

MATHEMATICS

MTH-4061-2 Logic, Set Theory and
Relations

**DEFINITION OF THE DOMAIN FOR
SUMMATIVE EVALUATION**

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1. INTRODUCTION

This definition of the domain for summative evaluation describes and classifies the essential and representative elements of the *Mathematics* program, and more specifically of the *Logic, Set Theory and Relations* module. 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 module in this program is organized in a similar manner; however, the content of this definition of the domain is specific to the *Logic, Set Theory and Relations* module.

The goal of the Definition of the Domain for Summative Evaluation is to prepare examinations that are valid from one version to another, from year to year, and 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

The main purpose of the adult education secondary level *Mathematics* program is to help adults understand the mathematical concepts needed to solve problems related to everyday situations, expand their knowledge of mathematics and, ultimately, facilitate access to a future career. Consequently, in the program, mathematics is presented as a practical tool for solving common, real-life problems.

Another area of development emphasized in the program involves mastering the mathematical operations used in science and technology for processing the kind of information students encounter in their daily lives, and which enables them to understand various everyday phenomena in terms of quantities and relations. In developing these skills, the *Mathematics* program can also prepare interested adults for studies leading to a career in science.

Whether the aim is to enable students to solve practical problems or to orient them towards a career in science, all the learning activities in the program emphasize the acquisition of a systematic work method.

The program places equal emphasis on mastering the use of a calculator or a microcomputer in the classroom. This particular area of development, as well as the growing importance of the international metric system (SI) in the life of each individual are addressed throughout the different learning activities.

Consequences

Evaluation items should deal with either original and practical situations taken from everyday life or those associated with an occupation.

Evaluation items should also pertain to situations in the fields of science or mathematics. For example, examination problems could deal with such things as the calculation of interest rates or the use of mathematical formulas used in science.

Evaluation should measure the adult's ability to follow the steps involved in solving a problem. It should also verify whether or not the student has mastered a work method.

The use of a calculator is permitted.

3. CONTENT OF THE PROGRAM FOR PURPOSES OF SUMMATIVE EVALUATION

Concepts

Logic

- Logical connectives, truth tables, simple or compound propositions
- Propositional forms, quantifiers

Set Theory

- Set relations: inclusion, equality
- Representations of a set, set operations

Relations

- Domain and range of a relation, Cartesian product
- Inverse of a relation
- Composition of two relations

Skills

Each skill is defined within the context of a mathematics program. Given that the adult education *Mathematics* program harmonizes with the mathematics programs in the youth sector, the skills involved are the same for students in both sectors.

STRUCTURING	Being familiar with the fundamentals of mathematics, understanding some mathematical concepts, establishing some cognitive relations. <i>Possible actions:</i> to associate, classify, compare, complete, describe, define, distinguish, state, enumerate, group, name, order, organize, rank, recognize, arrange, and so on.
MATHEMATIZING	Interpreting a given situation using a mathematical model (arithmetical, algebraic or graphic). <i>Possible actions:</i> to formalize, illustrate, represent, schematize, symbolize, translate, transpose, and so on.
OPERATING	Performing a given operation or transformation. <i>Possible actions:</i> to calculate, construct, break down, perform, estimate, evaluate, isolate, measure, reconstruct, solve, draw, transform, verify, and so on.
ANALYZING OR SYNTHESIZING	Establishing a link between a given solution and a problem or finding a solution to a given problem. <i>Possible actions:</i> to conclude, deduce, derive, explain, extrapolate, infer, justify, prove, solve, transfer, and so on.

4. TABLE OF DIMENSIONS

CONCEPTS	LOGIC	SET THEORY	RELATIONS
SKILLS	35 %	35 %	30 %
STRUCTURING 5 %		Relations: inclusion or equality 6 5 %	
MATHEMATIZING 25 %		Different representations of a set 7 10 %	Definition of a relation by listing its elements 10 5 % Definition of a relation by means of set-builder notation, domain and range 11 10 %
OPERATING 50 %	Truth value of a compound proposition 1 5 %	Set operations 8 10 %	Cartesian Product 12 5 %
	Logical equivalence 2 5 %	Operations on intervals 9 10 %	Inverse 13 5 %
	Negation of a compound proposition 3 5 %		Composition 14 5 %
ANALYZING OR SYNTHESIZING 20 %	Solution set of a propositional form 4 10 %		
	Truth value of a quantified propositional form 5 10 %		

Note: The numbers **1** to **14** identify the dimensions.

5. OBSERVABLE BEHAVIOURS

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

Dimension 1

To determine the truth value of a proposition consisting of up to three simple propositions, given the truth value for each type of proposition. The truth value of each simple proposition is known.

Dimension 2

To determine whether two compound propositions linked together to create a biconditional statement form a logical equivalence, using a truth table.

Dimension 3

To determine the negation of a compound proposition. In the answer, only simple propositions will bear the negation sign.

Dimension 4

To list the elements of the solution set of a simple propositional form or the elements of the solution set of a propositional form containing two simple propositional forms.

Dimension 5

To determine the truth value of a quantified compound propositional form. The solution set of each propositional form is required.

Dimension 6

To determine whether two given sets are equal or whether one is included within the other ($\subseteq, \varnothing, =, \neq$) or to indicate the subsets of a given set.

Dimension 7

To convert the description of a given a set to one of the other descriptive forms. The given set is expressed in any of the following ways: its elements are listed or it is described by means of set-builder notation or a Venn Diagram.

Dimension 8

To perform a series of up to four set operations ($\cup, \cap, \setminus, '$) on two or more sets whose elements are listed or that are defined by means of set-builder notation or a Venn Diagram.

Dimension 9

To perform a series of up to four set operations on intervals of real numbers that are written in brackets, graphed on a number line or described by means of set-builder notation.

Dimension 10

To list the elements of a given relation defined by means of set-builder notation.

Dimension 11

To define a given relation, using set-builder notation. The given relation is described in one of two ways: its elements are listed or it is represented graphically. The rule of correspondence must be expressed as a first - or second - degree equation or inequality in one variable.

Dimension 12

To find the Cartesian product of two sets whose elements are listed or that are defined by means of set-builder notation or a Venn Diagram.

Dimension 13

To find the inverse of a relation whose elements are listed, that is defined by means of set-builder notation or that is represented by an arrow diagram or a Cartesian graph. The inverse must be expressed in the same form as the given relation.

Dimension 14

To find the composition of two relations governed by a rule of correspondence that is expressed as a simple mathematical relation.

6. JUSTIFICATION OF CHOICES

Given that the program focuses on helping students learn how to use various mathematical skills to solve practical problems in everyday situations, emphasis has been placed on the skills needed to solve these problems: **mathematizing, operating** and **analyzing**.

The weighting of the skills listed below is based on the program itself and on the time normally required to master these skills.

STRUCTURING	5%
MATHEMATIZING	25%
OPERATING	50%
ANALYZING OR SYNTHESIZING	20%

The objectives are related to the following three themes: logic, set theory and relations. These themes have been weighted as follows:

LOGIC	35%
SET THEORY	35%
RELATIONS	30%

7. DESCRIPTION OF THE EXAMINATION

A. TYPE OF EXAMINATION

There shall be a written examination consisting mostly of items that will be scored subjectively (free-response or extended-response items). Some items may be scored objectively.

B. CHARACTERISTICS OF THE EXAMINATION

- The examination must be taken in one session lasting no more than two hours.
- The distribution of the marks should be consistent with the percentages indicated in the table of dimensions.
- Students are permitted to use a calculator.
- The items must reflect the requirements and restrictions outlined in the objectives of the program.
- Students are provided with a truth table for simple propositions.

C. PASS MARK

The pass mark is set at 60 out of 100.

