

**Department of Economics, Iowa State University**  
**Math Review Course for New Graduate Students**  
**August 1 - 12, 2011**

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**Objectives of the course:** The math review course, or “math camp,” will cover some basic concepts from calculus, linear algebra, and real analysis that will be essential tools in both the Ph.D. and M.S. level core courses. Math camp is primarily designed for our incoming students who will start with the Ph.D. core. The material in math camp will lead, in a quite seamless way, into Econ 600 Quantitative Methods of Economics Analysis II, one of the required Ph.D. core courses for fall semester. However, most of the material in math camp will be useful and will be accessible to new students (whether admitted at the Ph.D. or M.S. levels) who will start with the M.S. core courses in fall.

Math camp is an informal, no-credit, no-fee course. Although attendance is optional for new students, I personally encourage all new students to attend, if possible. We have offered the review course for many years. Most of the students who attended, even those with unusually good math backgrounds, found the course to be helpful.

**Schedule and organization:** Math camp will meet Monday through Friday of the weeks of August 1 and August 8, 2011. There will be a two-hour lecture on each day between 10:00 a.m. and noon. A total of 5 - 7 hours of additional “recitation” sessions will be held between 1:00 p.m. and 2:00 p.m. on selected days of the weeks of August 1 and 8. The recitations will be conducted by a teaching assistant (an advanced graduate student from the Department of Economics) who will outline solutions to assigned practice exercises.

**Text:** The textbook for the math camp is

Simon, Carl P. and Lawrence Blume, *Mathematics for Economists*, W. W. Norton and Company, 1994.

The Simon and Blume text will also be the required text for Econ 600. It will be available for students to purchase in the University Bookstore. Here are two other standard references for the material that will be covered in the math camp:

Chiang, A. C., *Fundamental Methods of Mathematical Economics*, 3<sup>rd</sup> edition, McGraw-Hill Book Company, 1984.

Sydsaeter, K. and P. Hammond, *Essential Mathematics for Economic Analysis*, 2<sup>nd</sup> edition, Prentice Hall, 2006.

**Course Content:** The attached page contains an outline of topics to be covered. The primary reference for each topic is the indicated section of Simon and Blume (SB). Where appropriate, references are also given to sections of Chiang (C) and Sydsaeter and Hammond (SH).

## I. Euclidean spaces.

Points and vectors in  $\mathfrak{R}^n$  - SB 10.1-2.

The algebra of vectors - SB 10.3, SH 15.7.

Euclidean norm and inner product - SB 10.4, SH 15.7-8.

Sequences and limits in  $\mathfrak{R}^n$  - SB 12.1-2, C 6.4.

Open and closed sets in  $\mathfrak{R}^n$  - SB 12.3-4.

## II. Calculus of functions of one real variable.

Vocabulary of functions - SB 13.5, SH 4.2.

Continuity - SB 2.5, 13.4; C 6.7; SH 7.8.

The derivative - SB 2.3, 2.5; C 6.2-3, 6.7; SH 6.1-4.

Rules for differentiation - SB 2.4, C 7.1-2, SH 6.6-7.

Mean value theorem and Taylor's theorem - SB 30.1-2, A2.8; C 9.5; SH 7.6, 7.10.

Chain rule - SB 4.1, C 7.3, SH 6.8.

Inverse function theorem - SB 4.2, C 7.3, SH 7.3.

Integration and the fundamental theorem of calculus - SB A4.1-2, C 13.2-3, SH 9.1-3.

Integration by parts - SB A4.1, C 13.3, SH 9.5.

## III. Linear algebra and matrices.

Basic matrix operations - SB 8.1, SH 15.2-5.

The determinant - SB 9.1, 26.1; C 5.2-3; SH 16.1-3.

Properties of determinants - SB 11.1, 26.2; SH 16.4.

The adjoint matrix and matrix inversion - SB 26.3, C 5.4, SH 16.5-7.

Cramer's rule - SB 26.3, C 5.5, SH 16.8.

Quadratic forms and sign definiteness - SB 16.1-2, C 11.3.

## IV. Calculus of functions of several real variables.

Partial differentiation - SB 14.1, C 7.4, SH 11.2-3.

Taylor's theorem for functions defined on  $\mathfrak{R}^n$  - SB 30.3.

Directional derivatives and gradient vectors - SB 14.6.

Implicit function theorem - SB 15.1, 15.3; C 8.5-6.

Geometry of level curves and gradient vectors - SB 15.2, SH 12.3.

## V. "Cookbook" summary of optimization methods.

Unconstrained optimization - SB 17.2-4; C 9, 11; SH 13.1-3, 13.6.

Equality-constrained optimization and the method of Lagrange - SB 18.2, 19.3; C 12;  
SH 14.1-5