CY Cergy Paris Université
Masters in Economic Analysis

Mathematics for Economics

Fall 2023

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Schedule:
There will be 18 lectures of one and a half hour each. All lectures will be on Wednesday and Friday, from **10h30** to **12h00**.
A tutorial (exercises) session will run each Monday from **11h00** to **12h30**.

Location: tba

Textbooks

Simon, C. P. and Blume, L. (1994), *Mathematics for Economists*, Norton, New York NY.
Knut Sydsaeter, Peter Hammond, Atle Seierstad, and Arne Strøm (2008), *Further mathematics for economic analysis*, Prentice Hall.

Evaluation:

Midterm exam: 50 %
Final exam: 50 %

Exams will be based on a list of recommended problems.

Syllabus:

1. **Linear Algebra** (S&B Ch. 7,8,9; Sydsaeter et al. Ch. 1)
a) Matrix Algebra
b) Gauss-Jordan Elimination
c) Matrix Methods for Linear Systems
d) Determinants
e) Eigenvalues and Eigenvectors
2. **Unconstrained Optimization (**S&B Ch. 16,17; Sydsaeter et al. Ch. 1,2)
a) Maxima and Minima in $\mathbb{R}^n$
b) First Order Conditions
c) Second Order Conditions
d) Global Maxima and Minima
e) Concave, Convex, Quasiconcave and Quasiconvex functions
3. **Constrained Optimization (**S&B Ch. 18,19; Sydsaeter et al. Ch. 3)
a) Lagrange's method
b) Envelope Theorem
c) Maximization under several inequality constraints (Kuhn-Tucker method)
d) Non-negativity Constraints

4. **Functions (**S&B, Part I)
a) Most common symbols
b) Introduction to Functions
c) Graphing Functions
d) Limit of a Function
e) Continuity
5. **Calculus (**Sydsaeter et al. Ch. 4, Appendix A)
a) Sequences
b) Infimum, Supremum, Minimum and Maximum
c) Differentiation in Several Variables
d) The Indefinite Integral: The Antiderivative
e) The Definite Integral: The Area under the Curve
f) The Leibniz integral rule

6. **Difference equations** (Sydsaeter et al. Chapter 11)
a) First order difference equations
b) Application: net present value
c) Second order difference equations
d) Stability analysis
7. **Discrete time dynamic optimization** (Sydsaeter et al. Chapter 12)
a) Euler equation,
b) Infinite horizon problems
c) The Maximum principle
d) Stochastic optimization
e) Stationary problems
8. **General topology** (Sydsaeter et al. Chapter 13)
a) Convergence
b) Continuity
c) Compactness
d) Maximum theorems
e) Convexity and separation theorems
9. **Correspondences and Fixed point theorems** (Sydsaeter et al. Chapter 14)
a) Contraction mapping theorem
b) Brouwer's Fixed Point Theorem
c) Correspondences. Upper/lower hemicontinuity
d) Kakutani's Fixed Point Theorem
e) Applications to existence of Nash and Walrasian equilibria
f) Tarski's Fixed Point Theorem
10. **(time permitting) Differential equations** (Sydsaeter et al. Chapter 5)
a) First order linear and nonlinear equations
b) Second order linear and nonlinear equations
c) Equilibria & stability analysis for linear systems
d) Phase plane analysis
e) Equilibria & stability analysis for nonlinear systems

Advice: We will follow the textbooks closely. Thus, it is *strongly recommended* that you obtain copies of the textbooks, and read the recommended sections of the book *before* each lecture. Come to class prepared to ask questions. Be an active learner. After each class, review the exercises solved in class, and solve the other assigned problems.