MATHEMATICS

MTH-1006-3 The Four Operations on Fractions

DEFINITION OF THE DOMAIN FOR SUMMATIVE EVALUATION

FEBRUARY 1995

Quebec

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Direction de la formation générale 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 *Mathematics* program, and, more specifically, of the module on *The Four Operations on Fractions*. 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 Fractions*.

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	Consequences
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.	Evaluation items should deal with either original and practical situations taken from everyday life or those associated with an occupation.
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.	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.
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.	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 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.	The use of a calculator is permitted.

3. CONTENT OF THE PROGRAM FOR THE PURPOSES OF SUMMATIVE EVALUATION

Concepts

* Positive and negative fractions
* Equivalent and simplified fractions
* Comparing fractions
* Adding, subtracting, multiplying and dividing fractions
* Order of operations
* Arithmetic expressions
* Word problems

Skills

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

STRUCTURING:	Being familiar with the fundamentals of mathematics, understanding some mathematical concepts, establishing some cognitive relations. *Possible actions:* to arrange, associate, classify, compare, complete, contrast, define, describe, distinguish, enumerate, group, name, order, organize, rank, recognize, state, and so on.
MATHEMATIZING:	Interpreting a given situation using a mathematical model (arithmetical, algebraic or graphic). *Possible actions:* to formalize, illustrate, represent, schematize, symbolize, translate, transpose, and so on.
OPERATING:	Performing a given operation or transformation. *Possible actions:* 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 given solution and a problem or finding a solution to a given problem. *Possible actions:* 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 / SKILLS	FRACTIONS 20%	THE 4 OPERATIONS ON TWO FRACTIONS AND THE LAW OF SIGNS 20%	ORDER OF OPERATIONS IN ARITHMETIC EXPRESSIONS 60%
STRUCTURING 5%	Comparing fractions 1 5%		
MATHEMATIZING 10%			Finding arithmetic expressions 5 10%
OPERATING 55%	Simplified and equivalent 2 5% Number line 3 10%	+ , - , × , ÷ of positive and negative fractions 4 20%	Order of operations 6 20%
ANALYZING OR SYNTHESIZING 30%			Problems related to everyday situations 7 30%

Key: The numbers 1 to 7 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 rational numbers expressed as fractions or mixed numbers.

Dimension 2
To convert a fraction to an equivalent fraction and to reduce a fraction to its lowest terms. The terms of the fraction are less than 225.

Dimension 3
To locate, on a number line, a set of no more than six positive or negative fractions expressed in different forms. The denominators are less than or equal to 12 and the interval on the number line ranges from –2 to + 2.

Dimension 4
To add, subtract, multiply or divide fractions.

Dimension 5
To translate a word problem into an arithmetic expression containing fractions. (In these problems, students must apply the rules for the order of operations.)

Dimension 6
To perform operations on arithmetic expressions containing fractions, by applying the rules for the order of operations. (The steps in the solution must be clearly indicated.)

Dimension 7
Solving word problems that deal with everyday situations and that can be written as arithmetic expressions containing fractions. (The steps in the solution 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 everyday 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 and should be able to determine and define them clearly.

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	10%
OPERATING	55%
ANALYZING OR SYNTHESIZING	30%

With regard to concepts, those that have been given the greatest emphasis are the four operations and the order of operations. The concepts have been weighted as follows:

POSITIVE AND NEGATIVE FRACTIONS	20%
THE FOUR OPERATIONS ON TWO FRACTIONS	20%
ORDER OF OPERATIONS IN ARITHMETIC EXPRESSIONS	60%

These percentages are slightly different from those found in the program because there is not always a direct correlation between the objectives and the dimensions.

7. DESCRIPTION OF THE EXAMINATION

A. TYPE OF EXAMINATION

There will 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 must 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 60 out of 100.

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