Mathematics I: Real Analysis

Naples Ph.D. in Economics: Fall 2024

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1 Overview

Description. This course provides an introduction to Real Analysis, Linear Algebra, and Matrix Analysis. The course aims to make grade-level courses in Economic Theory and Econometrics accessible to students of different backgrounds.

Prerequisites. Basic knowledge of Mathematical Analysis, Linear Algebra, and Matrix Analysis at the undergraduate level is assumed. However, we will try to make the course's content as self-contained as possible.

Course Material. We will closely follow the relevant chapters in de la Fuente (2000). We will provide further references or handouts for any additional material we may cover.

Office Hours. Contact us via email to schedule a meeting.

2 Evaluation

To learn the material of this course, you must do more than just read textbooks and listen to lectures. Some tips are the following:

- *Active Reading.* Work through each line of each result, be sure you know how to get from one line to the next, and re-do and complete the proofs made in class.
- *Active Listening.* Follow each step as we work through arguments in class. We expect you to ask questions in class.
- *Working Problems.* Solving the assigned exercises (and, if you like, more) is the most valuable part of the course.
- *Working Together.* Working in groups is strongly encouraged, but always try to work through each exercise yourself before talking to others.

Grading. Problem Sets (30%) and Final Exam (70%).

- *Problem Sets.* We will assign weekly Problem Sets. We will share all relevant instructions about them via email.
- *Final Exam.* The final exam will be in class, open book, and with no time pressure.

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3 Detailed Syllabus

1. Preliminaries of Real Analysis
2. Metric Spaces, Normed Spaces, and Continuity
3. Vector Spaces, Linear Transformations, and Linear Algebra
4. Differential Calculus
5. Static Models and Comparative Statics
6. Convex Sets and Concave Functions
7. Fixed-Point Theorems
8. Difference Equations, Differential Equations, and Dynamical Systems

4 References

The main reference is:

- de la Fuente (2000). *Mathematical Methods and Models For Economists*. Cambridge University Press.

Additional references are:

- Corbae, Stinchcombe, and Zeman (2009). *An Introduction to Mathematical Analysis for Economic Theory and Econometrics*. Princeton University Press.
  This textbook is a bit more advanced than the course's content.
- Ok (2007). *Real Analysis with Economic Applications*. Princeton University Press.
  This textbook is a bit more advanced than the course's content.
- Simon and Blume (1994). *Mathematics for Economists*. W. W. Norton & Company.
  This textbook is a bit less advanced than the course's content.