

# Mathematical Economics

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## Teaching Material

Lecture notes have been distributed to you in hard copies; they are also available on my webpage. If you have time, you're recommended to read them beforehand.

## References

Sundaram, *A First Course in Optimization Theory*, 1996, Cambridge University Press. (\*)  
Rudin, *Principles of Mathematical Analysis*, Third edition, 1976, McGraw-Hill. (\*)  
Mas-Colell, Whinston and Green, *Microeconomic Theory*, Mathematical Appendix, 1995, Oxford University Press.  
Kreps, *Microeconomic Foundations I: Choice and Competitive Markets*, Mathematical Appendix, 2013, Princeton University.  
Simon and Blume, *Mathematics for Economists*, 1994, W.W. Norton & Company.

## Prerequisites

Calculus and linear algebra.

## Course Objectives

This course is an introductory course of mathematical economics, which aims at introducing to students the basic mathematical tools for economic analysis. We will focus on basic mathematical analysis, optimization methods, fixed-point theorems and their applications in economics.

### Course Schedule (subject to change)

| Week | Topic                                                                     |
|------|---------------------------------------------------------------------------|
| 1    | General introduction, Implicit function theorem                           |
| 2    | Convex analysis I                                                         |
| 3    | Convex analysis II                                                        |
| 4    | Unconstrained optimization, Weierstrass theorem                           |
| 5    | Optimization with equality constraints, envelope theorem                  |
| 6    | Optimization with inequality constraints: Kuhn-Tucker method              |
| 7    | The real line and metric spaces                                           |
| 8    | Sequences and limits, cardinality of sets                                 |
| 9    | Point-set topology I                                                      |
| 10   | Point-set topology II                                                     |
| 11   | Continuous functions, Weierstrass theorem                                 |
| 12   | Correspondences, theorem of the Maximum                                   |
| 13   | Contraction mapping (fixed-point) theorem, stationary dynamic programming |
| 14   | Brouwer's fixed-point theorem, existence of competitive equilibrium       |
| 15   | Kakutani's fixed-point theorem, existence of Nash equilibrium             |
| 16   | Tarski's fixed-point theorem, existence and structure of stable matchings |