INTRODUCTION

Welcome to Econ 4808/5808! This course is designed to introduce you to mathematical concepts which are useful for analyzing issues in economics. These concepts will enable you to understand economic phenomena more clearly. The course will include geometrical interpretations to help you visualize the mathematical ideas, and economic examples to demonstrate their use.

The course consists of four modules:

- **Introduction** - provides some mathematical basics such as sets and functions; demonstrates the use of mathematics in economic models.
- **Linear Models and Matrix Algebra** - introduces vectors and matrices which are convenient concepts for describing systems with several variables.
- **Differential Calculus** - describes derivatives, rules of differentiation, and interprets derivatives as rates of change; shows how derivatives are used in comparative statics to explore changes in the solution of economic models when parameters of the models vary.
- **Optimization** - explains how to find the maximum or minimum of a function of one or more variables; considers cases without constraints, and cases with equality constraints.

Each module is important in its own right, but in a sense the first two modules are preparation for the second two. The module on optimization also draws heavily on results from differential calculus. Optimization is used extensively in economics. For example, individual demand curves can be derived from a model which assumes that individuals maximize their utility, subject to a budget constraint. Similarly, firms are usually assumed to minimize their costs for a given level of production; or to maximize their profits. In many econometric models, parameters are selected to minimize the difference between actual observations and model predictions. Thus this course is excellent preparation for further study in economics. In addition, these mathematical concepts are used in many other disciplines which use quantitative models.

**PREREQUISITES:** Econ 2010 and 2020, Math 1080, or consent of the instructor.


**HOMEWORK:** Weekly homework will be assigned but will not be graded. Doing homework is the best way to learn the material. You are encouraged to consult with each other or with me on the homework.

**GRADING:** Your course grade will be based on weekly quizzes (25%), a midterm (25%), and a comprehensive final (50%). The quizzes will be handed out on Wednesday and must be returned at the beginning of class on the following Wednesday (no exceptions). You must do the quizzes individually; do not consult with others. Your worst quiz score will not be included in your grade.

**FIRST LECTURE:** The first lecture will be on Friday, 31 August. Please read chapter 1 and chapter 2, sections 1-4, before class.
INTRODUCTION
  Mathematical Basics (Ch. 2)
  Equilibrium Analysis in Economics (Ch. 3, Secs. 1-3, 5)

LINEAR MODELS AND MATRIX ALGEBRA
  Vectors and Matrices (Ch. 4)
  Solving Matrix Equations (Class notes)
  General Market Equilibrium (Ch. 3, Sec. 4)
  Leontief Input Output Models (Ch. 5, Sec. 7)
  Determinants (Ch. 5, Sec. 2)
  Eigenvalues and Eigenvectors (p. 326)
  Quadratic Forms (Ch. 11, Sec. 3)

DIFFERENTIAL CALCULUS
  Derivatives (Ch. 6, Secs. 2-4)
  Rules of Differentiation (Ch. 7, Secs. 1-4)
  Comparative Statics (Ch. 7, Sec. 5)
  Elasticity (Ch. 8, p. 191)

OPTIMIZATION
  Unconstrained
    - Single Variable (Ch. 9, Secs. 1-4)
    - Taylor Series (Ch. 9, Sec. 5)
    - N-th Derivative Test (Ch. 9, Sec. 6)
    - Two or More Variables (Ch. 11, Secs. 2, 4-6)
  Equality Constraints (Ch. 12, Secs. 1-3, 5, 7)