Department of Economics
ECON 4001 A
Mathematical Analysis in Economics

Fall 2026

Instructor: Zhiqi Chen
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Office Hours: Mondays 2:00pm – 3:30pm or by appointment

Course Location/Delivery: In Person. Log into Carleton Central to view the location on your timetable.

Lectures: Mondays 8:35am – 11:25am

Brightspace Course Page: https://brightspace.carleton.ca/d2l/home/449389

Course Description

Analysis and algebra: set theory, sequences and series, quadratic forms, separation and fixed-point theorems. Static optimization: the Weierstrass, Lagrange, and Kuhn-Tucker theorems; convexity and quasi-convexity; the envelope theorem. Dynamic optimization: the Maximum Principle and Bellman's equation. Applications of these tools to economic theory.

Prerequisite: ECON 3001 with a grade of C+ or higher.

Learning Outcomes

Students will acquire the main elements of common mathematical tools used in economic analysis.

Required Text

Further Mathematics for Economic Analysis (2nd edition) by Knut Sydsaeter, Peter Hammond, Atle Seierstad, Arne Strom Prentice Hall, 2008

Estimated cost of the required text is $283.31. Note that your actual cost may differ depending on the time and location of your purchase.

Topics

I. Static Optimization

- Unconstrained optimization
- Optimization with equality constraints
- Optimization with inequality constraints

Sydsaeter et al., chapter 3

II. Differential Equations

- First order linear differential equations
- A system of linear equations
- Phase plane analysis

Sydsaeter et al., chapter 5 and 6

III. Dynamic Optimization

- Optimal control theory and the maximum principle
- Dynamic programming and the Bellman's equation

Sydsaeter et al., chapters 9 and 12

IV. Real Analysis

- Set theory
- Separation theorems
- Fixed-point theorems

Sydsaeter et al., chapters 13 and 14

Evaluation

Each student's grade in the course will be determined based on the following three components:
Take-Home Assignment: 10% (Due on October 9)
Midterm Examination: 45% (In person, to be held in class on November 2)
Final Examination: 45% (In person, to be scheduled by Scheduling and Examination Services)

About the take-home assignment: Use of generative AI tools is permitted. However, each student must complete their work independently and write their answers by hand.

About the mid-term examination: Any student who fails to write the midterm exam without a valid medical or equivalent excuse will receive a zero for the exam. With a valid excuse, a substitute exam will be scheduled.

About the final examination: Failure to write the final examination when the student has achieved satisfactory performance during the term will result in a grade of F until an appeal to write the deferred final exam is granted. Application to write a deferred final examination must be made at the Registrar's Office.

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Use of Brightspace

Students are advised to check the course website in Brightspace regularly for course materials and updates. Lecture slides and problem sets will be posted at the Brightspace course website.

Course Materials

Student or professor materials created for this course (including presentations and posted notes, assignments and exams) remain the intellectual property of the authors. They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author.
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Generative Artificial Intelligence (AI)

Students may use AI tools to assist their studies, including the take-home assignment. However, each student must complete their assignment independently and write their answers by hand. The midterm and final examinations will be written without access to AI tools or any other reference materials.

Academic Integrity

The University Academic Integrity Policy defines plagiarism as "presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own." This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, artworks, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Student Mental Health

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult https://wellness.carleton.ca/.

Academic Accommodations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the *Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances*, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).