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Mathematics I

Syllabus

Information at a glance

This is a course for first year Ph.D. students at the Naples School of Economics.

Instructor:	Niccolò Urbinati (email: niccolo.urbinati@unina.it)
Period:	First Term (25 Sept - 5 Nov)
Final Evaluation:	Written exam
Office hours:	By appointment, Room C2, Dept. of economics and statistics

Purpose of course

The course is an introduction (or a reminder) of the basic concepts in mathematics required for the Ph.D. program in economics. Its aim is to develop the formal language of theoretical reasonings and to set the basis for further courses and for students' independent studies.

Prerequisites

The course addresses elementary concepts for which no previous knowledge is required, but examples and digressions are designed for an audience with a background in Economics. For these parts, students are expected to be familiar with some basic concepts from the undergraduate courses in Mathematics, Microeconomics and Macroeconomics.

Tentative program

- **The language of set theory:** Sets and statements; Cardinalities; Cartesian products, sequences and matrices; Binary relations and correspondences; Functions; Concepts from order theory.
- **The space of real numbers:** Construction of the real line $\mathbb{R}$; Topological and order properties of $\mathbb{R}$; Sequences and functions on $\mathbb{R}$; Continuity; Monotonicity.
- **The metric space $\mathbb{R}^\ell$:** Vector spaces; The Euclidean space $\mathbb{R}^\ell$; Norms and topology of $\mathbb{R}^\ell$; Continuity on $\mathbb{R}^\ell$; Convexity; Concave and convex functions; Duality and separation.
- **Additional material:** Monotonicity in abstract lattices; Summability; Completeness and contraction mappings; Brower fixed-point Theorem; Continuity of correspondences and the Theorem of maximum.

Disclaimer: This course is the first one that students attend and it starts a little after the end of the admission process. As a consequence, the class is typically very heterogenous and students have very short time to prepare. It is likely that some parts of the program above may change according to students reactions, difficulties and attitude towards the subject.

Reading material

The course covers selections of the following books (specific references for each topic will be given in class).

- De la Fuente, A. (2000). *Mathematical methods and models for economists*. Cambridge University Press.
- Ok, E. A. (2007). *Real analysis with economic applications* (Vol. 10). Princeton University Press.

Another useful reference is the following book, which is complete and compact but a little more advanced in the exposition:

- Corbae, D., Stinchcombe, M. B., & Zeman, J. (2009). *An introduction to mathematical analysis for economic theory and econometrics*. Princeton University Press.

On a broader level, students are invited to read the following texts:

- Halmos, P. R. *How to write mathematics*. Enseign. Math 16.2 (1970): 123-152.
- Thomson, W. *The young person's guide to writing economic theory*. Journal of Economic Literature 37.1 (1999): 157-183.