

Preparatory Course in Mathematics

Master's Degree in Economics and Finance

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Course Description

This crash course provides a review of the main mathematical tools that will be used throughout the Master's programme in Economics and Finance. The course is intended as a refresher rather than as a substitute for an undergraduate course in mathematics. Emphasis will be placed on recalling key concepts, notation, and computational techniques, and on developing familiarity with the mathematical methods most frequently encountered in economics and finance.

Contents

- **Functions of one variable:** limits, continuity, derivatives, and differentiation of elementary functions.
- **Analysis of functions of one variable:** monotonicity, concavity and convexity, local and global maxima and minima, inflection points, and graphical analysis.
- **Taylor approximations:** Taylor's formula and local approximation of functions.
- **Integration:** definite and indefinite integrals, the Fundamental Theorem of Calculus, and basic integration techniques, including substitution, partial fractions, and integration by parts.
- **Functions of several variables:** partial derivatives, gradients, second-order derivatives, Hessian matrices, and identification of maxima, minima, and saddle points.
- **Linear algebra:** vectors and matrices, matrix operations, determinants and inverses, and systems of linear equations, including the Rouché–Capelli theorem.

Learning Objectives

The objective of the course is to refresh the mathematical knowledge and computational skills required for graduate-level courses in economics and finance. By the end of the course, students should be able to:

- work confidently with elementary functions and their main properties;
- compute and interpret limits, derivatives, and partial derivatives;
- apply differentiation rules to analyze the local and global behavior of functions;

- determine monotonicity, concavity, convexity, critical points, and inflection points of functions of one variable;
- use derivatives to solve basic optimization problems involving functions of one or several variables;
- use Taylor's formula to obtain local approximations of functions;
- compute definite and indefinite integrals using standard integration techniques;
- work with vectors and matrices and perform basic matrix operations;
- compute determinants and matrix inverses and solve systems of linear equations;
- recognize and use the mathematical notation and techniques that will appear in subsequent courses in economics and finance.

Teaching Method

The course is primarily lecture-based and combines a review of the main theoretical concepts with worked examples and exercises. Particular attention will be devoted to the mathematical techniques that are most relevant for subsequent courses in economics and finance.

Lectures will be held in person in **Aula 13, via dei Caniana 4, Bergamo**, and will also be available online via Microsoft Teams:

<https://teams.microsoft.com/meet/399369002188853?p=d4HtXmjtQujSQbGIzJ>

Program

The course is organized according to the following schedule. The content of each lecture may be adjusted depending on students' needs and progress during the course.

Lecture	Date	Time	Topics
1	Tuesday, 1 September 2026	09:00–10:00	Set theory
2	Tuesday, 8 September 2026	09:00–12:00	Functions of one variable: definitions, domains, and limits
3	Wednesday, 9 September 2026	09:00–12:00	Derivatives and integrals
4	Thursday, 10 September 2026	09:00–12:00	Vectors and vector spaces
5	Thursday, 10 September 2026	14:00–17:00	Matrices and systems of linear equations
6	Saturday, 12 September 2026	09:00–12:00	Functions of several variables

Additional Reading

- J. R. Hass, C. E. Heil, and M. D. Weir, *Thomas' Calculus: Early Transcendentals*, 15th ed., Pearson, 2022.
- C. P. Simon and L. Blume, *Mathematics for Economists*. New York: W. W. Norton & Company, 1994.