

Mathematics I

Code: 102345
ECTS Credits: 6

Degree	Type	Year	Semester
2501572 Business Administration and Management	FB	1	1
2501573 Economics	FB	1	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: Yes
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: Yes

Teachers

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Laia Egea Cortes
Pol Orobítg Bernades

Prerequisites

Entry level pre-requisites have not been established. However, enrolment in the course requires the student to have achieved a knowledge of mathematics at a secondary/high school level. It is strongly recommended that those students who do not meet those standards, or those having difficulties in mathematics (in particular those who have not studied higher levels maths in high school) enrol in the preparation programme organised by the Faculty and/or other preparatory courses in order to achieve the minimal tools required to pass the course satisfactorily.

Objectives and Contextualisation

The objective of the Mathematics I course is to bring all students to a certain level of mathematics that will allow them to acquire and consolidate the knowledge and skills necessary to understand and correctly manipulate basic mathematical concepts and carry out the analysis of a real variable. In addition, the student must be capable of applying such knowledge to simple models and problems as they pertain to an economics and business context. The skills and knowledge acquired in Mathematics I, together with Mathematics II, will afford the student the necessary tools to study more advanced subjects.

For this reason, the objectives that are intended to be achieved are the following:

1. To familiarise the student with the formulation and mathematical reasoning.
2. To introduce the role of mathematical models in economics and business.
3. To identify and know how to deal with the main families of functions.

4. To work with derivatives and to solve function limits of one variable.
5. To understand and to know how to determine the basic properties that exhibit the functions of one variable.
6. To represent functions of one variable graphically.
7. To solve optimisation problems in one variable.
8. To determine and calculate antiderivatives using basic integration techniques.

Competences

Business Administration and Management

- Apply mathematical instruments to synthesise complex economic-business situations.
- Capacity for oral and written communication in Catalan, Spanish and English, which enables synthesis and oral and written presentation of the work carried out.
- Demonstrate an understanding of mathematical language and some methods of demonstration.
- Organise the work in terms of good time management, organisation and planning.
- Use of the available information technology and adaptation to new technological environments.

Economics

- Apply mathematical instruments to synthesise complex economic-business situations.
- Capacity for independent learning in the future, gaining more profound knowledge of previous areas or learning new topics.
- Demonstrate an understanding of mathematical language and some methods of demonstration.
- Demonstrate initiative and work individually when the situation requires it.
- Organise the work in terms of good time management, organisation and planning.
- Select and generate the information necessary for each problem, analyse it and take decisions based on that information.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills in order to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Use of the available information technology and adaptation to new technological environments.

Learning Outcomes

1. A capacity of oral and written communication in Catalan, Spanish and English, which allows them to summarise and present the work conducted both orally and in writing.
2. Analyse and draw functions.
3. Analytically consider and solve optimisation problems in the context of the economy.
4. Be able to work with inequalities and sequences.
5. Calculate and study the extrema of functions.
6. Calculate the functional integrals of a variable.
7. Capacity to continue future learning independently, acquiring further knowledge and exploring new areas of knowledge.
8. Deduce the properties of a function based on its graph.
9. Demonstrate initiative and work independently when required.
10. Organise work, in terms of good time management and organisation and planning.
11. Solve problems that involve considering integrals in problems in the context of the economy (consumer and producer surplus, etc.).

12. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
13. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
14. Students must develop the necessary learning skills in order to undertake further training with a high degree of autonomy.
15. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
16. Use available information technology and be able to adapt to new technological settings.
17. Work intuitively, geometrically and formally with the notions of limits, derivatives and integrals.

Content

PART I. INTRODUCTION

Topic 1. BASIC CONCEPTS

- 1.1. Basics: variables, constants, parameters, equations and identities
- 1.2. Sets. Basic operations and properties of sets
- 1.3. Real numbers: definition and absolute value
- 1.4. The real line: distance, inequalities, and intervals

Topic 2. BASICS OF ALGEBRA AND BASIC OPERATIONS

- 2.1. Growth rates
- 2.2. The use of logarithms. Applications to the economy
- 2.3. Calculation with fractions, powers and roots
- 2.4. Simplification of mathematical expressions

PART II. STUDY AND REPRESENTATION OF FUNCTIONS

Topic 3. FUNCTIONS

- 3.1. Real functions of one variable; domain and image
- 3.2. Types of functions and their properties
- 3.3. Operations with functions

Topic 4. CONTINUITY

- 4.1. Limits and indeterminate forms
- 4.2. Study of the continuity of a function. Types of discontinuities

Topic 5. DIFFERENTIATION

- 5.1. The concept of derivative. Economic and geometric interpretation
- 5.2. The derived function. Differentiation rules

Topic 6. STUDY AND REPRESENTATION OF FUNCTIONS

- 6.1. Differentiable functions

- 6.2. Basic study of functions; intercepts and symmetries
- 6.4. Monotone functions. Increasing, decreasing and local stationary points
- 6.5. Curvature of functions. Concavity, convexity, maximum, minimum and inflection points
- 6.6. Asymptotes
- 6.7. Plotting functions

PART III. SINGLE-VARIABLE OPTIMISATION

Topic 7. SINGLE-VARIABLE OPTIMISATION

- 7.1. Local stationary points and extrema
- 7.2. Optimisation over closed intervals. The Weierstrass theorem

PART IV. PRINCIPLES OF INTEGRATION

Topic 8. INTRODUCTION TO INTEGRATION

- 8.1. The concept of integral
- 8.2. Anti-derivatives and calculation of integrals
- 8.3. Definite integrals

Topic 9. METHODS OF INTEGRATION

- 9.1. Integration by substitution
- 9.2. Integration by parts

Methodology

Teaching will be offered on campus or in an on-campus and remote hybrid format depending on the number of students per group and the size of the rooms at 50% capacity.

To achieve the objectives previously outlined, the following types of activities will be used:

1. Theoretical lectures where teachers will present the main concepts

The objective of this activity is to present the fundamental notions of the subject, and to facilitate their learning through the analysis of examples, which will emphasise both intuitive aspects and applications and explanations in the field of Economics.

2. Practical classes where the problem solving will be discussed

This activity has the purpose to answer doubts that students may have encountered during the resolution of the problems and to correct possible errors committed. The presentation of solutions by students will be prioritised, either orally as a first step in their discussion, or in written form.

3. Problem solving by students (independent work)

Each topic will have a list of associated problems, which the students will have to solve independently. This activity has a dual objective of allowing the student to demonstrate that he/she has assimilated the theoretical concepts and work tools presented in class and that he/she has acquired the necessary skills to solve exercises and problems.

4. Attending office hours

The student will have access to some tutorials with the teacher that presents the course, in order to address doubts that may have arisen during the study of the subject and in the resolution of the problems. Due to the use of mathematical symbols that this activity implies, the tutorials will be developed in person.

The proposed teaching methodology may undergo some modifications according to the restrictions imposed by the health authorities on on-campus courses.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem sets resolution	17	0.68	2, 5, 6, 1, 8, 4, 10, 3, 11, 17, 16
Theory lectures	32.5	1.3	2, 5, 6, 8, 4, 3, 11, 17
Type: Supervised			
Follow-up of homework	3	0.12	2, 5, 6, 1, 8, 4, 10, 3, 11, 17, 16
Tutorships	3.5	0.14	2, 5, 6, 1, 8, 4, 10, 3, 11, 17, 16
Type: Autonomous			
Study	90.5	3.62	2, 5, 6, 1, 8, 4, 10, 3, 11, 17, 16

Assessment

The evaluation of the course will be carried out in a continuous way, through partial assessments and a final exam. The type of activities and their relative weight in the final note is the following:

- Final exam: 50% of the final mark (it will include the totality of the syllabus)
- Mid-term exam: 30% of the final mark
- Continuous assessment activities: a total of 20% of the final mark

The final grade will be the weighted average of all the activities. The minimum mark for any activity is not set.

If, once applied the above mentioned percentage the mark achieved is 5 or higher, the course is considered as passed and this will not be subject to a new evaluation. In case of a grade less than 3.5, the student will have to sit it again in the following year. For those students who have obtained a grade that is equal to or greater than 3.5 and less than 5 there will be a re-take exam. The teachers of the subject will decide the modality of this re-take exam. This re-take exam is scheduled in the last week of the semester. The re-take exam grade will be qualitative and will only have two possible options: PASS or NO PASS. If the student obtains a PASS grade, it is considered that they have passed the subject with a maximum numerical grade equal to 5. If the student obtains a NO PASS score, they do not have passed the subject and the final grade will be equal to the one obtained before the re-take exam.

A student is considered to be "Not Evaluated" in the subject as long as he/she has not participated in any of the assessment activities. Therefore, it is considered that a student who carries out some components of the continuous assessment modality can no longer opt for a "Not Evaluated".

Students attending the subject for the second, third or fourth time have the option to follow the continuous modality or to sit directly and only the final exam, which will count 100% of the final grade.

The choice of this last option must accordingly be notified to their teacher during the first weeks of the semester, prior to any of the continuous evaluation activities. Submission of any of such activities shall be understood as to implicitly waiving this option.

Both the mid-term and the final exams will be common to all the bachelor grades of the Faculty and they will be carried out on the same day and at the same time (the mid-term will take place either in the morning or in the afternoon, according to the group the student was previously assigned to).

Students must be examined in the classroom assigned to the group where they are enrolled. Doing the exam in the classroom assigned to another group may entail invalidation of the exam and it will be classed as 'Not-attended'.

Calendar of evaluation activities

The dates of the evaluation activities (midterm exams, exercises in the classroom, assignments, ...) will be announced well in advance during the semester.

The date of the final exam is scheduled in the assessment calendar of the Faculty.

"The dates of evaluation activities cannot be modified, unless there is an exceptional and duly justified reason why an evaluation activity cannot be carried out. In this case, the degree coordinator will contact both the teaching staff and the affected student, and a new date will be scheduled within the same academic period to make up for the missed evaluation activity." **Section 1 of Article 115. Calendar of evaluation activities (Academic Regulations UAB).** Students of the Faculty of Economics and Business, who in accordance with the previous paragraph need to change an evaluation activity date must process the request by filling out an Application for exams' reschedule https://eformularis.uab.cat/group/deganat_feie/nou-reprogramacio-de-proves

Grade revision process

After all grading activities have ended, students will be informed of the date and way in which the course grades will be published. Students will also be informed of the procedure, place, date and time of grade revision following University regulations.

Retake Process

"To be eligible to participate in the retake process, it is required for students to have been previously been evaluated for at least two thirds of the total evaluation activities of the subject." Section 3 of Article 112 ter. The recovery (UAB Academic Regulations). Additionally, it is required that the student to have achieved an average grade of the subject between 3.5 and 4.9.

The date of the retake exam will be posted in the calendar of evaluation activities of the Faculty. Students who take this exam and pass, will get a grade of 5 for the subject. If the student does not pass the retake, the grade will remain unchanged, and hence, student will fail the course.

Irregularities in evaluation activities

In spite of other disciplinary measures deemed appropriate, and in accordance with current academic regulations, *"in the case that the student makes any irregularity that could lead to a significant variation in the grade of an evaluation activity, it will be graded with a 0, regardless of the disciplinary process that can be instructed. In case of various irregularities occur in the evaluation of the same subject, the final grade of this subject will be 0"*. **Section 10 of Article 116. Results of the evaluation. (UAB Academic Regulations).**

The proposed evaluation activities may undergo some changes according to the restrictions imposed by the health authorities on on-campus courses.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activities to be delivered	20%	0.5	0.02	2, 5, 6, 8, 4, 10, 3, 15, 14, 13, 12, 11, 17, 16
Final exam	50%	2	0.08	2, 5, 6, 1, 7, 8, 9, 4, 10, 3, 11, 17, 16
Mid-term exam	30%	1	0.04	2, 5, 6, 1, 7, 8, 9, 4, 10, 3, 11, 17, 16

Bibliography

Main textbooks:

- Sydsaeter, K. P.J. Hammond, A. Strom i A. Carvajal. *Essential Mathematics for Economic Analysis*. Fifth edition. Pearson Education (2016).

Complementary textbooks:

- Alejandro, F., F. Llerena, i C. Villela, *Problemes de matemàtiques per a econòmiques i empresarials*, Editorial Media (1995).
- Chiang, A.C., *Fundamental Methods of Mathematical Economics*, McGraw-Hill. (2005).
- Hoffmann, L.D., G.L. Bradley, G., and K.H. Rosen, 2005, *Applied Calculus for Business, Economics, and the Social and Life Sciences*, McGraw-Hill (2005).
- Alegre, P., L. Jorba, F.J. Orti, G. Rodriguez, J.B. Saez, T. Sancho i A. Terceño, *Ejercicios Resueltos de Matemáticas Empresariales II*. Editorial Alfacentaur, Madrid (2000).

Software

No special software will be used.