

Mathematics II

Code: 102344
ECTS Credits: 6

2025/2026

Degree	Type	Year
Business Administration and Management	FB	1
Economics	FB	1

Contact

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Teaching groups languages

You can view this information at the [end](#) of this document.

Prerequisites

To successfully follow this course, students must be able to handle basic mathematical concepts and tools, as well as have previously acquired fundamental notions of continuity, derivatives, and the analysis and graphical representation of real functions of a single real variable, as presented and studied in the Mathematics I course.

Objectives and Contextualisation

In this course, students are introduced to the study of linear algebra and multivariable functions, with an emphasis on their applications in the field of economics.

Therefore, the objective of the course is for students to become familiar with the basic mathematical concepts that they will later use in the study of economic theory and analysis.

Specifically, the intended learning objectives are:

- To familiarize students with n -dimensional Euclidean space
- To work with determinants and matrices
- To solve systems of linear equations
- To understand multivariable functions and their role in more complex economic models
- To represent functions of two variables geometrically using contour plots
- To understand the notion of the limit of a function at a point and the concept of continuity
- To understand Weierstrass's Theorem
- To familiarize students with partial derivatives of multivariable functions and with the concept of differentiability
- To use partial derivatives to obtain the slope of the contour line at a point and to carry out comparative statics exercises

- To solve optimization problems both without constraints and with equality constraints

Learning Outcomes

1. CM01 (Competence) Solve and discuss systems of linear equations in the field of economics and business.
2. CM02 (Competence) Express complex economic-business situations mathematically.
3. CM04 (Competence) Solve mathematical problems using the information technologies available in the field of economics and business.
4. CM20 (Competence) Solve and discuss systems of linear equations in the field of economics and business.
5. CM21 (Competence) Express complex economic-business situations mathematically.
6. CM23 (Competence) Solve mathematical problems using the information technologies available in the field of economics and business.
7. KM02 (Knowledge) Recognise mathematical language and some demonstration methods.
8. KM19 (Knowledge) Recognise mathematical language and some demonstration methods.
9. SM01 (Skill) Develop problems using differential calculus in several real variables in the field of economics and business.
10. SM02 (Skill) Apply the Inverse Function and Implicit Function theorems to specific problems in the field of economics and business.
11. SM03 (Skill) Analytically pose optimisation problems in the field of economics and business.
12. SM21 (Skill) Develop problems using Differential Calculus in several real variables in the field of economics and business.
13. SM22 (Skill) Apply the Inverse Function and Implicit Function theorems to specific problems in the field of economics and business.

Content

PART I. LINEAR ALGEBRA

Topic 1. VECTOR AND MATRIX ALGEBRA

- 1.1. Systems of linear equations
- 1.2. Operations with matrices and vectors
- 1.3. Linear dependence and independence of vectors
- 1.4. Properties of basic operations and geometric interpretations
- 1.5. Norm and Euclidean distance
- 1.6. Sets, lines, and planes

Topic 2. MATRIX CALCULUS

- 2.1. Matrices, determinants, inverse matrices, and rank
- 2.2. Solving systems of equations using matrices

PART II. MULTIVARIABLE FUNCTIONS

Topic 3. STUDY OF MULTIVARIABLE FUNCTIONS

- 3.1. Characteristics of multivariable functions
- 3.2. Geometric representation
- 3.3. Surfaces and distances
- 3.4. Level curves

Topic 4. PARTIAL DERIVATIVES AND DIFFERENTIABLE FUNCTIONS

- 4.1. Derivative of a function at a point in the direction of a unit vector
- 4.2. Partial derivatives
- 4.3. Gradient of a function at a point. Geometric interpretation and directional derivatives
- 4.4. Differentiable functions. Continuity of partial derivatives
- 4.5. Chain rule
- 4.6. Partial derivatives of linear combinations and quadratic forms
- 4.7. First- and second-order Taylor approximations

Topic 5. IMPLICIT FUNCTION THEOREM AND INVERSE FUNCTION THEOREM

- 5.1. Implicit function theorem
- 5.2. Inverse function theorem
- 5.3. Applications and geometric intuition

PART III. OPTIMIZATION WITH MULTIVARIABLE FUNCTIONS

Topic 6. UNCONSTRAINED OPTIMIZATION

- 6.1. Local and global optima
- 6.2. First- and second-order conditions for local optima
- 6.3. Global optima of concave and convex functions

Topic 7. CONSTRAINED OPTIMIZATION

- 7.1. Maximization and minimization problems with equality constraints
- 7.2. Constrained local optima. Lagrange's Theorem
- 7.3. Global constrained optima of concave and convex functions
- 7.4. Weierstrass Theorem
- 7.5. Introduction to inequality constraints

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
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Type: Directed			
Preparation and solution of exercises	17	0.68	CM01, CM02, CM04, CM20, CM21, CM23, KM02, KM19, SM01, SM02, SM03, SM21, SM22, CM01
Theory classes	32.5	1.3	CM01, CM02, CM20, SM01, SM02, SM03, SM21, SM22, CM01
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Type: Supervised			
Progress monitoring	3	0.12	CM01, CM02, CM04, CM20, CM21, CM23, KM02, KM19, SM01, SM02, SM03, SM21, SM22, CM01
Tutorials	7	0.28	CM01, CM02, CM04, CM20, CM21, CM23, KM02, KM19, SM01, SM02, SM03, SM21, SM22, CM01
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Type: Autonomous			
Exercise preparation and problem-solving	40	1.6	
Study	45	1.8	CM01, CM02, CM04, CM20, CM21, CM23, KM02, KM19, SM01, SM02, SM03, SM21, SM22, CM01
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Lecture-based classes in which professors will develop the main concepts.

The aim of this activity is to introduce fundamental notions and facilitate student learning, with an emphasis on the economic applications of the mathematical concepts studied.

Guided instruction, where professors will apply the concepts studied to specific families of multivariable functions.

The goal of this activity is to foster student independence in the learning process by applying theoretical concepts to families of multivariable functions.

Problem sets to be solved by students.

Each topic will be accompanied by a list of problems that students must solve independently. This activity has a dual purpose: on one hand, to help students assimilate the theoretical concepts presented in class; on the other hand, to develop the necessary problem-solving skills.

Collaborative problem solving will be encouraged, through stable work groups of 3 or 4 students throughout the semester, who will collaborate to overcome difficulties encountered by any of the group members.

Problem-solving classes in which students will discuss the resolution of problems.

This activity aims to address and clarify doubts that students may have had while working on the problem sets, allowing them to better understand the material and correct any mistakes made.

In-person tutorials

Students will have access to a number of scheduled hours during which professors will be available to answer questions in person.

The proposed teaching methodology may be subject to change depending on any restrictions on in-person attendance imposed by health authorities.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Deliverables and continuous assessment	20%	2	0.08	CM01, CM02, CM04, CM20, CM21, CM23, KM02, KM19, SM01, SM02, SM03, SM21, SM22
Final exam	50%	2	0.08	CM01, CM02, CM04, CM20, CM21, KM02, KM19, SM01, SM02, SM03, SM21, SM22
Parcial exam	30%	1.5	0.06	CM01, CM02, CM04, CM20, CM21, KM02, KM19, SM01, SM02, SM03, SM21, SM22

This module does not include single-assessment evaluation.

Assessment Criteria

The midterm exam will account for 30% of the final average grade of the course.

The final exam will account for 50% of the final average grade of the course.

Thus, the final average grade is calculated as follows:

Final average grade =
30% (midterm exam grade) +
50% (final exam grade) +
20% (grade from exercises/assignments/laboratory tests)

The course will be considered passed if the following two requirements are met:

- The final average grade is equal to or greater than 5, and
- The final exam grade is equal to or greater than 3.

If a student meets the first requirement but not the second, they will receive a final average grade of 4.5 and may take the reassessment exam, according to the conditions outlined in the "Reassessment Process" section below.

If a student meets the second requirement but not the first, or neither of the two, they may still take the reassessment exam, under the same conditions.

A student who has not participated in any assessment activity will be considered "Not assessable."

Assessment Schedule

The dates of the various assessment activities (midterm exams, in-class exercises, assignment submissions, etc.) will be announced well in advance during the semester.

The date of the final exam is scheduled in the Faculty's official exam calendar.

"Assessment activities may not be rescheduled, except in cases of exceptional and duly justified reasons that prevent the student from attending an evaluation activity.

In such cases, the academic program coordinators, after consultation with the teaching staff and affected students, will propose a new schedule within the corresponding academic period."

(Section 1, Article 264 - Assessment Activities Calendar, UAB Academic Regulations)

Students from the Faculty of Economics and Business who, according to the above, need to reschedule an assessment must submit a request by filling out the form:

Assessment Rescheduling Request: e-Form for Rescheduling Assessments.

Grade Review Procedure

Coinciding with the final exam, the date and method of publication of the final grades will be announced. Details regarding the procedure, location, date, and time of the exam review session will also be provided, in accordance with university regulations.

Reassessment Process

"To participate in the reassessment process, students must have been previously assessed in activities representing at least two-thirds of the total grade for the course or module."

(Section 2, Article 261 - Reassessment, UAB Academic Regulations)

Students must have obtained a final average grade between 3.5 and 4.9.

The date of the reassessment exam will be scheduled in the Faculty's exam calendar.

If the student passes this exam, they will pass the course with a grade of 5. Otherwise, their original grade will remain unchanged.

Irregularities in Assessment

Without prejudice to other disciplinary measures deemed appropriate and in accordance with current academic regulations:

"If a student commits any irregularity that could lead to a significant alteration of the grade of an assessment activity, that activity will be graded with a 0, regardless of any disciplinary proceedings that may be initiated.

If multiple irregularities occur across different assessment activities in the same course, the final grade for that course will be 0."

(Section 11, Article 266 - Assessment Results, UAB Academic Regulations)

Bibliography

Basic Bibliography

Sydsæter, K., P.J. Hammond, and A. Carvajal, 2012, **Matemáticas para el Análisis Económico**. Prentice Hall, Madrid.

(Available online through the UAB library)

This is a widely accepted reference manual with a long-standing reputation. Thanks to its updated editions, it has become a standard reference work. It also covers the syllabus of the course *Mathematics for Economists I*. It is a comprehensive and accessible textbook focused on economic applications.

The same authors have another book at a slightly more basic level, available only in English, which is also a good option as a main textbook:

Sydsæter, K. and P.J. Hammond, 2012, **Essential Mathematics for Economic Analysis**. Fourth edition. Pearson Education.

Complementary Bibliography

The following manuals can be very useful for students, whether to complement the content of the main textbook or to expand their knowledge:

- Alegre, P., L. Jorba, F.J. Ortí, G. Rodríguez, J.B. Sáez, T. Sancho, and A. Terceño, 2000, *Solved Exercises in Business Mathematics II*. Editorial AlfaCentaur, Madrid.
- Besada, M., F.J. García, M.A. Mirás, and M.C. Vázquez, 2001, *Multivariable Calculus: Questions and Solved Exercises*. Prentice Hall, Madrid.
- Chiang, A.C., 2006, *Fundamental Methods of Mathematical Economics*. McGraw-Hill, Madrid.
- Larson, R., R. Hostetler, and B. Edwards, 2006, *Calculus II of Several Variables*. McGraw-Hill, Mexico.

Additional material will be uploaded to the course webpage on the Virtual Campus, at the discretion of the teaching staff.

Software

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Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Spanish	second semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	4	English	second semester	morning-mixed
(PAUL) Classroom practices	8	English	second semester	morning-mixed
(PAUL) Classroom practices	51	Spanish	second semester	afternoon
(PAUL) Classroom practices	52	Catalan	second semester	afternoon
(PAUL) Classroom practices	60	Spanish	second semester	morning-mixed
(TE) Theory	1	Spanish	second semester	morning-mixed
(TE) Theory	2	Catalan	second semester	morning-mixed
(TE) Theory	4	English	second semester	morning-mixed
(TE) Theory	8	English	second semester	morning-mixed
(TE) Theory	51	Catalan	second semester	afternoon
(TE) Theory	52	Catalan	second semester	afternoon
(TE) Theory	60	Spanish	second semester	morning-mixed