

*Definition of the Domain
for Summative Evaluation*

MTH-5110-1

Mathematics Introduction to Vectors

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Mathematics Introduction to Vectors

Formation professionnelle et technique
et formation continue

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 secondary-level adult education Mathematics program and, more specifically, of the course entitled Introduction to Vectors. 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 Introduction to Vectors.

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 and the school boards.

2. PROGRAM ORIENTATIONS AND CONSEQUENCES FOR SUMMATIVE EVALUATION

ORIENTATIONS

The main objective of the secondary-level adult education Mathematics program is to help students fully understand mathematical 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.

The program aims to provide students with the skills they need to process information by applying mathematical models and appropriate strategies for solving problems.

The program also aims to improve the students' ability to clearly relate information using mathematical language.

The program is intended to help students develop a systematic work method.

The program will help students master the use of technological tools.

CONSEQUENCES

Evaluation should involve verifying whether the student has fully understood the different concepts.

Evaluation items should pertain to situations in the field of science and technology or to situations related to trades.

Evaluation items should involve performing tasks that require the students to classify information, use mathematical models and solve problems.

Evaluation items should involve performing tasks that require the use of mathematical language. The appropriateness and clarity of the language used should be taken into account in the marking process.

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 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

Definitions

- unit vectors
- collinear vectors
- zero vectors
- orthogonal vectors
- equipollent vectors
- opposite vectors
- vector basis

Addition of vectors

- addition properties
- construction of the resultant of two vectors, using the triangle method or the parallelogram method
- calculation of the components of the resultant of two vectors, using the algebraic method
- calculation of the norm of the resultant of two vectors
- calculation of the angle between the resultant and one of the vectors or between the two vectors

Linear combination of vectors

- properties of linear combination
- calculation of the components of a vector resulting from a linear combination of two algebraic vectors
- determination of the coefficients in a linear combination, given three vectors

Scalar product of vectors

- properties of scalar product
- calculation of the scalar product of two vectors, given their norm and the angle between the vectors
- calculation of the scalar product of two vectors, given their norm and their respective angle of direction
- calculation of the measurement of the angle between two vectors, given their norm and their scalar product

Demonstration using vectors

Algebraic demonstration of the properties of the operations involving vectors

Proving that a quadrilateral belongs to a specific category

Problems involving vectors

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 cognitive relations among them.

Possible actions: to associate, classify, compare, complete, describe, define, contrast, distinguish, state, enumerate, group, name, rank, organize, recognize, arrange, and so on.

Operating Performing a given operation or transformation.

Possible actions: to calculate, construct, break down, perform, estimate, evaluate, isolate, measure, reconstruct, solve, draw, 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.

Synthesizing Effectively integrating a variety of concepts and skills to solve a problem.

Possible actions: to solve a problem.

4. TABLE OF DIMENSIONS

CONCEPTS	VECTORS	ADDITION OF VECTORS	LINEAR COMBINATION OF VECTORS	SCALAR PRODUCT OF VECTORS
SKILLS	5%	25%	10%	60%
STRUCTURING 10%	Determine whether a vector is a zero vector or a unit vector, whether two vectors are collinear, orthogonal, equipollent or opposite vectors, or whether they form a vector basis. 1 5%	Given expressions that symbolically describe the properties of operations involving vectors, determine which expression is true and which property it describes. 6 5%		
OPERATING 40%		Using the triangle method or the parallelogram method, construct the resultant of two vectors described by their norm and their direction. 7 5%	Calculate the components of the vector resulting from the linear combination of two algebraic vectors. 11 5%	Calculate the scalar product of two vectors, given their norm and the angle between these vectors. or Calculate the scalar product of two vectors, given their norm and their respective angle of direction. or Calculate the measurement of the angle between two vectors, given their norm and their scalar product.
		Using the algebraic method, calculate the components of the resultant of two vectors described by the coordinates of their head and those of their tail. 8 5%	Determine the coefficients of a linear combination, given three vectors described by their components. 12 5%	
		Calculate the norm of the resultant of two vectors. 9 5%		
		Calculate the angle between the resultant and one of the vectors or the angle between the two vectors. 10 10%		13 5%
ANALYZING 30%	Complete a demonstration containing vectors. 2 10%			
	Demonstrate a property of an operation involving vectors or, using vectors, prove that a quadrilateral belongs to a specific category. 3 10%			
	Given statements containing vectors that describe a relationship between the elements of a figure, determine which statements are false and correct them. 4 10%			
SYNTHESIZING 20%	Solve two problems involving vectors. 5			20%

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 given vector is a zero vector or a unit vector, whether two vectors are collinear, orthogonal, equipollent or opposite vectors, or whether they form a vector basis.

(structuring) /5

Dimension 2

Complete a demonstration containing vectors. The students must clearly show all their work.

(analyzing) /10

Dimension 3

Demonstrate a property of an operation involving vectors. The students must clearly show all their work.

or

Using vectors, prove that a quadrilateral belongs to a specific category of quadrilaterals. The students must clearly show all their work.

(analyzing) /10

Dimension 4

Given a figure, whose elements are defined, and statements using vectors to describe a relation between these elements, determine which statements are false and correct them to make them true.

(analyzing) /10

Dimension 5

Solve two problems involving vectors that may or may not be associated with specific situations. The problem may include a figure. The students must clearly show all their work.

(synthesizing)

/20

Dimension 6

Given three expressions that symbolically describe the properties of operations involving vectors, determine which expression is true and which property it represents.

(structuring)

/5

Dimension 7

Given two vectors described by their norm and their direction, construct their resultant using the triangle method or the parallelogram method.

(operating)

/5

Dimension 8

Given two vectors described by the coordinates of their tail and the coordinates of their head, calculate the components of their resultant using the algebraic method. The students must clearly show all their work.

(operating)

/5

Dimension 9

Given two vectors described by their norm and their direction, calculate the norm of their resultant. The students must clearly show all their work.

(operating)

/5

Dimension 10

Given two vectors described by their norm and their direction, calculate the measurement of the angle between the resultant and one of the vectors or the angle between the vectors. The students must clearly show all their work.

(operating)

/10

Dimension 11

Calculate the components of the vector resulting from the linear combination of two algebraic vectors.

(operating)

/5

Dimension 12

Determine the coefficients of a linear combination, given three vectors described by their components. One of the vectors is the result of a linear combination of the two other vectors. The students must clearly show all their work.

(operating)

/5

Dimension 13

Calculate the scalar product of two vectors, given their norm and the contained angle between these vectors.

or

Calculate the scalar product of two vectors, given their norm and their respective angle of direction.

or

Calculate the measurement of the angle between two vectors, given their norm and their scalar product.

(operating)

/5

Note: At least two items from Dimensions 7 to 13 must refer to concrete situations.

6. JUSTIFICATION OF CHOICES

In the examination, 10% of the items test the students' **STRUCTURING** skills by verifying their:

- knowledge of the definitions
- knowledge of the properties of the operations involving vectors

In the examination, 40% of the items test the students' **OPERATING** skills by verifying whether they have mastered certain operations or transformations:

- construction of vectors resulting from addition
- calculation of the components of the resultant of two vectors
- calculation of the norm of the resultant of two vectors
- calculation of the angle between the resultant and one of the vectors
- calculation of the measurement of the angle between two vectors
- calculation of the components of the vector resulting from a linear combination
- determination of the coefficients of a linear combination
- scalar product of two vectors
- calculation of the measurement of the angle between two vectors

In the examination, 30% of the items test the students' skill in **ANALYZING** information; they involve verifying whether the students have the ability to make connections:

- by completing a proof using vectors
- by demonstrating a property of an operation involving vectors
- by using vectors to prove that a quadrilateral belongs to a specific category of quadrilaterals

In the examination, 20% of the items test the students' **SYNTHESIZING** skills by verifying their ability to:

- solve problems
- use a rigorous work method
- communicate clearly using mathematical language

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 the 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.

C. PASS MARK

The pass mark is set at 60 out of 100.

