Econ 205: Mathematics Overview
Fall 2004

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This course is a rapid review of topics in analysis, calculus, and optimization. Some students will find the course challenging, while some with recent mathematics training will find much of the material review. Everyone should recognize the importance of ongoing mathematical study, which is a critical part of the core economics sequences.

Schedule: 8:30-11:00 a.m. daily (Monday through Friday) from Monday, August 30, through Monday, September 20. Class *will* be held on Monday, September 6 (Labor Day), unless a make-up session can be unanimously agreed on. The class session on Friday, September 17, may be rescheduled to allow students to attend the OGSR orientation. On some days, the time between 10:30 and 11:00 will be devoted to informal discussion and problem-solving. Some extra afternoon sessions may also be scheduled.

Exams: The final exam will take place on Monday, September 20. There will also be a few graded quizzes.

Problem Sets: Working through exercises is an important part of learning mathematics. The course outline includes a list of exercises from the textbooks; I will also provide supplemental problems. You should work diligently on them. Your work will not be collected, nor graded.

Grading: All entering Ph.D. students are required to pass this course. Your course grade will be computed as the maximum of your final exam grade, and a weighted average of your final exam grade (75%) and grades on quizzes. Students with very good training in mathematics are allowed to skip the lectures, but *everyone* must take the final examination.

Textbooks and Reference Material: The following textbook is available at the bookstore:

(SB)   Simon and Blume, *Mathematics for Economists* (Norton).

I recommend at least purchasing this or a comparable textbook. You are welcome to use any other suitable book as your primary reference. Other textbooks that cover some of the course material are:

      Binmore, *Calculus*,
      Binmore, *Mathematical Analysis* (Cambridge)
      Chiang, *Fundamental Methods of Mathematical Economics*,
      Dixit, A., *Optimization in Economic Theory* (Oxford),
      Intriligator, M., *Mathematical Optimization and Economic Theory* (Prentice-Hall),
(JP)   Johnsonbaugh and Pfaffenberger, *Foundations of Mathematical Analysis*,
      Marsden and Tromba, *Vector Calculus*, and
(N)   Novshek, *Mathematics for Economists*.

Econ 205 Course Outline, Fall 2003, Prof. Watson

Topic	Reading	Exercises
The Real Line		
1. Basic set theory, functions, real numbers, properties (intervals, bounds, inf, sup, min, max)	JP 1, 3, 5 N 1 SB 1, 2, A1	1.1-1.5, 5.1-5.5 2.4, 4.1, 4.2
2. Mathematical induction; methods of proof	JP 6, 7 SB A1	6.1, 6.2, 6.5, 7.3
3. Sequences, subsequences, convergence	JP 10-14, 16 (to p50) N 3 SB 29	10.1-10.4, 10.9, 10.11, 11.9 12.1-12.4, 13.1, 13.3, 14.1
4. Bolzano-Weierstrass theorem, Cauchy condition	JP 18, 19 SB 29	18.1, 18.2, 18.5, 19.1, 19.4
5. Functions, limits of functions, continuity	JP 2, 30-33 N 1 SB 2	30.1, 30.2, 30.8, 31.3, 32.5, 33.1, 33.2
6. Differentiation (continuity, chain rule, l'Hopital's rule)	JP 48, 49 N 1 SB 2, 4	48.1, 48.2, 49.1, 49.2 2.7-2.9, 211, 2.12, 2.15, 2.16, 3.1, 4.4-4.6
7. Mean-value theorems and Taylor's theorem	JP 49, 50 N 1 SB 30	50.1, 50.2, 50.4 2.1, 30.7, 30.8
8. Univariate optimization, concavity, convexity (first- and second-order conditions)	N 1 SB 3	 3.4, 3.5, 3.11
9. Integration	(JP 51-58) N 1 SB A4	 1.1-3 A4.1-A4.4
Euclidean Space and Vector Calculus		
10. Concepts of Euclidean space (vectors, matrices, geometry of real-valued functions, metrics, open/closed/compact sets, continuity, eigenvalues/vectors)	N 2,3 SB 10, 12, 23	3.1,3.4,3.6-13 10.1-10.3, 10.11-10.13, 10.27-10.31, 10.32, 10.38-10.40 23.1-23.5, 23.47-23.52
11. Differentiation (gradient, continuity, chain rule, iterated partials)	N 5 SB 13, 14	5.1-7 13.17, 13.21, 14.1, 14.2, 14.11, 14.13, 14.18, 14.20-14.22
12. Taylor's theorem	N 5 SB 14, 30	 14.24.14.28, 30.13, 30.14
13. Unconstrained optimization, concavity, convexity (first- and second-order conditions)	N 5 SB 16, 17, 30	 17.1, 17.2
14. Implicit function theorem, envelope theorem	N 7,8 SB 15	8.2-5, 8.8, 8.10 15.6, 15.8, 15.13, 15.18, 15.21, 15.22
15. Overview of Constrained optimization (quasiconcavity, first-order conditions)	N 5 SB 18,19	6.1-36 18.2-18.7, 18.10-18.12, 18.15, 19.3, 19.4
16. Overview of Dynamic Optimization		