University of Hawaii at Manoa  
Department of Economics  

**Mathematics for Economics**  
**ECON 627, Fall 2008**  
(Tentative; subject to change)  
MW 3:00-4:15PM BUSAD D201

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**Learning Objectives**  
The goal of this course is to prepare you for, or remind you of, the mathematical underpinnings of economic theory courses–Econ 606, 607, 608 and 609. To that end, we will seek to translate undergraduate economic theory topics into the language of mathematics, taking considerable care to develop the necessary mathematical framework and adding a few bells and whistles in the process. In addition, several increasingly important topics in economic theory are inherently mathematical–notably dynamic optimization models that form the basis of macroeconomic growth theory, natural resources exploitation models and other “dynamic” topics. We will cover both the mathematics and economics of these subjects, though only briefly.

Ideally, we would cover each topic in this course just in time for the theory courses to use that topic. Inevitably, we will miss the timing on at least some topics. If the theory courses arrive at some topic that requires mathematics we have not yet covered in this course, you will nonetheless be expected to read mathematical appendices or other textbooks for that course to obtain at least an intuitive feel for the mathematics. Of course, you are also welcome to request adjustments in our schedule, and I will try to accommodate.

**Prerequisites**  
MATH 203, MATH 215, MATH 241, MATH 251A or equivalent. Familiarity with the topics covered in the summer math cram course (offered by the Department of Economics).

**Grading**  
Problem Sets*  
Midterms (2)  
Final Exam (Dec 19 Friday, 2:15-4:15)  
30%  
40% (20% each)  
30%

*Problem sets include the online exercise available at [www.aplia.com](http://www.aplia.com) (see the pages 5 and 6 for details).
There will be periodic problem sets. The problem sets will be mostly analytical but may also include some numerical problems. The latter type may involve the use of Excel or Matlab on the computer. I encourage you to work together on problem sets but each of you will hand in your own assignment. **Though you are encouraged to work in groups, you must acknowledge your collaborators in your solutions to the problem sets.**

**Textbooks**
There are two books that we will reference fairly extensively in the course:

**Other references**
Calculus and its applications to economics
*(Sundaram’s book is also highly recommended.)*

**Dynamic programming**

**Optimal control theory**

**Analysis**

**Numerical methods**
Topics covered

1. Preliminaries
   Elements of set theory, logic, and proof

   *SB Appendix A1
   Sundaram Appendices A and B

   Properties of Euclidean space and metric space

   Sequence, convergence and limits, Cauchy sequence, vector space, norm, metric space, complete
   metric space, Banach space

   *SB Ch 10 and 12.1, 12.2
   *SLP Ch 3.1
   Sundaram, Ch 1.1 and 1.2
   Sundaram, Appendix C

   Topology of Euclidean spaces

   Open, closed, bounded, compact sets
   *SB Ch 12.3-12.6, Ch 29.

2. Multivariate calculus
   Functions: basic concepts
   Basic terminology of functions, continuity, monotonicity, partial and total derivatives, chain rule,
   higher order derivatives

   *SB Ch 13, 14.1-14.9
   Sundaram, Ch 1.4

   Functions: applications
   Intermediate and mean value theorems, Taylor’s Theorem, inverse and implicit function theorem
   *SB Ch 15, 30
   Sundaram, Ch 1.5 and 1.6

   Existence of solutions to optimization
   Weierstrass Theorem
   *SB Ch 30.1
   Sundaram, Ch 3

MIDTERM I

3. Static optimization
   Unconstrained optimization
   Quadratic forms, first order necessary conditions, second order sufficient conditions
Constrained optimization
Lagrangian method, first order necessary conditions, second order sufficient conditions, equality and inequality constraints, Kuhn-Tucker Theorem, interpretation of Lagrangian multipliers, envelope theorems, concave and quasiconcave functions, concave programming

Economic applications of static optimization
Utility maximization and expenditure minimization, Roy’s identity, Shephard’s lemma, Slutsky matrix

MIDTERM II

4. Dynamic optimization
Difference and differential equations
- Difference equation: SB 23.1, 23.2

Dynamic optimization: Calculus of variations, optimal control theory
- The Calculus of Variations: Chiang Ch 2, 3, 6
- The Hamiltonian Function: Chiang Ch. 7
- More on Optimal Control: Chiang Ch 8
- Infinite-Horizon Problems: Chiang Ch 5, 9

5. Other possible topics
Maximum Theorem, Fixed Point Theorem, …

Disability Access
If you feel you need reasonable accommodations because of the impact of a disability, please: (1) contact the KOKUA Program (V/T) at 956-7511 or 956-7612 in room 013 of the QLCSS (Queen Lili’uokalani DCenter for Student Services); (2) speak with me privately to discuss your specific needs. I will be happy to work with you and the KOKUA Program to meet access needs related to a documented disability.
**Aplia online microeconomics exercise (Summer/Fall 2008)**

As part of the coursework for the math cram course and ECON 627 “Mathematics for Economists,” you will complete online microeconomics exercise at aplia.com. Having a solid understanding of undergraduate microeconomics is crucial for your success in the graduate program. The purpose of this exercise is to give you a chance to review basic intermediate microeconomics and make sure that all of you are on the same page.

The assignments of exercises will start on August 4, 2008 and will continue for several weeks into the middle of the Fall semester. There will be multiple deadlines for different sets of exercises. The first deadline is August 8, 2008 (Friday).

Aplia will grade each of the submitted answers once the corresponding deadline is reached, and keep track of your performance. **Your grades for the aplia exercise will contribute toward your grades for Econ 627. If you cannot start the exercise in time and miss the first couple of exercises, let me know and I will come up with some makeup exercise.**

You can complete the exercise using any computer connected to the internet whenever convenient for you before the deadline is reached. Please let Sean know if you do not have internet access. Sean will let you know the location of the computer labs on campus.

Here is the registration instruction.

You can begin working on your homework as soon as you register.

**Registration Instructions**

1. Connect to [http://www.aplia.com](http://www.aplia.com). (Both Firefox and MS Internest Explorer should work.)
2. Click the System Configuration Test link below the Sign In and Register sections to make sure you can access all of the features on Aplia's website. This takes just a few seconds and tells you how to update your browser settings if necessary.
   a. If you have never used Aplia before, click the New Student button and enter your Course Key: 9GYW-8TQ6-S5NF. Continue following the instructions to complete your registration.
   b. If you have used Aplia before, sign in with your usual e-mail address and password and enter your Course Key when prompted: 9GYW-8TQ6-S5NF. If you are not prompted for a new Course Key, click the Enter Course Key button to enroll in a new Aplia course. Enter your Course Key when you are prompted.
4. Instructions for using aplia are available at the aplia website.
5. You will have access to aplia free of charge (the Department will pay for your registration).
Notes
The aplia exercise questions are based on the materials from the following textbook.

The exercise questions at aplia come from the following book accompanying the above textbook:

These books are on reserve at (the location to be announced).

If you do not have Varian’s book, any other intermediate microeconomics textbook will be useful as a reference. Because each aplia graded exercise comes with a practice question with an answer key, you might not need any textbook and find aplia self-sufficient.

If you have any question, contact the instructor.