Mathematics for Economists

Economics 205, Fall 2010

General Information

Instructor: Joel Sobel
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Office Hours: After class
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Homepage (with link to handouts for course):
http://www.econ.ucsd.edu/%7Ejsobel/205f10/205f10home.htm
Teaching Assistant: Lawrence Schmidt (lschmidt@ucsd.edu)

Organization

The class meets from 8:30 to (approximately) 11:00 every weekday from Monday, August 23 through Monday, September 13, with the following exception: There is no class on September 6. I will also use time between 11:00 and 11:30 if necessary for quizzes or to stay on schedule.

In addition, the classroom will be available from 1:00-4:00 for study sessions on most days. On some days there will be organized problem sessions led by the TA. On other days, students can use the room to work together on class material.

Description

This course is a rapid overview of topics in calculus, advanced calculus, optimization, and linear algebra that are relevant to economic theory. It provides some of the necessary mathematical background to begin the core graduate sequence. The course covers a large amount of material at a relatively high level of rigor.

If you have mastered the material in standard upper-division analysis and linear algebra classes, then this class should contain little that is new. If it has been a long time since you have used calculus, then the course will be difficult. If you have never used calculus, then the course may be impossible.

To avoid misunderstandings, let me emphasize that the class is not simply a review of lower-division calculus. Nor does it cover all (or even most) of the mathematics used in the core classes.

Requirements

The main evaluation will be a three hour, closed book, closed notes examination tentatively scheduled for Thursday, September 16 from 8:30 to 11:30. (This time becomes official if there are no complaints today.) Your grade will be the maximum of your grade on the final examination, and a weighted average of your final exam grade (75%), and your performance on quizzes. You must pass the final examination in order to enroll in Economics 200A. Officially this course is part of the Fall Quarter, so you have the unusual ability to enroll in the class after it you completed it.

Problems are a necessary part of learning the material. I will suggest problems and there are additional problems posted on the web page. It is important that you find exercises that are at your level – challenging, but not impossible. If the suggested problems are too easy or too hard, let me know and I'll find something appropriate for you. Relevant problems are also available in the texts. There will be a list of problems posted on the web page. I will suggest problems from texts in most class periods. You should attempt to do them throughout the course.

Texts and Course Material

(SB) C. Simon and L. Blume, Mathematics for Economists

(N) W. Novshek, Mathematics for Economists

(D) A. Dixit, Optimization in Economic Theory, 2nd edition

(MA) K. G. Binmore, Mathematical Analysis

(C) K. G. Binmore, Calculus

(CH) A. Chiang, Fundamental Methods of Mathematical Economics

(SB) should be available in the University Bookstore. I have copies of all books (and others). In addition to these books, my web page contains course notes prepared by Joel Watson and me. These are a work in progress, filled with errors, inconsistent notation, and irrelevant material. I will make an effort to update and augment these notes throughout the class.

There are many books that cover the basic material of this course. Feel free to use another book as a primary reference. (If you are not sure whether another book is adequate, then check with me.)

(SB) is officially the text for the course. It has the following strengths: it contains many economic examples; it covers the topics that I intend to cover; it covers other material that you should know; it has many problems and solutions. On the other hand, it is poorly organized and its level of treatment is uneven. My lectures will be quite different from the text material. (N) is concise, covers most of the topics, and has many problems and solutions. Its coverage of one-variable calculus is brief and its approach to optimization is mechanical. (D) is a nice introduction to optimization from the perspective of economics. (MA) is a concise introduction to "advanced" one-variable calculus. It presents definitions and theorems with care and provides an introduction to proofs. It is slightly more advanced than the course will be. It may be a good place to look if the material in the first week seems to easy. (C) is more basic than (MA). It has reasonable coverage of most of the topics of multi-variable calculus. (CH) is a standard reference for courses in mathematics for economists, but I find it too mechanical. It may be a good place to look if the lectures seem difficult. Dixit contains material relevant to the optimization topics.

Paternalism

When I started teaching this course (before you were born), I just introduced myself, described the topics, and began teaching math. Gradually, I spent more and more time telling the class things that I thought would help it adjust to the graduate program. Now I have learned that the first day of class is not a good time to get advice and, besides, you'll hear similar advice from others. Here is a short list of recommendations. Consult the list when you are ready.

1. You cannot learn mathematics by reading a book. It is better to work problems. It is better still to pose problems yourself and try to solve them.

2. Performance in Econ 205 is related to how much math you already know. It is a good predictor of success in first-year courses. It is a bad predictor of the quality of your dissertation.

3. The hardest part of graduate school is starting your research project. (In particular, it is not Econ 205.)

4. No one on the faculty wants you to fail.

5. Be nice to Rebecca, Rafael, Nieves, ...

6. You do not need to know everything already.

7. Work – and play – with classmates. You'll learn more from them than your professors. Some of them will be friends and colleagues for life.

8. Figure out what is important to you.

9. Good research projects are not scarce, but they are hard to find.

Topical Outline and References

The table on the next page lists the topics that I hope to cover. (I rarely reach differential equations and integration.) It relates the topics to pages in five of the texts mentioned above. The number of pages devoted to each topic varies drastically from text to text. The quality and the level of treatment vary as well.

Topic	Ch	MA	C	N	SB
Basic Concepts	132-44	1-48;65-84		1-2; 36-42	3-9; 847-57
Continuity	145-49	85-91		2-3; 42-44	10-21
Differentiability	128-32;149-74	92-100		3-5	22-34;39-42;70-4
Mean Value Theorems	254-62	101-8		5-6	822-32
Extrema, Concavity					43-6; 51-69
One-variable wrap up		138-43			75-103
Vectors	54-87		1-32		199-204;209-30
Eigenvalues					188-94; 579-84;601-7;609-15
Quadratic Forms					375-86;398-404;620-32
Vector Calculus	169-78		39-59	56-70	273-95;301-5;313-28
Multi-variable MVT			101-29	70-73	328-32;832-6
Implicit Functions	184-86;204-27		161-211	133-46	334-64
Unconstrained Optimization	231-54; 307-68		149-54	6-7; 73-77	375-86;396-410
Equality Constraints	369-432		85-95	77-103	411-23;478-80
Inequality Constraints	688-755		131-35	111-127	424-78;480-2
Integration	435-57		226-46	9-19	887-92
Differential Equations	470-96		313-32	20	633-665