Barcelona School of Economics

COURSE SYLLABUS **19BE02**

Calculus and Linear Algebra

Brushup course

Professor

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Prerequisites to enroll

This is a brush-up course designed for incoming Master's students. No formal prerequisites, but prior exposure to calculus and linear algebra at the undergraduate level is expected.

Overview and objectives

This intensive course reviews key tools in calculus and linear algebra that will be essential for success in the Master's programs in Economics and Finance.

Because we cover a large amount of material in a short period, the pace is demanding. Students are encouraged to use the course strategically: it provides an opportunity to refresh fundamental concepts, to identify personal gaps in mathematical background, and to establish good study habits before the start of the program.

By the end of the course, students should feel more confident applying mathematical reasoning in economic and financial contexts.

Course outline

The course is organized in five lectures, each combining theory, worked examples, and practice problems. The topics covered are:

1. Calculus review (single-variable)

- Sequences, series, limits
- Continuity and differentiability
- Taylor expansion
- Integration techniques

2. Multivariable calculus

- Functions of several variables
- Partial derivatives and gradients
- Tangent planes and linear approximations
- Optimization of functions of several variables
- Convexity and concavity

3. Linear algebra fundamentals

- Vectors and vector spaces
- Matrices and linear transformations
- Matrix operations, inverses, rank
- Systems of linear equations

4. Advanced linear algebra

- Determinants
- Eigenvalues and eigenvectors
- Diagonalization
- Quadratic forms and applications

The lecture will be complemented by tutorial sessions.

Required activities

- Attendance at all lectures (highly recommended given the compressed format)
- Active participation in problem-solving sessions
- Independent review of exercises and textbook material

Evaluation

There will be a short final exam at the end of the course covering the main topics. The exam will be graded, but the grade will not count toward the Master's program. Its purpose is purely diagnostic: to help students check their current level, identify strengths and weaknesses, and plan how much review or extra study may be needed in the short period before the core courses begin.

Materials

Main references (students may use any comparable text they are familiar with):

- Simon, C.P. and Blume, L. *Mathematics for Economists*, Norton, 1994.
- Sydsaeter, K. and Hammond, P.J. *Mathematics for Economic Analysis*, Prentice Hall, 1995.
- Werner, F. and Sotskov, Y.N. *Mathematics for Economics and Business*, Routledge, 2006.

Lecture slides and problem sets will be provided.

Competencies

- Strengthening of core mathematical foundations (calculus, algebra, optimization).
- Ability to work with mathematical formulations in economics and finance.
- Improved problem-solving skills under time pressure.

Learning outcomes

- Students will recall and apply central results in calculus and linear algebra.
- Students will identify and remedy personal gaps in their mathematical preparation.