

ECO 205: QUANTITATIVE METHODS I
(Winter 2007)

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COURSE DESCRIPTION:

This is the first of a two-course sequence designed to give economics majors the quantitative skills necessary for upper-level courses in the department. The principal topics covered are: i) linear equations, systems of linear equations, and exponential and logarithmic functions as they applied to economics and business problems, ii) basic mathematics of finance, and iii) applied calculus--differentiation, optimization and simple integration. In this course, mathematics is viewed as a means rather than an end in itself. Thus, applications of the relevant mathematical concepts and theories to economics and business related problems are strongly emphasized. Prerequisite: at least two years of high school algebra.

TEXTBOOK:

Rosser, Mike, *Basic Mathematics for Economists*, Routledge Publishing, 2nd edition, 2003.

PART I: BASIC CONCEPTS OF FUNCTIONS AND ALGEBRAIC RELATIONSHIPS

1. LINEAR RELATIONSHIPS

Section A: Functions and Linear Equations (Chapter 4, pp. 63-86)

- a) The basic concept functions
- b) Linear functions
- c) Equation of a line: the slope-intercept form
- d) Inverse functions
- e) Applications: linear demand and supply functions, budget equation, break-even analysis and a straight-line depreciation of a capital asset.

Section B: Systems of Linear Equations (Chapter 5, pp. 109- 126)

- a) Basic notions
- b) Operations on linear systems
- c) Simultaneous equations
- d) Applications: production problems, simultaneous equilibrium in related markets, and aggregate consumption function

Section C: Fitting a Linear Function – an overview

- (a) Scattered diagram
- (b) The least square estimators

Section D: Linear Programming (Chapter 5, pp. 148-167)

- (a) The general properties of Linear Programming as a mathematical model
- (c) Constrained maximization
- (d) Constrained minimization

2. QUADRATIC FUNCTIONS AND THEIR APPLICATIONS IN ECONOMICS (Chapter 6, pp. 168-184)

- a) The general form of the quadratic function
- b) Quadratic equations
- c) Polynomials
- d) Economic applications

3. EXPONENTIAL AND LOGARITHMIC FUNCTIONS

- a) Exponential functions and their properties
- b) Graphs of exponential functions
- c) The function e
- d) Logarithms and logarithm rules
- e) Common and natural logarithms
- f) Economic applications: growth functions, log-linear demand and production functions

PART II: MATHEMATICS OF FINANCE (Chapter 7, pp. 189-218)

- a) Compound interest and the future value
- b) Compound discount: present value
- c) Continuous compounding
- e) Doubling time
- f) Applied problems in business and economics

PART III: APPLIED DIFFERENTIAL AND INTEGRAL CALCULUS

1. INTRODUCTION TO DIFFERENTIAL CALCULUS: Single Variable Functions (Chapter 8, pp. 247-271; Chapter 12, pp. 372-379)

- a) The concept of limits and basic limit theorems
- b) The concept of continuity and the basic notion of continuous functions
- c) The average rate of change: the difference quotient
- d) The derivative
- e) Basic differentiation rules
- f) Derivatives of exponential and logarithmic functions
- f) Economic applications: marginal concepts and analysis, relationships among total, Average and marginal concepts, tax yield, point elasticity of demand, the Keynesian multiplier, etc..

2. UNCONSTRAINED OPTIMIZATION: Functions of Single Variable (Chapter 9, pp. 272-290)

- a) The basic notion of optimization
- b) Maxima and minima of functions: the first derivative test
- c) The second derivative test
- d) Economic applications: maximization of revenue and profit functions and minimization of cost functions, inventory control, comparative static effects of taxes

3. MULTIVARIATE CALCULUS AND CONTRAINED OPTIMIZATION (Chapter 10, pp. 291-328; Chapter 11, pp. 334-363)

- a) The partial derivative
- b) Maxima and minima: two independent variables
- c) Total differentials and total derivatives
- d) Constrained optimization
- g) the method of the Lagrange multiplier
- h) Applications: production, revenue, cost and profit functions.

4. **MORE ON DIFFERENTIAL CALCULUS (Chapter 12, pp. 364-377)**

- a) The chain rule
- b) Implicit differentiation
- c) Economic applications: elasticity of demand and total revenue and the multiplier

5. **SIMPLE INTEGRATION (Chapter 12, pp. 384-394)**

- a) Anti-derivatives: the indefinite integral
- b) Rules of integration
- c) The definite integral
- d) The fundamental theorem of calculus
- i) Area and the definite integral
- h) Applications: consumers' and producers' surplus; the Lorenz coefficient, and depreciation

GRADING:

Two mid-term exams	60%
Final exams	30%
Homework Assignments	10%

IMPORTANT REMINDER:

Exams must be taken at the times designed except in the case of illness with a physician's excuse. No late assignment will be accepted. The final exam will be comprehensive. Violation of an academic regulation could have a very serious consequence ranging from a reduction of grade on a specific project to failure in a course. In this class, in no time and under no circumstance is academic dishonesty tolerated.