

MATHEMATICS

MTH-1005-3 The Four Operations
on Integers

**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 module on *The Four Operations on Integers*. 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 domain is specific to the module on *The Four Operations on Integers*.

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 is 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

- * Integers or whole numbers
- * Symbols: + , - , \times , \div , () , = , > , <
- * Basic operations within the interval [-30, +30]
 - addition
 - subtraction
 - multiplication
 - division
- * The law of signs
- * Order of operations

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 cognitive relations. <i>Possible actions:</i> to arrange, associate, classify, compare, complete, contrast, define, describe, distinguish, enumerate, group, name, organize, recognize, rank, state, and so on.
MATHEMATIZING:	Interpreting a given situation using a mathematical model (arithmetical, algebraic or graphical). <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 break down, calculate, construct, draw, estimate, evaluate, isolate, measure, perform, reconstruct, solve, transform, verify, and so on.
ANALYZING or SYNTHESIZING:	Establishing a link between a problem and a given solution 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

For purposes of summative evaluation, only skills and knowledge (concepts) will be measured. In the table below, essential and representative elements of the program have been grouped by combining concepts with skills. Each combination of one or more concepts with a skill is called a dimension. A given dimension may encompass more than one objective and, conversely, a given objective can be related to more than one dimension.

CONCEPTS	MATHEMATICAL SYMBOLS	THE FOUR OPERATIONS ON INTEGERS	THE ORDER OF OPERATIONS IN ARITHMETIC EXPRESSIONS
SKILLS	7%	44%	49%
STRUCTURING	+ , - , x , ÷ , () , [] , < , > , =	Law of Signs	Rules for the Order of Operations
16%	1 7%	2 4%	6 5%
MATHEMATIZING		Determining Appropriate Operations	Determining Arithmetic Expressions
25%		3 10%	7 15%
OPERATING		Performing Operations	Applying the Rules for the Order of Operations
30%		4 15%	8 15%
ANALYZING OR SYNTHESIZING		Problem Solving	Problem Solving
29%		5 15%	9 14%

Key: The numbers 1 to 9 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 compare two integers chosen from the interval $[-100, +100]$.

Dimension 2

To state the law of signs to be used for evaluating an arithmetic expression.

Dimension 3

To translate word problems into simple arithmetic expressions (two integers and one operation).

Dimension 4

To perform the four operations on integers chosen from the interval $[-30, +30]$.

Dimension 5

To solve simple word problems involving operations on integers. (Use cases that require just one operation.)

Dimension 6

To identify, among a set of mathematical operations on integers, those that must be performed in sequence. These operations may or may not be grouped within parentheses or brackets.

Dimension 7

To translate word problems into arithmetic expressions. (The problems require the students to apply the rules for order of operations: multiplication and division before addition and subtraction, performing operations from left to right, and operation within parentheses or brackets must be performed first.)

Dimension 8

To perform operations on arithmetic expressions made up of integers and requiring students to apply the rules for the order of operations. (The steps must be clearly indicated.)

Dimension 9

To solve word problems that are related to everyday situations and that can be written as arithmetic expressions with integers. (The steps involved in solving a problem must be clearly indicated.)

6. JUSTIFICATION OF CHOICES

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

Since it is also important that students be able to use a systematic procedure to solve a word problem, they should clearly understand the steps involved in solving a problem.

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

STRUCTURING	16%
MATHEMATIZING	25%
OPERATING	30%
ANALYZING OR SYNTHESIZING	29%

With regard to concepts, most of the emphasis has been placed on the four operations and the rules for the order of operations. The concepts have been weighted as follows:

MATHEMATICAL SYMBOLS	7%
THE 4 OPERATIONS ON INTEGERS	44%
THE ORDER OF OPERATIONS IN ARITHMETIC EXPRESSIONS	49%

The definitions that are more common to formative evaluation have not been used. Furthermore, since adults do not often encounter word problems that require them to apply the rules for the order of operations, more emphasis has been given to the four operations involving integers than originally indicated in the program.

7. DESCRIPTION OF THE EXAMINATION

A. TYPE OF EXAMINATION

There shall be a written examination consisting 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 a single session lasting no more than two hours.
- The distribution of 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.

C. PASS MARK

The pass mark is set at 60 out of 100.

