Definition of the Domain for Summative Evaluation

Mathematics

MTH-5112-1

Logic

April 2006

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 Logic. 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 Logic.

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, du Loisir et du Sport 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 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

Propositions:

- definition of a simple proposition, a compound proposition, a simple propositional form and a complex propositional form
- translation into symbolic language of compound propositions expressed as verbal statements
- verification of the logical equivalence between two compound propositions linked together to form a biconditional statement, using a truth table
- application of negation to compound propositions
- determination of the truth value of the simple propositions making up a compound proposition, given the truth value of the compound proposition and the truth value of one of the simple propositions
- connection between the application of negation to compound propositions linked together to form a biconditional statement and the creation of a contradiction or a tautology

Propositional forms:

- translation into symbolic language of quantified compound propositional forms expressed as verbal statements
- application of negation to quantified compound propositional forms
- determination of the truth value of compound propositional forms, given a numerical value for the variable
- list of the elements of the solution set of a compound propositional form
- determination of the most appropriate quantifier for quantified simple propositional forms
- determination of the missing operator in a compound propositional form given its solution set

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 relationships among them. Possible actions: to associate, classify, compare, complete, describe, define, contrast, 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 formalize, 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, 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.

4. TABLE OF DIMENSIONS

CONCEPTS SKILLS	PROPOSITIONS	PROPOSITIONAL FORMS
STRUCTURING **5%**	Determine whether a verbal or mathematical statement is a simple proposition, a compound proposition, a simple propositional form or a compound propositional form. **1** **5%**	
MATHEMATIZING **10%**	Translate into symbolic language compound propositions expressed as verbal statements. **2** **5%**	Translate into symbolic language quantified compound propositional forms expressed as verbal statements. **7** **5%**
OPERATING **50%**	Verify the logical equivalence between two compound propositions linked together to form a biconditional statement, using a truth table. **3** **10%**	Apply negation to two quantified compound propositional forms that are not biconditional. **8** **10%**
	Apply negation to two compound propositions that are not biconditional. **4** **10%**	Determine the truth value of two compound propositional forms, given a numerical value for the variable. **9** **10%**
		List the elements of the solution set of a compound propositional form made up of two simple propositional forms and a logical connective. **10** **10%**
ANALYZING **35%**	Determine the truth value of two simple propositions making up a compound proposition, given the truth value of the compound proposition and the truth value of one of the simple propositions. **5** **10%**	If necessary, modify the quantifiers of three quantified simple propositional forms in order to make them more appropriate. **11** **5%**
	Demonstrate that, by applying a negative to two compound proposals linked together to form a biconditional statement, the result is either a contradiction or a tautology. **6** **10%**	Determine the missing operator of a compound propositional form given its solution set. **12** **10%**

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

Determine whether a verbal or mathematical statement is a simple proposition, a compound proposition, a simple propositional form or a compound propositional form. Five statements are given.
(Structuring) /5

Dimension 2

Translate into symbolic language compound propositions expressed as verbal statements, using the logical connectives $\neg$, $\wedge$, $\vee$, $\rightarrow$, $\leftrightarrow$. The compound propositions involve no more than two logical connectives. The simple propositions are given.
(Mathematizing) /5

Dimension 3

Verify the logical equivalence between two compound propositions linked together to form a biconditional statement, using a truth table. The truth tables for compound propositions with a single logical connective are not given. The compound propositions must be presented symbolically and must be made up of no more than three simple propositions and three logical connectives.
(Operating) /10

Dimension 4

Apply negation to two compound propositions that are not biconditional, so that the negation connective affects only the simple propositions. The compound propositions are presented symbolically and are made up of no more than three simple propositions and five logical connectives. Students must clearly show all their work.
(Operating) /10

Dimension 5

Determine the truth value of two of the simple propositions making up a compound proposition, given the truth value of the compound proposition and the truth value of one of the simple propositions. The compound proposition is made up of three simple propositions and two or three logical connectives. Students must clearly show all their work.
(Analyzing) /10

Dimension 6

Apply a negation connective to one of two compound propositions linked together to form a biconditional statement (or remove the negation connective) in order to obtain either a contradiction or a logical equivalence.
(Analyzing) /10

Dimension 7

Translate into symbolic language compound propositional forms expressed as verbal statements, using the logical connectives ¬, $\wedge$, $\vee$, $\rightarrow$, $\leftrightarrow$ and the quantifiers $\forall$, $\exists$ or $\exists!$. The compound propositional forms include two logical connectives. The simple propositional forms are given.
(Mathematizing) /5

Dimension 8

Apply negation to two quantified compound propositional forms that are not biconditional so that the negation connective affects only the simple propositional forms. The quantified compound propositional forms include an existential or universal quantifier and no more than three simple propositional forms and three logical connectives. Students must clearly show all their work.
(Operating) /10

Dimension 9

Determine the truth value of two compound propositional forms, given a numerical value for the variable. The propositional forms are made up of two simple propositional forms and no more than three logical connectives. Students must clearly show all their work.
(Operating) /10

Dimension 10

List the elements of the solution set of a propositional form made up of two simple propositional forms and a logical connective. The reference set is listed and contains five to ten elements. Students must clearly show all their work.
(Operating) /10

Dimension 11

If necessary, modify the quantifiers of three quantified simple propositional forms in order to make them more appropriate. The reference set contains five to ten elements. All three quantifiers must be used. Students must clearly show all their work.
(Analyzing) /5

Dimension 12

Determine the missing operator of a compound propositional form given its solution set. The propositional form includes no more than three simple propositional forms and three logical connectives. The reference set contains five to ten elements. Students must clearly show all their work.
(Analyzing) /10

6. JUSTIFICATION OF CHOICES

In the examination, 5% of the items test the students' **STRUCTURING** skills by verifying their understanding of certain concepts:

- identification of a simple proposition, a compound proposition, a simple propositional form and a complex propositional form

In the examination, 10% of the items test the students' **MATHEMATIZING** skills by verifying whether they are able to translate a given situation into a mathematical model:

- translation into symbolic language of compound propositions expressed as verbal statements
- translation into symbolic language of quantified compound propositional forms

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

- verifying the logical equivalence between two compound propositions linked together to form a biconditional statement
- applying negation to compound propositions
- applying negation to quantified compound propositional forms
- determining the truth value of a compound propositional form
- listing the elements of the solution set of a compound propositional form

In the examination, 35% of the items test the students' skill in **ANALYZING** information; they involve verifying whether the students have the ability to make connections:

- between the truth value of two simple propositions and the truth value of the compound proposition of which they are a part
- between the application of the negation connective to two compound propositions linked together to form a biconditional and the creation of a contradiction or a tautology
- between the choice of quantifier for quantified simple propositional forms and their truth value
- by determining the missing operator in a quantified compound propositional form given its solution set

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 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

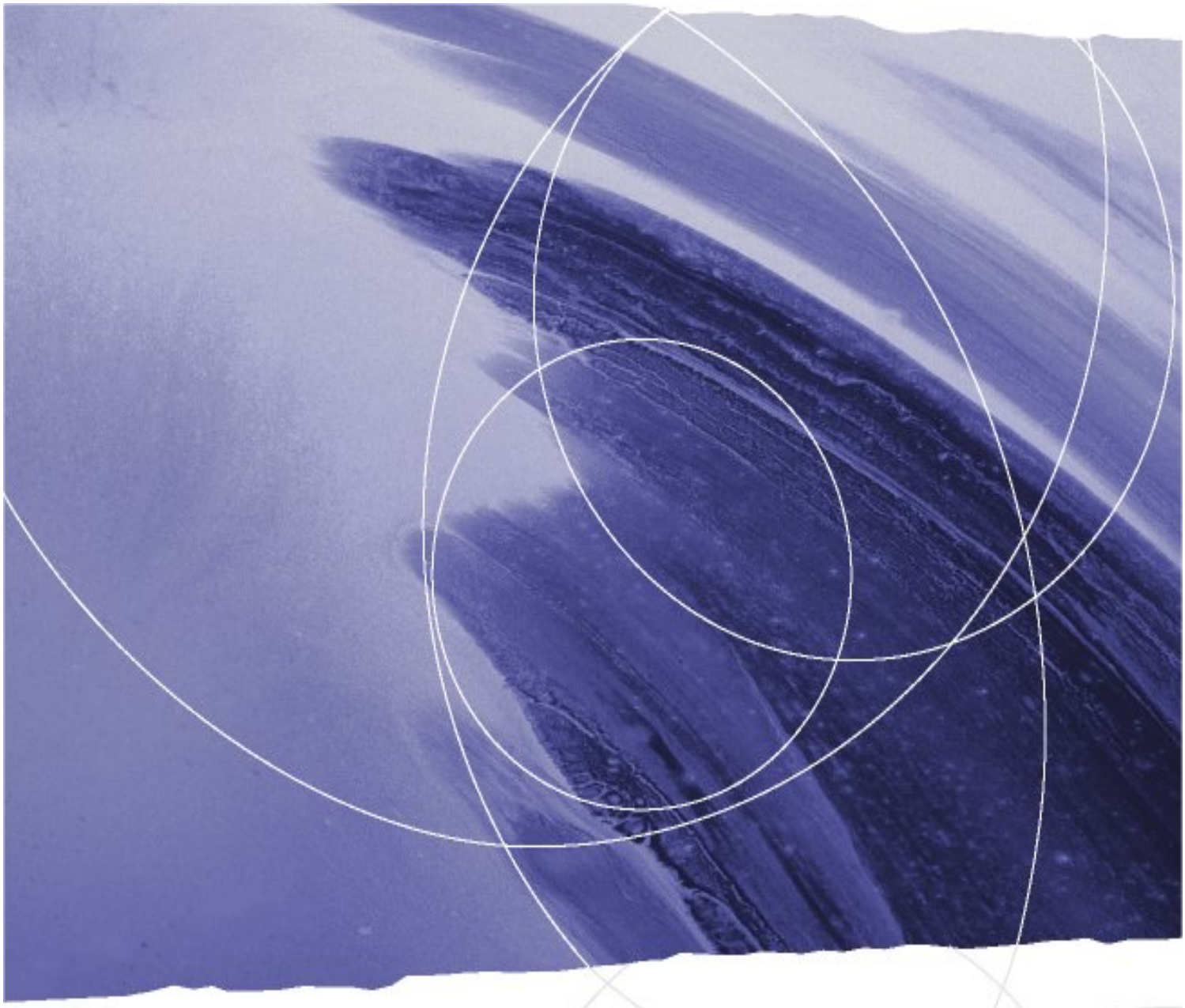
The examination will be administered in a single session lasting no more than two and a half hours.

Students are permitted to use a scientific calculator; however, they are not permitted to use a graphing calculator.

The truth tables for compound propositions containing a single logical connective will not be given.

C. PASS MARK

The pass mark is set at 60 out of 100.



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