

MATHEMATICS I

Degree(s)	: Economics; Management
Type	: Compulsory course unit
Curricular year/semester	: 1st year - 1st Semester / 2nd Semester
ECTS / hours per week	: 6 ECTS / 5.0 Hours
Workload per week	: 2Theoretical x 1.5 Hours + 1Practical x 2 Hours
Teacher responsible	: Professor Fernando Gonçalves (1st Semester) : Professor Filipa Duarte de Carvalho (2nd Semester)

OBJECTIVES

- To provide a grounding in mathematical tools that are needed for economics.
- To develop rigour and ability to manipulate mathematical methods.
- To increase capacity for solving quantitative problems having applications in economics in view.

PROGRAM

Introduction to linear algebra

1. Vectors: The linear space R^n ; Dot product, norm, distance, and orthogonal vectors; Linear combination and independence.
2. Matrices: Matrix algebra; Invertible matrices; Rank.
3. Determinants: Definitions. Properties of the determinants; Laplace's expansion; Ad-jugate and inverse of a square matrix.
4. Systems of linear equations: Matrix form and solvability; Gaussian elimination; Application: invertibility of a matrix and determining the inverse; Cramer's rule.

Calculus

5. The real number system: Basic concepts of set theory; Axioms of the real number system, basic results; The metric space R .
6. Sequences; Definitions; Basic results; Extended real numbers.
7. Series: Definitions and basic results; Geometric series; Power series.

8. One-variable functions: Generalities; Geometric representation of real functions; Operations on functions; Boundedness, monotonicity, parity, zeros; Main types of real functions.
9. Limits and continuity: The notion of limit; Algebra of limits; Infinite limits and limits at infinity; Continuous functions; Theorems about continuous functions.
10. Differentiation: The notion of derivative, geometric interpretation; The algebra of derivatives, derivatives of elementary functions; Theorems about differentiable functions; Polynomial approximations.
11. Optimisation: Extreme values of functions; Geometric properties of functions; Second derivative test for extrema; Sketching the graph of a function.
12. Antidifferentiation: Definitions and basic results; Methods of antidifferentiation; Partial fractions.
13. Integration: Definite integral; The fundamental theorem of calculus; Methods of integration; Improper integrals; Application to the computation of areas.

BIBLIOGRAPHY

Recommended Bibliography:

- Apostol, T., 1967: Calculus, Vol. 1: One-Variable Calculus, with an Introduction to Linear Algebra, 2nd ed., John Wiley, USA.
- Blyth, T. S., and E. F. Robertson, 1998: Basic Linear Algebra, Springer-Verlag, UK.
- Gonçalves, F. F., 2014: Mathematics I - Lecture Notes, ISEG, Lisboa.
- Simmons, G. F., 1996: Calculus with Analytic Geometry, 2nd ed., McGraw-Hill, USA.