

# ECON5102 Mathematics for Economic Analysis

Fall 2024

Department of Economics  
The Chinese University of Hong Kong

Professor LI Duoze

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Lectures: Mon, Wed, Fri 9:30AM to 12:15PM  
Aug 5 to Aug 30

Classroom: ELB203

Office Hour: Mon 2:30 to 3:30PM

Tutor: Dr. Wendy Xu

Email: [wendyxu@cuhk.edu.hk](mailto:wendyxu@cuhk.edu.hk)

Tutorials: Wed, Fri 2:30PM to 4:15PM

Classroom: ELB203

Office Hour: TBA

## Course Description

This course reviews some of the mathematical methods most widely used in modern economic analysis. We shall cover the following topics: linear algebra, elementary real analysis, multivariable differential calculus, theory of optimization with constraints, and if time allows, dynamical systems in discrete and continuous times. It is assumed that the students are familiar with basic calculus and elementary linear algebra.

## Learning Outcomes

The primary goal of this course is to provide solid mathematics preparation for graduate study in economics. After taking this course, the students are expected to:

- Master the basic mathematical methods most widely used in economic analysis;
- Become comfortable with reading and analyzing research papers in economics;
- Deepen the understanding of the nature and the role of mathematics in economic analysis.

## Recommended Textbooks

The lecture will mainly be based on the following two textbooks:

- Carl P. Simon and Lawrence Blume, *Mathematics for Economists*, Norton, 1994.
- Alpha C. Chiang and Kevin Wainwright, *Fundamental Methods of Mathematical Economics*, McGraw-Hill, 2005.

## Assessment Scheme

The course grade will be determined by problem sets (10%) and a comprehensive final exam (90%). The assignment of grades will follow the descriptors as given below.

Grade	Descriptor
A	Truly outstanding performance, able to apply knowledge to novel situations/problems
A-	Thorough understanding of taught concepts, steady accumulation of knowledge and skills throughout the course
B+/B/B-	Satisfactory grasp of key concepts, consistent involvement in learning activities
C+/C/C-	Fair understanding of key concepts
D+/D	Some misunderstanding of key concepts, inconsistent efforts observed
F	Unsatisfactory performance, poor understanding of subject matter, poor efforts

## **Attendance Policy**

Students are required to attend all the lectures. Students absent from class for any reason are responsible for the missed work.

## **Problem Sets**

Problem sets will be given regularly. As essential adjunct to the lecture material, these problem sets will assist you in preparing for the final exam. Students are required to hand in their solutions individually before each due date. Late submission will not be accepted. One randomly selected question in each problem set will be marked to determine your problem set grade. Suggested solutions will be provided on the tutorials.

## **Academic Honesty**

Attention is drawn to university policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at <http://www.cuhk.edu.hk/policy/academichonesty/>

## **Course Content**

### **1. Linear Algebra**

Matrix Algebra, Rank, Determinant, Linear Equation Systems, Cramer's Rule, Vector Space, Linear Independence and Dimension, Fundamental Theorem of Linear Algebra

### **2. Elementary Real Analysis**

Metrics and Norms, Sequences, Open and Closed Sets, Continuity, Compact Sets, Extreme Value Theorem, Convex Sets and Separating Hyperplanes

### **3. Differential Calculus of Several Variables**

Mean Value Theorem, Taylor Polynomials, Inverse Function Theorem, Implicit Function Theorem, Homogeneous and Homothetic Functions, Concavity and Quasiconcavity

### **4. Optimization Theory**

Optimization with Equality and/or Inequality Constraints, Lagrangian Method, First-Order and Second-Order Conditions, Kuhn-Tucker Conditions, Envelope Theorem and Duality Theory

### **5. (If time allows) Dynamical Systems in Discrete and Continuous Times**

Eigenvalue and Eigenvector, First-Order and Higher-Order Differential Equations, First-Order and Higher-Order Difference Equations, Simultaneous Differential Equations and Difference Equations