Mathematics - Preparatory Course
Academic Year 2025-2026 (Fall 2025)
PhD in Business Administration and Management and Economics and Finance, Bocconi University

Course Description:

- This course is a preparatory mathematics course for the incoming PhD students in accounting/economics/finance and business administration and management programs. This course (and its followup course, Introduction to Mathematics) aims to cover the core mathematical techniques which are used in subsequent PhD courses. The preparatory course has three units. First, we go over a brief introduction to basic probability theory. We then move on to study the basics of both differential and integral calculus. We conclude with a brief introduction to optimization techniques.
- This course will cover both mathematics in the abstract as well as its applications economics, finance, etc. This means that for certain topics lectures and problem sets will be primarily proof based. For other topics, the emphasis will be on applying mathematical results to applied settings.
- The detailed syllabus will be distributed via the course website.

Prerequisites:

- Undergraduate-level set theory, calculus, matrix/linear algebra, and probability required for social sciences

Instructor:

- Christopher Turansick (Department of Decision Sciences)
- Lecture and Office Hours: TBA

Course Outline (Tentative):

1. Probability Theory
    - Probability spaces, random variables, conditional probability, conditional expectations, Bayes rule
2. Calculus
    - Differentiation: Derivatives and partial derivatives, standard techniques (Chain rule, inverse functions)
    - Integration: Indefinite and definite integrals, some examples, fundamental theorem of calculus, standard integration techniques (integration by parts and integration by substitution)
3. Optimization

- Unconstrained optimization
- Constrained optimization: Lagrangian, Kuhn-Tucker

Course materials and textbooks:

- There are no required textbooks for the course. The course material will draw from lecture notes/slides which will be made available on the course website. For those who wish to consult a textbook in addition to lecture materials, a list of suggested textbooks will be provided on the course website.

Course materials and textbooks:

- Grades will be determined based off of performance on a problem set and a final exam. Precise information will be announced at the start of the course.