calculation of the image of an element in two different functions, given their rules
- rule of an absolute value function and a square root function, given the graph or pertinent data
- sign of parameters, given the parametric equation and a graph
- connections between the change in parameters and the transformation of a graph, given the parametric equation and graphs
- characteristics of a square root function or an absolute value function, given their rule
- increase or decrease of a function, given its rule
- sign of a function, given its rule
- problems involving real functions

Inverse of a function
- inverse rule of a linear function
- inverse rule of a quadratic function
- inverse rule of a square root function

Equations
- algebraically solving equations in one real variable (the equations contain an absolute value)
- algebraically solving equations in one real variable (the equations contain a square root)

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.
Operating	Performing a given operation or transformation. Possible actions: to calculate, construct, break down, perform, estimate, evaluate, isolate, measure, reconstruct, solve, 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	FUNCTIONS 45%	INVERSES 15%	EQUATIONS 40%
STRUCTURING **5%**	Determine the characteristics of a rational or greatest integer function, given its graph and its rule. **1** **5%**		
OPERATING **50%**	Algebraically calculate the image of an element in two different functions, given their rules. **2** **5%**	Determine the rule of the inverse of a linear function. **11** **5%**	Algebraically solve two equations in one real variable (the equations contain an absolute value). **13** **10%**
	Determine the rule of an absolute value function, given the graph or pertinent data. **3** **5%**	Determine the rule of the inverse of a quadratic function or a square root function. **12** **10%**	Algebraically solve two equations in one real variable (the equations contain a square root). **14** **10%**
	Determine the rule of a square root function, given the graph or pertinent data. **4** **5%**		
ANALYZING **25%**	Determine the sign of parameters, given the parametric equation and a graph. **5** **5%**		
	Determine the change in the parameters of the rule that led to the transformation of a graph. **6** **5%**		
	Given statements about the characteristics of a square root function or an absolute value function, determine whether statements are true or false. **7** **5%**		
	Examine the increase or decrease of a function over a given interval. **8** **5%**		
	Examine the sign of a function, given its rule. **9** **5%**		
SYNTHESIZING **20%**	Solve two problems involving real functions. **10** **20%**		

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 the graph and the rule of a rational or greatest integer function, determine certain characteristics of this function. The source and target sets are $\mathbb{R}$ or subsets of $\mathbb{R}$, given in the form of continuous intervals.
(structuring) /5

Dimension 2

Using algebra, calculate the image of an element in two different functions from among the following: the absolute value function, the greatest integer function less than or equal to the expression in question, the square root function or the rational function. The rules of the functions are given. Solving the problem may require a justification related to the domain of the definition of the function.
(operating) /5

Dimension 3

Given the graph of an absolute value function or pertinent data, determine the rule of this function. The students must clearly show all their work.
(operating) /5

Dimension 4

Given the graph of a square root function or pertinent data, determine the rule of this function. The students must clearly show all their work.
(operating) /5

Note: If Dimension 3 was evaluated using a graph, then Dimension 4 must be evaluated using pertinent data. If Dimension 3 was evaluated using pertinent data, then Dimension 4 must be evaluated using a graph.

Dimension 5

Given the parametric equation and a graph, without any underlying grid, of a type of real function, determine the sign of certain parameters.
(analyzing) /5

Dimension 6

Given the parametric equation of a type of real function and two graphs without any underlying grid, determine the change in the parameters of the rule that made it possible to transform the first graph to obtain the second.
(analyzing) /5

or

Given the parametric equation of a type of real function, a graph of this equation sketched on paper without any underlying grid and the description of a change in two of its parameters, choose, from a selection of graphs, the graph obtained following the change.
(analyzing) /5

Dimension 7

Given the rule of a square root function or an absolute value function and statements describing certain characteristics of this function, determine which statements are false and correct them to make them true. The source and target sets of the function are $\mathbb{R}$ or subsets of $\mathbb{R}$, given in the form of continuous intervals. At least two statements are false.
(analyzing) /5

Dimension 8

Given the rule of a real function, with the exception of the linear function, determine whether this function is strictly increasing or strictly decreasing over a given interval. The students must justify their answer by defining the characteristic and the coordinates of two points of the function.
(analyzing) /5

or

Given the rule of a real function, with the exception of the linear function, determine which values of the domain of this function are strictly increasing or strictly decreasing. The students must justify their by defining the characteristic and the coordinates of two points of the function.
(analyzing) /5

Dimension 9

Given the rule of a real function, with the exception of the linear function, determine whether this function is positive or negative over a given interval**.**
(analyzing) /5

or

Given the rule of a real function, with the exception of the linear function, determine which values of the domain of this function are positive or negative**.**
(analyzing) /5

Dimension 10

Solve two problems involving real functions. Solving the problems may require determining the inverse of a function, describing certain characteristics of the function or its inverse, comparing certain characteristics of various functions over a given interval or calculating the distance between certain points. Solving one of the problems requires finding the rule of a function. The students must clearly show all their work.
(synthesizing) /20

Dimension 11

Determine the rule of the inverse of a linear function. The function and its inverse must be defined in the same way, either by means of set-builder notation or functional notation. The source and target sets are $\mathbb{R}$ or subsets of $\mathbb{R}$ written in the form of continuous intervals.
(operating) /5

Dimension 12

Determine the rule of the inverse of a quadratic function or a square root function. The function and its inverse must be defined in the same way, either by means of set-builder notation or functional notation. The source and target sets are $\mathbb{R}$ or subsets of $\mathbb{R}$ written in the form of continuous intervals.
(operating) /10

Dimension 13

Algebraically solve two equations in one real variable. The equations contain an absolute value. The equations require a certain transformation before being solved. The expression inside the absolute value is a first-degree expression and the variable is not included in this expression.
(operating) /10

Dimension 14

Algebraically solve two equations in one real variable. The equations contain a square root. The equations require a certain transformation before being solved. The expression under the square root is a first-degree expression and the variable is not included in this expression.
(operating) /10

6. JUSTIFICATION OF CHOICES

– In the examination, 5% of the items test the students' **STRUCTURING** skills by verifying their understanding of the characteristics of a rational function or a greatest integer function, given its graph and its rule.

In the examination, 50% of the items test the students' **OPERATING** skills by verifying whether they have mastered certain operations or transformations:

– algebraically calculating the image of an element in two different functions, given their rules
– determining the rule of an absolute value function, given the graph or pertinent data
– determining the rule of a square root function, given the graph or pertinent data
– finding the inverse rule of a linear function
– finding the inverse rule of a quadratic function or a square root function
– algebraically solving two equations in one real variable (the equations contain an absolute value)
– algebraically solving two equations in one real variable (the equations contain a square root)

In the examination, 25% of the items test the students' skill in **ANALYZING** information; they involve verifying whether the students have the ability to make connections:

– between the change in parameters and the transformation of a graph
– between the sign of parameters, the parametric equation and the graph
– between the characteristics of a square root function or an absolute value function and its rule
– by studying the increase or decrease of a function
– by studying the sign of a function

In the examination, 20% 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.

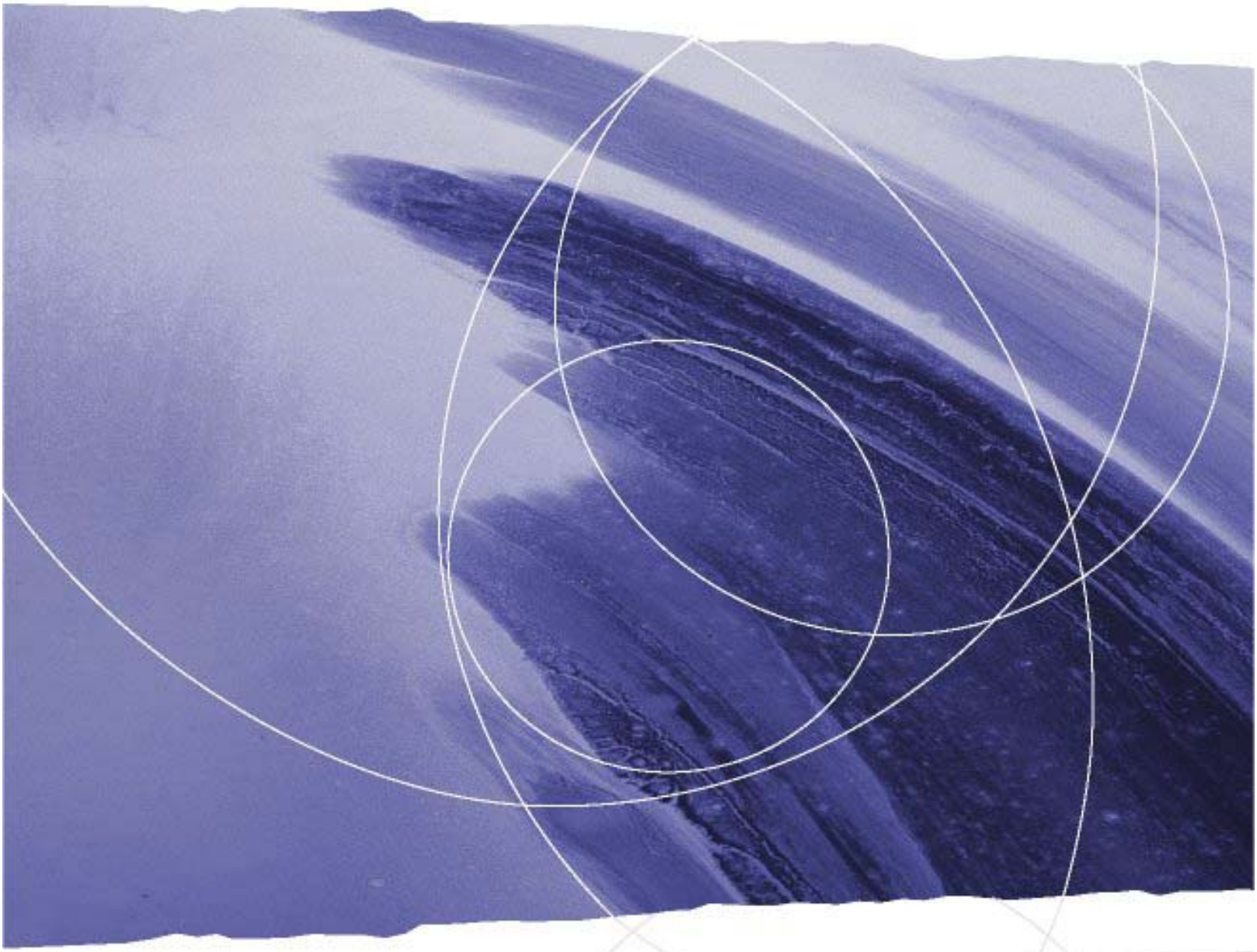
B. CHARACTERISTICS OF THE EXAMINATION

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

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

C. PASS MARK

The pass mark is set at 60 out of 100.



Éducation Québec

learning throughout life

41-3518-A