Universitat Autònoma de Barcelona

Mathematics I

2016/2017

Code: 102345
ECTS Credits: 6

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

Contact

Name: Ricard Esparza Masana
Email: Ricard.Esparza@uab.cat

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

Sergio Baena Mirabete
Antonio Angel Martinez Chamizo
Maria del Mar Gómez Pujalte

Prerequisites

Being a course in the first semester of the first course of the degree, obviously it will not be necessary to have previously attained any knowledge or skills given by any of the courses of the degree. However, the course cannot "start from scratch" since the learning of mathematics is part of the studies in secondary school. Basic knowledge of algebraic manipulation like solving first and second degree equations, algebraic simplification, working with elemental mathematical functions, etc. will ease the achievement of the competences of the course. Even though the first two chapters of the program are devoted to these issues, starting the course having revised them will prove useful.

Objectives and Contextualisation

In the education of any student of the area of economics, the courses of mathematics have a dual function. On the one hand, they convey the set of concepts, tools of consistent reasoning and technical tools necessary for the proper development of many other subjects using quantitative analysis. On the other hand, they provide the opportunity for an in-depth analysis of important issues dealing with the setting and solving problems in the economic and business environment.

In this sense, the course of Mathematics I has a leveling role that should enable students to acquire and consolidate their knowledge and skills to correctly understand and handle basic mathematical concepts and tools of real univariate analysis. Also, the course must allow to work with simple models inspired by economics and business problems.

The objectives of the course are thus,

1. To familiarize students with the mathematical formulation and reasoning.
2. To introduce the role of mathematical models in economics and business.
3. To identify and learn how to manipulate the main families of functions.

4. To working with derivatives and solve limits of functions of one variable.
5. To understand and learn how to determine the basic properties of real functions of one variable. 6. To introduce the graphical representation techniques of functions of one variable.

7. To solve optimization problems in one variable. 8. To learn the basic integration techniques.

At the end of the course, students must be able to use the elementary calculus techniques (derivatives, limits, integration), to explain the way these techniques are used, and to apply them to particular functions and models, as well as to develop coherent reasoning.

Basic training in mathematics continues with the courseMathematics II dealing with the study of real functions of several variables. Thus, the achievement of the basic notions of analysis in real functions of one variable are also key to follow properly this sequel.

Skills

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

- Demonstrate an understanding of mathematical language and some methods of demonstration.

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. Deduce the properties of a function based on its graph.
8. Organise work, in terms of good time management and organisation and planning.
9. Solve problems that involve considering integrals in problems in the context of the economy (consumer and producer surplus, etc.).
10. Use available information technology and be able to adapt to new technological settings.
11. Work intuitively, geometrically and formally with the notions of limits, derivatives and integrals.

Content

Topic 1. **INTODUCTION**

1.1. Basic concepts: variables, constants, parameters, equations and identities

1.2. The real numbers: concept and absolute value

1.3. The real number line: distance, inequalities, inequations, and intervals

1.4. Sets

Topic 2. **FUNCTIONS**

2.1. Real functions of one variable: domain and images; graphic representation

2.2. Types of functions and graphic representation

2.3. Operations with functions; composition and inverse functions

Topic 3. **CONTINUITY**

3.1. Limits and behaviour of functions

3.2. Continuity and discontinuity

3.3. The intermediate value theorem

Topic 4. **DERIVATION**

4.1. The concept of derivative. Economic and geometric interpretation

4.2. The derivate function. Derivation rules

Topic 5. **DIFFERENTIATION AND BEHAVIOUR OF FUNCTIONS**

5.1. Characteristics of differentiable monotonous functions

5.2. Monotonous intervals of functions. Increase, decrease and local extremes

5.3. Concavity and convexity of functions

5.4. Curvature of functions. Maximum, minimum, and inflection points

5.5. Limits and indeterminacies. Hôpital's rule

5.6. Asymptotes

5.7. Graphic representation of functions

Topic 6. **ONE-VARIABLE OPTIMISATION**

6.1. Optimisation problems. Local extremes and optimal solutions

6.2. Optimisation in closed intervals. The Weierstrass theorem

6.3. Local maximum and minimum points. Necessary and sufficient conditions

6.4. Determination of the optimal solution

Topic 7. **INTEGRATION**

7.1. The concept of integral

7.2. Primitives and integral calculations

7.3. Integrals by parts

7.4. Integrals by substitution

Methodology

To achieve the objectives of the course, the following taxonomy of activities will be used:

1. Theory classes where teachers develop the main concepts.

The objective of this activity is to present the fundamental notions of course, and to facilitate their learning through the analysis of examples illustrating the intuitions and economic applications.

2. Exercises sessions devoted to the resolution of problems.

This activity aims to discuss and answer any questions that students may have in solving the problem sets, and at the same time to correct mistakes. These sessions will also stimulate the participation of students presenting the solutions of the problem sets either orally or in written form.

3. Organized supervised activities, to apply the concepts studied to economic situations

The objective of this activity is to encourage the student to establish links between the mathematical tools and their use in economics. When possible, these sessions will be organized in small groups of students.

4. Problem solving by students

Each topic will have a list of associated problems that must be solved independently by students.
The objective of this activity is two-fold: on the one hand it aims at the reinforcement of the theoretical concepts and tools exposed in the theory sessions; on the other hand it aims at the acquisition of the skills required to solve exercises and problems.
We promote the cooperative resolution of problems in stable working groups of 3 or 4 students throughout the semester, to stimulate team work to overcome the difficulties that may arise to their components.

5. Tutorial attendance

Students have several hours where the teachers of the course may help them to resolve any doubts that may arise in the

study of the course and in the solution of the problem sets. These sessions cannot be on-line, but face-to-face between the teacher and the students.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Preparing and solving exercises	15	0.6	2, 5, 6, 1, 7, 4, 8, 3, 9, 11, 10
Theory classes	30	1.2	2, 5, 6, 7, 4, 3, 9, 11
Type: Supervised			
Follow-up of homework	3	0.12	2, 5, 6, 1, 7, 4, 8, 3, 9, 11, 10
Tutorships	7	0.28	2, 5, 6, 1, 7, 4, 8, 3, 9, 11, 10
Type: Autonomous			
Study	90	3.6	2, 5, 6, 1, 7, 4, 8, 3, 9, 11, 10

Evaluation

The course's evaluation will be carried out in a continuous way, through mid-term and final evaluations. The typology of activities and their share on the final grade are the following:

- Final exam: 60% of the final grade

- Mid-term exam: 30% of the final grade

- Deliverable activities: 10% of the final grade

Additionally, one or more activities will be proposed to students, allowing them to get extra marks according to its/their results. Professors will inform on this/these activity/activities during the course.

Final Exam: It is a comprehensive exam of all the topics of the course. The maximum resolution time is 2 hours. All students are required to take the final exam and participate in all the other assessment activities on the dates indicated in the academic calendar. No evaluation activities will be programmed outside of the dates indicated.

If using the weights mentioned above a student's grade is 5 or higher, the course will be considered as passed and it can not be the subject of a new assessment. In the case of a grade below 4, the student must retake the course the following year. For those students who have obtained a grade equal to or greater than 4 and less than 5 there will be a re-evaluation. Teachers will decide the design of the re-evaluation. The re-evaluation is scheduled in the last week of the semester. Its grtading will be qualitative and only admit two possible outcomes: pass or fail. A student obtaining a grade of PASS is considered to have passed the course with a maximum numerical grade equal to 5. If the student receives a grade of fail, fail the course and the final grade will be equal to the grade obtained before the re-evaluation.

A student is considered "no graded" on the subject only if he/she has not participated in any of the evaluation activities. Therefore, the participation in a single or the several activities eliminates the no graded outcome.

Code of honor: Without prejudice to other disciplinary action deemed appropriate and in accordance with current academic standards, any irregularity committed by the student that may lead to a change in the qualification of an act of assessment will convey a grade of zero. Therefore, copying or allowing to copy in any assessment activity will involve suspending it with a zero. Also, if passing such activity is necessary to pass the course, the entire course will be graded as fail. The activities failed due to violations of the code of honor will not be recoverable by the assessments described and the course will be graded as fail directly without the opportunity to recover in the same academic year.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Activities to be delivered	10%	2	0.08	2, 5, 6, 7, 4, 8, 3, 9, 11, 10
Final exam	60%	2	0.08	2, 5, 6, 1, 7, 4, 3, 9, 11
Mid-term exam	30%	1	0.04	2, 5, 6, 1, 7, 4, 3, 9, 11

Bibliography

Main textbooks:

- Sydsaeter, K. and P.J. Hammond, 1995, Mathematics for Economic Analysis. London, Prentice Hall.
- Sydsaeter, K. and P.J. Hammond, 2002, Essential Mathematics for Economic Analysis. London, Prentice Hall.

Complementary textbooks:

- Alejandre, F., F. Llerena, and C. Villela, 1995, Problemes de matemàtiques per a econòmiques i empresarials, Editorial Media.
- Chiang, A.C., 2005, Fundamental Methods of Mathematical Economics, McGraw-Hill. Demidovich, B.P., 1976, Problems in Mathematical Analysis, Moscow, MIR Publishers.

- 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.
- Larson, R., R. Hostetler, and B. Edwards, 1994, Calculus with Analytic Geometry, Lexington, D.C. Heath.