

COURSE GUIDE

**Mathematics**

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<b>Grado (Bachelor's Degree)</b>	Bachelor's Degree in Economics		<b>Branch</b>	Social and Legal Sciences			
<b>Module</b>	Formación Básica		<b>Subject</b>	Matemáticas			
<b>Year of study</b>	1º	<b>Semester</b>	1º	<b>ECTS Credits</b>	6	<b>Course type</b>	Core course

**PREREQUISITES AND RECOMMENDATIONS**

Pre-university level of mathematics

**BRIEF DESCRIPTION OF COURSE CONTENT (According to the programme's verification report)**

The contents developed in the program are mathematical calculation and Linear Algebra:

- Basic concepts of real functions of one variable.
- Differential and integral calculus of real functions of one variable.
- Optimisation of functions of one variable.
- Basics of vectors and matrices.
- Solving systems of linear equations.
- Matrix diagonalisation.
- Numerical sequences and series

**SKILLS**

**GENERAL SKILLS**

- CG02 - Habilidad de comprensión cognitiva
- CG03 - Capacidad de análisis y síntesis
- CG04 - Capacidad de organización y planificación
- CG08 - Capacidad para la resolución de problemas
- CG09 - Capacidad para la toma de decisiones
- CG16 - Capacidad de razonamiento crítico y autocrítico
- CG17 - Capacidad de aprendizaje y trabajo autónomo
- CG24 - Capacidad de aplicar los conocimientos en la práctica

**SUBJECT-SPECIFIC SKILLS**



- CE11 - Conocer y aplicar los conceptos básicos de Matemáticas
- CE12 - Utilizar las herramientas adecuadas del Algebra lineal y del Cálculo Diferencial en el análisis económico
- CE13 - Aprender métodos de integración y su aplicación al campo económico-empresarial
- CE14 - Conocer las series numéricas y aprender a calcular el valor de la suma en las series geométricas

## LEARNING OUTCOMES

1. Acquisition of the basic techniques of mathematics.
2. Gain the ability to lay out economic and business problems with mathematical language.
3. Relate the knowledge acquired with the typical concepts of other subjects of the degree (Statistics, Economic Theory, Accounting ...).
4. Solve problems in the economic and business environment using the most appropriate mathematical techniques.
5. Analyse the economic and business reality quantitatively.
6. Calculate the value of the sums in geometric series.
7. Adequately interpret graphs of functions of one variable.
8. Calculate derivatives and primitives of elementary functions.
9. Solve optimisation of functions of one variable.
10. Solve symbolically abstract matrix equations.
11. Calculate the determinants of low dimensional square matrices.
12. Calculate the inverse matrices of regular low dimensional matrices.
13. Calculate and interpret the eigenvalues and eigenvectors of square matrices.
14. Apply abstract knowledge to problems formulated with economic terminology.

## PLANNED LEARNING ACTIVITIES

### THEORY SYLLABUS

1. Basic notions on single-variable functions
  1. Intervals. Domain and range of a function.
  2. Elementary functions. Properties.
  3. Functions in Economics: supply, demand, incomes, costs, benefits, utility.
  4. Limit of a function. Continuity.
  5. Bolzano's theorem. Applications.
2. Differential and Integral Calculus of single-variable functions
  1. Derivatives: geometric interpretation and applications.
  2. Antiderivatives (primitive functions).
  3. Definite integrals. Barrow's rule.
  4. Optimization of single-variable functions
3. Optimization of single-variable functions
  1. Increase and decrease intervals. Concave and convex functions.
  2. Local and global extrema. Weierstrass theorem.



4. Basic notions on matrices
  1. General knowledge about matrices: notation, operations and properties.
  2. Computing determinants.
  3. Computing the inverse of a matrix.
  
5. System of linear equations
  1. Row reduction. Rank of a matrix.
  2. Gaussian elimination.
  3. Rouché- Fröbenius theorem ([Rouché–Capelli theorem](#)). Cramer's rule.
  4. [Homogeneous systems](#).
  
6. Matrix diagonalisation
  1. Computing eigenvalues and eigenvectors
  2. Equivalent matrices. Diagonalisation: the diagonal and the invertible matrices.
  3. Economic applications.
  
7. Sequences and series of real numbers
  1. Sequences of real numbers, operators on sequences, arithmetic and geometric sequences.
  2. Series of real numbers. Convergence and series convergence tests.
  3. Sum of a geometric series.

## PRACTICAL SYLLABUS

Seminars / Workshops (This is non-scoring activity)

At least a one seminar will be performed, whose contents will be selected amongst the following ones:

- Seminar 1: Demand and supply equations. Surplus and shortages.
- Seminar 2: Taylor series approximation.
- Seminar 3: Optimization of basic functions in Economics and Business.

Computer-based practices:

- Practice 1. Representation of single-variable functions. Derivatives and antiderivatives.
- Practice 2. Operating with matrices. Solving systems of linear equations. Matrix diagonalization.

## RECOMMENDED READING

### ESSENTIAL READING

- García Cabello J., Matemáticas imprescindibles en la Administración de empresas: Ejemplos prácticos y aplicaciones. Ed. Fleming, (2016).



Haeussler J.R y Paul R.S. Matemáticas para Administración, Economía, Ciencias Sociales y de la Vida. Ed. Prentice Hall.

- Larson, R B., R P. Hostetler y B. H. Edwards. Cálculo y geometría analítica. Vol. I (9 Ed.) Mc-Graw-Hill, Madrid, (2011).
- Merino, L. M. y E. Santos. Algebra Lineal con métodos elementales. Ed. Thomson, (2006).
- Stewart J. Cálculo Diferencial e integral. Ed. Thomson.
- Sydsaeter, K., Hammond, P.J., Matemáticas para el Análisis Económico. Ed. Prentice Hall.
- Zill, D. y Wright, W. Cálculo de una variable. Mc Graw Hill, (2011)

### COMPLEMENTARY READING

- Alegre P. y otros. Matemáticas Empresariales. Ed. AC.
- Balbás A. y otros. Análisis Matemático para la Economía (I y II). Ed. AC.
- Caballero R. y otros. Matemáticas Aplicadas a la Economía y la Empresa. Ed. Pirámide.

### RECOMMENDED LEARNING RESOURCES/TOOLS

Department of Applied Mathematics: <http://www.ugr.es/~mateapli>

### TEACHING METHODS

- MD01 Docencia presencial en el aula
- MD02 Estudio individualizado del alumno, búsqueda, consulta y tratamiento de información, resolución de problemas y casos prácticos, y realización de trabajos y exposiciones.
- MD03 Tutorías individuales y/o colectivas y evaluación

### ASSESSMENT METHODS (Instruments, criteria and percentages)

#### ORDINARY EXAMINATION DIET

1. In the continuous assessment, that attendance to the corresponding assessment activities is obligatory. Lack of attendance to the assessment activities on the dates and the places specified for it will be understood as a waiver of the right of performance of these activities.
2. In order to pass the course under this option, a final mark equal o bigger than 5 is required. Otherwise, the course is considered to be failed. Dates and places for assessment activities will be made public sufficiently in advance.
3. In the continuous assessment option, the total score is the sum of all scores corresponding to assessment activities. These are the following:
  - Two test-type controls throughout the semester corresponding to units 1,2,3 and 4, 5, 6 respectively. They are non-eliminatory while containing both theory and practical questions (including those of seminars and computer practicals) related to the matter of



- study. Each of these scored a maximum of 3 points. These shall be carried out either face-to-face or throughout the Prado platform, depending on the current sanitary situation.
- Two additional exams on computer practicals which score 0.5 points each. These shall be carried out either face-to-face or throughout the Prado platform, depending on the current sanitary situation.
  - A final written exam which scores a maximum of 3 points (30% weight versus 70% weight corresponding to all other assessment activities). Date and place for the final written exam will be made public by the Faculty of Economic and Business Sciences. These shall be carried out either face-to-face or throughout the Prado platform, depending on the current sanitary situation.

**All these assessment activities could be complemented with personal interviews lectures-students, if required by lectures.**

**The explanations given by students in such interviews therein will be binding when scoring these activities.**

These shall be carried out either face-to-face or throughout Google Meet sessions, depending on the current sanitary situation.

Students with no attendance to either the 2 partial tests or a partial and the final exam (that is, 2 of the 3 written exams) will have the final mark “Not Having Been Submitted” (“No Presentado”).

#### EXTRAORDINARY EXAMINATION DIET

It will consist of a single written exam which will be graded on a 0-10 scale (scoring a maximum of 10 points). In order to pass the course under this option, a final mark equal or bigger than 5 is required. Otherwise, the course is considered to be failed.

Date and place for the final written exam will be made public by the Faculty of Economic and Business Sciences. These shall be carried out throughout the Prado platform in case that face-to-face assessments are not allowed for the Sanitary Authorities’ dictations.

Students with no attendance to such final written exam (that scores a maximum of 10 points) will have the final mark “Not Having Been Submitted” (“No Presentado”).

#### SINGLE FINAL ASSESSMENT (evaluación única final)

According to the Rules for Assessment and grading of the students of the University of Granada (latest changes approved by the Governing Board of 26th October 2016, [http://secretariageneral.ugr.es/bougr/pages/bougr112/\\_doc/examenes%21](http://secretariageneral.ugr.es/bougr/pages/bougr112/_doc/examenes%21)) the assessment of students’ academic performance will reflect public, objective and impartial criteria, and will preferably be continuous.

Nevertheless, the students may apply for a single final assessment (article 8 of the current Rules for Assessment, which provides for the taking of a single final assessment). Students may apply for either in the first two weeks of teaching of the subject or two weeks following change of matriculation. Application is to be made through the electronic system



(<https://sede.ugr.es/sede/catalogo-de-procedimientos/solicitud-evaluacion-unica-final.html>), citing and accrediting the reasons for not being able to undergo the system of continuous assessment (reasons of employment, health, disability or any other correctly justified cause), with the understanding that this assessment is undertaken in a single academic act in order to accredit that the student has acquired in full the competencies described.

On one hand, lack of application for a single final assessment will be understood as a waiver of the right of such assessment. On the other hand, those students who have been granted a single final assessment are not eligible to apply for a continuous assessment.

Single Final Assessment shall consist of a single written exam which will be graded on a 0-10 scale (scoring a maximum of 10 points). In order to pass the course under this option, a final mark equal or bigger than 5 is required. Otherwise, the course is considered to be failed. Date and place for the final written exam will be made public by the Faculty of Economic and Business Sciences. These shall be carried out throughout the Prado platform in case that face-to-face assessments are not allowed for the Sanitary Authorities' s dictations.

Students with no attendance to such final written exam (that scores a maximum of 10 points) will have the final mark "Not Having Been Submitted" ("No Presentado").

## ADDITIONAL INFORMATION

PRADO online platform

Student Guides, where schedules, methodologies, timetables are fully described  
[https://fccee.ugr.es/pages/docencia/guias\\_titulaciones](https://fccee.ugr.es/pages/docencia/guias_titulaciones)

Rules for Assessment and grading of the students of the University of Granada (article 8)

[http://secretariageneral.ugr.es/bougr/pages/bougr112/\\_doc/examenes%21](http://secretariageneral.ugr.es/bougr/pages/bougr112/_doc/examenes%21)

