

1. OVERVIEW

Subject area	Mathematics: Algebra and Calculus
Degree	Bachelor's Degree in Business Analytics
School/Faculty	Social Sciences and Communication
Year	1st
ECTS	6 ECTS
Type	Core
Language(s)	Spanish
Delivery Mode	On campus
Semester	First semester
Year	2024/2025
Coordinating professor	Sara Sanchez Ruesgas

2. INTRODUCTION

“Mathematics: Algebra and Calculus” forms part of the core module of the Bachelor’s Degree in Business Analytics.

The main objective of the subject area is to provide students with a solid foundation in various basic aspects of Algebra and Calculus, which on the one hand will allow students to understand the basis of computer science, firmly rooted in Boolean algebra and, on the other hand, to provide mathematical knowledge necessary to solve complex problems required in business calculation.

Therefore, the Mathematics subject area focuses on the study of differential and integral calculus, both of which are necessary for the analysis of non-discrete functions, i.e. functions that depend on the trajectory and not only on the initial and final stages. In addition, it will provide students with knowledge on mathematical methods that can be applied to problem-solving, such as matrices or linear systems. With this, the students will have the necessary tools to face mathematical problems of great complexity.

The presence of Mathematics in economics and business is essential for describing complex economic relationships and formulating propositions on behavioural relationships. Essentially, all areas of mathematics are applicable to any branch of economics. For example, algebra is useful for data presenting and processing, input-output analysis, accountancy analysis, financial modelling, the study of statistical roles and econometric models, activity planning through mathematical programming, and business management and control.

On the other hand, functional analysis is used to find good statistical adjustment models, to study qualitative and quantitative models in economics, to distribute and allocate resources or to plan activities efficiently. Dynamic analysis is used in dynamic economics to trace useful temporal trajectories to quantitatively and qualitatively view the evolution of economic variables. It also allows for the study of economic behaviour in the short/medium/long term, being at the basis of economics.

3. SKILLS AND LEARNING OUTCOMES

Basic skills (CB, by the acronym in Spanish):

- CB1 - Students have shown their knowledge and understanding of a study area that builds on general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.
- CB3: Students have the ability to gather and interpret relevant data, normally within their area of study, to form opinions which include reflecting on relevant social, scientific or ethical matters.

Specific skills (CE, by the acronym in Spanish):

- CE16: Ability to use the mathematical tools necessary to solve economic problems and use basic methods of calculation, algebra and programming.
- CE31: Ability to manage uncertainty due to constantly changing information sources.

Learning outcomes (RA, by the acronym in Spanish):

By the end of the subject, the student should be able to:

- RA1: Accurately pose a problem with a mathematical formulation.
- RA2: Solve a problem using appropriate mathematical language and selecting the optimal method to do so.
- RA3: Use software for statistical analysis, numerical and symbolic calculation, graphic visualisation, optimisation, etc., in order to experiment in mathematics and solve problems.
- RA4: Participate in group work, taking responsibility for their assigned tasks and presenting results orally and in writing.

The following table shows how the skills developed in the subject area relate to the intended learning outcomes:

Skills	Learning outcomes (RA, by the acronym in Spanish)
CB1, CB3, CE16	RA1: Accurately pose a problem with a mathematical formulation.
CB1, CE16, CE31	RA2: Solve a problem using appropriate mathematical language and selecting the optimal method to do so.
CB1, CE16	RA3: Use software for statistical analysis, numerical and symbolic calculation, graphic visualisation, optimisation, etc., in order to experiment in mathematics and solve problems.
CB3, CE16	RA4: Participate in group work, taking responsibility for their assigned tasks and presenting results orally and in writing.

4. CONTENTS

- Differential calculus.
- Integral calculus.

- Numerical methods.
- Solving linear systems.
- Calculus with matrices.
- Eigenvalue and eigenvector.
- Diagonalisation.
- Conics and quadrics.

These will develop during the course in the following units:

Unit 1: DIFFERENTIAL CALCULUS OF FUNCTIONS 1.1

Basic functions. Domain.

1.2 Limits and continuity

1.3 Derivability

1.4 Local study of functions

1.5 Function optimization

1.6 Economic applications

The learning outcomes of this unit are: To know the basic functions; to calculate the domain of any function; to know the limit of a function concept and calculate the limit of a function at a point and solve indeterminacies; to know the definition of a continuous function at a point and discontinuity; to know the definition of the derivative of a function at a point and how its applied to the study of a function.

Unit 2: INTEGRAL CALCULUS OF FUNCTIONS OF A VARIABLE.

3.1 Concept of integral

3.2 Methods of integration

3.3 Economic applications

Learning Outcomes: To know the concept of integral and know and understand how to apply basic methods of integration.

Unit 3: NUMERICAL METHODS.

3.1 Basic concepts

3.2 Least-squares adjustment

3.3 Other numerical analysis methods

Learning Outcomes: To introduce students to numerical methods for real mathematical problem-solving.

UNIDAD 4: LINEAR ALGEBRA: Solving systems of equations and matrix analysis

4.1 Introduction to linear algebra

4.2 Matrices and determinants

4.3 Systems of linear equations

4.4 Economic applications

4.5 Eigenvalue and eigenvector.

4.6 Diagonalizable matrix and transition matrix

Learning Outcomes: To know systems of linear equations and their expression in matrix forms; to know matrix operations and how to calculate determinants; to know different methods of solving systems of linear equations using matrices and determinants.

Unit 5: Conics and quadrics.

5.1 Matrix associated with a quadratic form.

5.2 Conic classification.

5. TEACHING-LEARNING METHODS

The types of teaching-learning methods are as follows:

- Lectures
- Case studies
- Workshop-based learning

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

Learning activity	Number of hours
Asynchronous	20 h
Asynchronous lectures	10 h
Independent working	46 h
Case studies and problem-solving	30 h
Workshops and/or laboratory work	34 h
Tutorials	10 h
TOTAL	150 h

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

Assessment system	Weighting
Knowledge tests	50%
Reports and papers; Oral presentations. Group activities	20%
Solving application exercises, case study analysis, solving case studies/problem scenarios, reports and papers. Individual tasks	20%
Laboratory work	10%

On the Virtual Campus, when you open the subject area, you can see all the details of your assessable tasks and the deadlines and assessment procedures for each task.

7.1. Ordinary exam period

To pass the subject area in the ordinary exam period you must obtain a grade higher than or equal to 5.0 out of 10.0 in the final grade (weighted average) for the subject area. In particular, the weighted average mark of all the proposed activities grouped by blocks (or, where appropriate, those indicated by the teacher) must be higher than or equal to 5, and a mark higher than or equal to 4 (out of 10) must be obtained in the knowledge tests. The final grade will be the weighted average of the activities, achieving a final grade of at least 5 (out of 10) in the subject area.

In the event that the student does not comply with any of these requirements, the final grade of the subject area will be:

- The weighted average if its value is less than or equal to 4.
- 4 if the value of the weighted average is higher than 4.

The grade in the ordinary exam period will appear as NP (No grade reported) if the student fails to submit any assessable task which counts towards the weighted average.

7.2. Extraordinary exam period (resits)

To pass the subject area in the ordinary exam period you must obtain a grade higher than or equal to 5.0 out of 10.0 in the final grade (weighted average) for the subject area.

In any case, it is necessary that you obtain a grade higher than or equal to 4.0 in the final exam, so that it can be averaged with the rest of the tasks.

Tasks not passed in the ordinary exam period, or those not delivered, must now be delivered after having received the relevant corrections to them by the teacher.

8. TIMELINE

The timeline with delivery dates of assessable tasks in the subject area is indicated in this section:

Assessable tasks	Date
Diagnostic test/Levelling course	Weeks 0-2
Solving individual and/or group exercises	Weeks 1-3
Solving individual and/or group exercises	Weeks 4-7
Intermediate objective test	Weeks 9-10
Solving individual and/or group exercises	Weeks 10-13

Presentation of group work	Weeks 14-18
Solving individual and/or group exercises	Weeks 14-16
Intermediate objective test	Weeks 16-17
Integrative final test	Weeks 18-19

The timeline may be subject to modifications for logistical reasons. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

Useful reference books are listed below. They are all available in the Universidad Dulce Chacón library as a reference or for lending:

As an introduction and revising:

- García Pineda y colb. Iniciación a la Matemática Universitaria. Curso 0. Thomson

To complete:

- Alamillos, am, et.al.: Matemáticas para la Economía, Administración y Dirección de Empresas. ED Universitas
- Balbás, a, et. al. (1998) Análisis matemático para la economía (tomos I y II), Editorial AC. Madrid.
- Larson, et.al. (1999) Cálculo. (volúmenes 1 y 2). Editorial McGraw-Hill. Madrid.
- Burgos, J.(1993) Álgebra lineal. Editorial McGraw-Hill. Madrid. • Balbás, A, et. al.(1990) Programación matemática. Editorial AC. Madrid.
- Tan. S.T.(1998) Matemática para Administración y Economía. International Thomson Editores. México.
- Borbolla, R (2000) Optimización, cuestiones, ejercicios y aplicaciones a la economía. Prentice Hall.

Other digital resources:

- Para reforzar conocimientos previos se recomienda realizar el curso de nivelación *BASIC STEAM-Matemáticas* y revisar los videos del Canal de videos docentes AulaUE: [Aula UE - YouTube](#)

10. DIVERSITY AWARENESS UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

1. Accompaniment and follow-up by means of counselling and personalized plans for students who need to improve their academic performance.
2. In terms of attention to diversity, non-significant curricular adjustments are made in terms of methodology and assessment for those students with specific educational needs, pursuing an equal opportunities for all students.
3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:

orientacioneducativa@universidadeuropea.es

11. STUDENT SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, the degree and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the degree.

Many thanks for taking part.