

MATHEMATICS

MTH-5085-1 — GEOMETRY IV

**DEFINITION OF THE DOMAIN
FOR SUMMATIVE EVALUATION**

AUGUST 1997

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Direction de la formation générale des adultes
Service de l'évaluation des acquis

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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—specifically, for module : *Geometry IV*. It presents 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 organization of this definition of the domain is the same as that of those of other modules. The content of each section is, however, specific to this module.

The goal of the definition of the domain for summative evaluation is to permit the preparation of 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
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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 occupation. 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 toward 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 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 and mathematics.

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

- Relationships governing measures in a circle (measures of length, angles and area) given a list of theorems and corollaries
- Relationships governing measures in a right triangle (measures of length, angles and area) given a list of theorems and corollaries

Skills

Each skill is defined within the context of a mathematics program. Given that the adult education *Mathematics* program corresponds to 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.
Possible actions: associating, classifying, comparing, completing, describing, defining, contrasting, stating, enumerating, grouping, naming, ranking, organizing, recognizing, arranging, and so on
- **Operating:** Performing a given operation or transformation.
Possible actions: calculating, constructing, breaking down, performing, estimating, evaluating, isolating, measuring, reconstructing, solving, drawing, transforming, verifying, and so on
- **Analyzing or Synthesizing:** Establishing a link between a problem and a given solution or solving a given problem.
Possible actions: concluding, deducing, deriving, explaining, extrapolating, inferring, justifying, proving, solving, transferring, and so on

4. Table of Dimensions

CONCEPTS SKILLS	RELATIONSHIPS GOVERNING MEASURES IN A CIRCLE 55%	RELATIONSHIPS GOVERNING MEASURES IN A RIGHT TRIANGLE 45%
STRUCTURING 20%	1 Arc, chord, secant, tangent, point of tangency 5%	7 Choice of theorem or corollary 5%
	2 Central, inscribed, interior, exterior angles 5%	
	3 Choice of theorem or corollary 5%	
OPERATING 30%	4 Measures of length and area 10%	8 Measures of length, area and angles 15%
	5 Measures of angles and arcs 5%	
ANALYZING OR SYNTHESIZING 50%	6 Real-life problems 25%	9 Real-life problems 25%

Note: 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. A list of theorems and corollaries related to the relationships governing measures in a circle and in a right triangle will be provided with the examination (see appendix). The requirements and restrictions specified in the objectives of the program must be observed.

Dimension 1

Given a diagram of a circle in which several elements are represented, recognizing arcs, chords, secants, tangents and points of tangency.

Dimension 2

Given a diagram of a circle in which several elements are represented, recognizing central, inscribed, interior and exterior angles.

Dimension 3

Selecting the theorem or corollary used to support a relationship governing measures in a circle or in two circles.

Dimension 4

Determining the measure of a radius, a diameter, a circumference, an area, a chord, an arc or a segment tangent, given a diagram of one or two circles with the measures required and using the appropriate theorems or corollaries.

Dimension 5

Determining the measure of an arc, an inscribed angle, a central angle, an interior angle or an exterior angle, given a diagram of a circle with the measures required and using the appropriate theorems or corollaries. (For this dimension, use only those theorems and corollaries related to the measure of angles in a circle.)

Geometry IV

Definition of the Domain

Dimension 6

Solving problems related to a variety of human activities and based on the relationships governing measures in a circle. (The problem should require the application of three theorems or corollaries.)

Dimension 7

Selecting the theorem or corollary used to support a relationship governing measures in a right triangle.

Dimension 8

Determining the measure of an angle, a side, a segment, a median, an altitude, the hypotenuse, the perimeter or the area of a right triangle, given a diagram of one or more right triangles with the measures required and using the appropriate theorems or corollaries (a maximum of three).

Dimension 9

Solving problems related to a variety of human activities and based on the relationships governing measures in a right triangle. (The problem should require the application of a maximum of three theorems or corollaries.)

6. Explanation of Content and Weighting

Given that the program focuses on helping the students learn how to use various mathematical tools to solve concrete real-life problems, emphasis has been placed on the skills of operating and analyzing. Emphasis should also be placed on the steps involved in solving written problems.

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

STRUCTURING	20%
OPERATING	30%
ANALYZING OR SYNTHESIZING	50%

On the basis of the program, the themes have been weighted as follows:

RELATIONSHIPS GOVERNING MEASURES IN A CIRCLE	55%
RELATIONSHIPS GOVERNING MEASURES IN A RIGHT TRIANGLE	45%

7. Description of the Examination**7.1 Type of Examination**

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

7.2 Characteristics of the Examination

- The examination must be taken at the end of the module, 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, as well as a ruler, square, protractor and compass.
- A list of theorems and corollaries related to relationships governing measures in a circle and in a right triangle will be provided (see appendix).
- The requirements and restrictions specified in the objectives of the program must be observed.

7.3 Pass Mark

To pass the module, students must obtain 60 out of 100 on the examination.

APPENDIX

LIST OF THEOREMS AND COROLLARIES USED IN GEOMETRY IV

LIST 1

RELATIONSHIPS GOVERNING MEASURES IN A CIRCLE

A. Relationships within a circle

1. Any perpendicular bisector of a chord is a diameter of a circle.
2. The longest chord of a circle is a diameter.
3. In a circle, any radius perpendicular to a chord divides that chord into two congruent segments.
4. In a circle, any radius perpendicular to a chord divides the subtended arc into two congruent arcs.
5. In a circle, arcs located between two parallel chords are congruent.
6. Two chords are congruent if they are equidistant from the centre of the circle.
7. In a circle, congruent chords subtend congruent arcs and, conversely, congruent arcs are subtended by congruent chords.
8. Any line tangent to a circle is perpendicular to the radius that shares the point of tangency.
9. For any circle, two tangent segments originating from the same exterior point are congruent.
10. Two parallel lines, be they tangents or secants, intercept congruent arcs of a circle.

B. Relationships involving two circles

11. The circumferences of two circles have the same ratio as their radii.
12. The areas of two circles have the same ratio as the squares of their radii.
13. The measures of similar arcs of two circles have the same ratio as their radii.

C. Relationships governing angular measures in a circle

14. In a circle, the measure of a central angle is equal to the measure of its intercepted arc.
15. In a circle, the measure of an inscribed angle is one half the measure of its intercepted arc.
16. The measure of an angle formed by two chords intersecting in the interior of a circle is one half the sum of the measures of the arcs intercepted by the angle and its vertical angle.
17. The measure of an angle formed by two tangents, a tangent and a secant, or two secants is one half the difference of the measures of the intercepted arcs.

LIST 2

RELATIONSHIPS GOVERNING MEASURES IN A RIGHT TRIANGLE

18. The hypotenuse of a right triangle inscribed in a circle is always a diameter of that circle.
19. In a right triangle, the length of the median to the hypotenuse is one half the length of the hypotenuse.
20. In a right triangle with a 30° angle, the length of the side opposite this angle is one half the length of the hypotenuse.
21. A right triangle and the altitude to its hypotenuse form two right triangles that are similar to the given triangle and to each other.
22. The length of the altitude to the hypotenuse of a right triangle is the geometric mean between the lengths of the segments of the hypotenuse.
23. The length of a leg of a right triangle is the geometric mean between the length of the hypotenuse and the length of the adjacent segment of the hypotenuse formed by the altitude to the hypotenuse.
24. The product of the lengths of the legs of a right triangle is equal to the product of the length of the hypotenuse and the length of the altitude to the hypotenuse.

