Universidad de Navarra

Quantitative Methods I A

Teaching guide 2025-26

ACADEMIC YEAR 2025-2026

INTRODUCTION

Course Description: This course aims to provide the essential tools of Differential and Integral Calculus, which are necessary in order to succeed in the subsequent courses that you are studying in the degrees of Economics, Management, and Business Administration.

- **Degrees**:
  - *Grado en Administración y Dirección de Empresa bilingüe* + Data Analytics & Artificial Intelligence Program (Ab+DA)
  - *Grado en Administración y Dirección de Empresa bilingüe +* Finance & Accounting Program (Ab+FA)
- **Module:** *III. Métodos Cuantitativos* **/Course**: *III.1. Métodos Cuantitativos*
- **ECTS**: 6 (150 working hours)
- **Year:** 1st **/ Semester**: 1st
- **Type**: Basic
- **Instructors**:
  - David Puig Pomés (dpuigp@unav.es) - course coordinator
  - Juan Antonio Abello Durán (jabellodura@alumni.unav.es) - *Complemento de Métodos (sessions held in Spanish)*
  - Alfonso Mejía Córdoba (amejiacordo@alumni.unav.es) - *Complemento de Métodos (sessions held in Spanish)*
- **Language**: English
- **Lecture schedule and rooms**:

The use of electronic devices (cell phones, laptops, tablets, etc.) is NOT ALLOWED during class time.

- ***Ab+DA***
  - Tuesdays, 10:00 - 12:00, room 12 - Amigos Building (D. Puig)
  - Wednesdays, 12:00 - 14:00, room M5 - Amigos Building (D. Puig)
  - Fridays, 10:00 - 12:00, seminar room 24 - Amigos Building - *Complemento de Métodos* (A. Mejía)

- ***Ab+FA***
  - Tuesdays, 10:00 - 12:00, room 12 - Amigos Building (D. Puig)
  - Fridays, 8:00 -10:00, room M2 - Amigos Building - *Complemento de Métodos* (J.A. Abello)
  - Fridays, 10:00 - 12:00, room 05 - Amigos Building (D. Puig)

LEARNING OUTCOMES (Competencies)

Basic Competencies

BC1 - Students must demonstrate that they possess and understand knowledge in an area of study based on a general secondary school education whose content often comes from advanced textbooks but also includes cutting-edge knowledge in this field of study.

General Competencies

GC4 - To use independent critical reasoning on relevant topics in economics and business.

PROGRAM

0- Introduction

0.1 Intervals and absolute value.

0.2 Inequalities. Systems of inequalities.

0.3 Linear and nonlinear systems of equations.

1- Sums

1.1 Summation notation. Rules for sums.

1.2 Applications: Newton's Binomial Formula and Price Indices.

1.3 Double sums.

2- Functions of one variable

2.1 Basic definitions: notation, domain, and range.

2.2 Linear functions. Economic models: supply, demand, and equilibrium point.

2.3 Quadratic functions. Economic models: quadratic optimization.

2.4 Polynomials. Factoring (remainder theorem, Ruffini). Polynomial division. Rational functions.

2.5 Power functions.

2.6 Exponential and logarithmic functions. Different bases. Properties. Equations. Models: population growth and compound interest.

3- Properties of functions

3.1 Shifting graphs. New functions from old ones. Composite functions.

3.2 Inverse functions.

4- Derivatives I

4.1 Definition of a derivative. Geometric interpretation: slopes of curves, tangents, and derivatives. Applications: increasing and decreasing functions, rates of change.

4.2 Limits: basic rules.

4.3 Rules for differentiation.

4.4 Chain rule.

4.5 Higher-order derivatives.

5- Derivatives II

5.1 Implicit differentiation.

5.2 Differentiating the inverse.

5.3 Approximations: linear and polynomial. Differentials. Taylor's formula.

5.4 Continuity. Intermediate value theorem.

5.5 Limits: asymptotes, indeterminate forms, L'Hôpital's rule.

6- Integrals

6.1 Indefinite integrals: rules.

6.2 Definite integrals: properties. Areas.

6.3 Economic applications: consumer and producer surplus.

6.4 Integration by parts.

6.5 Integration by substitution. Rational integrals.

6.6 Improper integrals: infinite intervals of integration, integrals of unbounded functions (optional).

7- Single-variable optimization

7.1 Simple tests for extreme points.

7.2 Economic examples.

7.3 The extreme value theorem.

7.4 Local extreme points. First and second derivative tests.

7.5 Inflection points. Concavity and convexity.

EDUCATIONAL ACTIVITIES

The course includes different face-to-face and non-face-to-face activities.

Face-to-face activities

- Theoretical/practical classes: 26 hours. In a plenary session, the professor will explain the theoretical concepts and their possible applications to Economics and Business. Students can complete these explanations by reading the recommended bibliography for the course and using other resources.

- Problem-solving classes: 50 hours. Every week, some exercises and problems corresponding to the theoretical class will be discussed and solved in a group session.
- Exams (midterm and final exams) and other tests: 6 hours. In addition to a midterm and a final exam, continuous evaluation tests will be held. The Faculty will fix the exam dates, which will be published in due course.

Total face-to-face activities: 82 hours

Non face-to-face activities

- Workout of exercises: 24 hours. For each chapter, students are expected to work out the exercises from the corresponding problem set to strengthen their knowledge of the topic.
- Personal study: 44 hours. The number of hours of personal study may vary depending on the student's background in mathematics.

Total non-face-to-face activities: 68 hours.

Students are expected to attend **all** classes and devote the due time for personal study to master the program of the subject and be prepared for all the tests and exams programmed through the semester. The professors will be available to clarify doubts from the students, as detailed in the section on *Office Hours*.

ASSESSMENT

*** ATENCIÓN: Se recuerda que cualquier intento de fraude, copia, plagio u otro comportamiento irregular supone una infracción grave tal y como está contemplado en el título IV "Normas de disciplina académica de los estudiantes" dentro del** Sistema de normas sobre la convivencia en la Universidad de Navarra

ORDINARY EVALUATION (December)

- The following function will determine the final grade of the subject, provided that the student obtains a grade greater than or equal to 5 points out of 10 in the final exam in December:

$$max\{0.1 \times CE + 0.3 \times ME + 0.6 \times FE, \quad 0.1 \times CE + 0.9 \times FE\} + B$$

, where:

  - *CE*: Continuous Evaluation grade (10%):
    - 5% attendance/participation in the three weekly sessions (minimum attendance 80% of all semester sessions).
    - 5%, exercises/tests (scheduled or unannounced) performed in any of the three weekly sessions.
  - *ME*: Midterm Exam grade (30%). Date: October 24th. Contents: [Chapter 0 to Chapter 4]. If the student does not attend the midterm exam, their grade will be 0 points.
  - *FE*: Final Exam grade (60%). Date: December 4th. Contents: [Chapter 0 to Chapter 7].
  - *B*: Group bonus (10%). Average scores of the group members (n=6). The members of the groups should work/study together to get the maximum bonus for the group:

Universidad de Navarra

$$B = \frac{1}{n}\sum_{i=1}^{n}\left(0.5 \times CE_i + 0.5 \times ME_i\right) \times 0.1$$

- If a student obtains a grade of fewer than 5 points out of 10 on the December exam, their final grade will be calculated as

$$FE + B$$

.

- If the student does not attend the final exam in December, their final grade will be: Not Presented.

EXTRA-ORDINARY EVALUATION (June)

- The following function will determine the final grade of the subject, provided that the student obtains a grade greater than or equal to 5 points out of 10 in the final exam in June:

$$max\left\{0.1 \times CE + 0.3 \times ME + 0.6 \times FE, \quad 0.1 \times CE + 0.9 \times FE\right\} + B$$

, where:

  - *CE*: Continuous Evaluation grade (10%): The grade obtained in the ordinary evaluation.
  - *ME*: Midterm Exam grade (30%). The grade obtained in the ordinary evaluation.
  - *FE*: Final Exam (June) grade (60%). Date: *to be announced*. Contents: Chapter 0 to Chapter 7.
  - *B*: Group bonus (10%). The grade obtained in the ordinary evaluation.
- If a student obtains a grade of fewer than 5 points out of 10 on the June exam, their final grade will be calculated as

$$FE + B$$

.

- If the student does not attend the final exam in June, their final grade will be: Not Presented.

Students with special educational needs

Universidad de Navarra

Students with special educational needs must contact the Academic Coordination Office of the (faculty/school) in advance to obtain the corresponding authorization for any adaptations (for example, extra time in exams). This authorization must then be sent by the student to the professor. It is recommended that this procedure be completed at the beginning of the semester.

OFFICE HOURS

Dr David Puig Pomés (dpuigp@unav.es)

- Office 3030 (3rd floor, tower), Amigos Building
- Hours: Tuesdays, 16:00 to 19:00. **A previous appointment by e-mail is required.**

BIBLIOGRAPHY AND RESOURCES

Basic bibliography:

- Sydsaeter, K., Hammond, P., Strom, A. (2012). *Essential Mathematics for Economic Analysis.* 5th Edition. Pearson. Find it in the Library

Additional bibliography:

- Chiang, A. and Wainwright, K. (2005). *Fundamental methods of Mathematical Economics.* 4th Edition. McGraw Hill. Find it in the Library
- Larson, R. and Edwards, B.H. (2011). *Calculus*. 9th Edition. McGraw Hill. Find it in the Library
- Sydsaeter, K., Hammond, P. y Cravajal, A. (2012). *Matemáticas para el análisis económico.* 2ª edición. Pearson. Find it in the Library (versión electrónica) Find it in the Library (versión impresa)