Mathematics Optimization I

Linear Programming

Québec

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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 Optimization I (Linear Programming). 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 Optimization I (Linear Programming).

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

Optimization
- Functions to be optimized, written in the form $Ax + By + C = Z$
- constraints related to an optimization function
- systems of first-degree inequalities in two variables
- graph of a polygon of constraints
- coordinates of the vertices of a polygon of constraints
- whether or not a point belongs to a polygon of constraints
- changes due to the modification of a constraint

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, 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 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.
Synthesizing	Finding a solution to a problem.

4.   TABLE OF DIMENSIONS

CONCEPTS SKILLS	OPTIMIZATION 100%
STRUCTURING 10%	For a given problem, indicate the elements required to define the constraints and the elements required to define the function to be optimized. **1** **10%**
MATHEMATIZING 20%	Write the system of inequalities that corresponds to the constraints in an optimization problem and the equation that corresponds to the function to be optimized. **2** **20%**
OPERATING 30%	Draw a polygon of constraints and verify whether or not certain points belong to this polygon. **3** **20%**
	Find the coordinates of the vertices of a polygon of constraints. **4** **10%**
SYNTHESIZING 40%	Solve two word problems. **5** **20%**
	Solve two problems in which a constraint was modified. **6** **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

For a given problem, indicate the elements required to define the constraints and the elements required to define the function to be optimized.
(structuring)   /10

Dimension 2

Write the system of inequalities that corresponds to the constraints in an optimization problem and the equation that corresponds to the function to be optimized.
(mathematizing)   /20

Dimension 3

Draw the polygon of constraints defined by a system of inequalities and, using algebra, verify whether or not a point belongs to this polygon.
(operating)   /20

Dimension 4
Using algebra, find the coordinates of the vertices of a polygon of constraints.
(operating)   /10

Dimension 5

Solve two optimization word problems. The students must clearly show all their work.
(synthesizing)   /20

Dimension 6

Solve two optimization problems in which one of the constraints has been modified. The initial polygon of constraints and the coordinates of its vertices are given. The students must clearly show all their work.
(synthesizing)   /20

6. JUSTIFICATION OF CHOICES

In the examination, 10% of the items test the students' **STRUCTURING** skills by verifying their understanding of certain concepts:
– constraints to be respected
– function to be optimized

In the examination, 20% of the items test the students' **MATHEMATIZING** skills by verifying whether they are able to write:
– a system of inequalities that corresponds to certain constraints
– an equation that corresponds to a function to be optimized

In the examination, 30% of the items test the students' **OPERATING** skills by verifying whether they have mastered certain operations or transformations:
– graphing a polygon of constraints
– verifying whether or not certain points belong to a polygon of constraints
– determining the coordinates of the polygon of constraints using algebra

In the examination, 40% 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; however, they are not permitted to use a graphing calculator.

C. PASS MARK

The pass mark is set at 60 out of 100.