

## MATH TOPICS FOR GRADUATE STUDY

The following is a short list of the math topics that should be considered pre-requisite for entry to the program. If you feel weak in any area, review during the coming summer is advisable. Since coursework in the Ph.D. program is mathematical, a good base will make success in your first year more likely.

1. Algebra
  - Solving equations with one unknown
  - Solving a system of equations with at least two unknowns
  
2. Calculus
  - a. Functions of one variable
    - differentiation
    - optimization
    - first and second-order conditions for a maximum and minimum, both unconstrained and constrained optimization
    - solving equations both directly and implicitly
  - b. Functions of several variables
    - differentiation and optimization
    - gradients and vectors
    - using Cramer's rule to solve a system of equations
    - first and second-order conditions for a maximum and minimum, both unconstrained and constrained optimization (Lagrangian multipliers)
  - c. Integration of functions with one or more variables (double/triple integrals)
  - d. Review properties of logarithmic and exponential functions.
  
3. Linear algebra
  - a. Matrices
  - b. Determinants
  - c. Vector/matrix multiplication
  
4. Differential equations and solutions
  - Difference equations and solutions

Typically, texts in mathematical economics will direct you to the kinds of techniques and the applications that are most appropriate to economics. Good texts for this kind of review include:

Alpha Chiang, Fundamental Methods for Mathematical Economists, McGraw-Hill, 1984.  
Blume, Lawrence and Carl Simon, Mathematics for Economists, W. W. Norton, 1994  
ISBN 0-393-95733-0.

A few math resources that may prove helpful are in the Schaum outline series for calculus and linear algebra:

- Schaum's Outline of Calculus by Elliot Mendelson (1999) McGraw-Hill ISBN 0070419736
- Schaum's Outline of Theory and Problems of Beginning Linear Algebra by Seymour Lipschutz (1996) McGraw-Hill ISBN 0070380376.