The Chinese University of Hong Kong
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ECON 5101A Review of Quantitative Methods
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Syllabus

Course Description This course reviews mathematical methods that are required for graduate level courses in economic theory. Topics include logic, proof methods, sets, functions, basic topology, matrix, differentiation, exponential functions, concave functions, unconstrained optimization, constrained optimization, integration, differential equations, and difference equations. Related economic applications will also be discussed.

Learning Outcomes After taking this course, students should be familiar with mathematical methods that are required for graduate level courses in economic theory.

Readings Teaching materials are based the textbook [CW] and other references.

Lecture notes will be posted on the course website on the CU eLearning system.

Grade The course grade is counted as follows:

Mid-term	50%
Final	50%

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/.

Discussion Topics

1. Logic and Proofs: connectives, quantifiers, proof methods

2. Sets, Functions, and Countable Sets

3. Basic Topology: sequence, limit, supremum, continuous functions, open sets, closed sets, convex sets, compact sets

4. Matrix: matrix operations, inverse, determinant, Cramer's Rule, rank

5. Differentiation (Single Variable): derivative, differential rules, Mean Value Theorem, L'Hoptial Rule, Taylor expansion

6. Differentiation (General Case): differential, partial and total derivative, Inverse Function Theorem, Implicit Function Theorem

7. Unconstrained Optimization (Single Variable): first-order conditions, second-order conditions

8. Exponential and Logarithmic Functions: natural exponential number, differentiation rules

9. Concave Functions: characterizations of concavity, negative (semi)definite matrices, eigenvalues and eigenvectors, quasiconcave functions

10. Unconstrained Optimization (General Case): first-order conditions, second-order conditions for local maximization, global maximization

11. Optimization with Equality Constraints: Lagrangian method, homogeneous functions, envelope method

12. Optimization with Inequality Constraints: Kuhn-Tucker conditions

13. Integration: indefinite integrals, definite integrals, improper integrals

14. First Order Differential Equations: solution existence, separable equations, linear equations, exact equations

15. Second Order Linear Differential Equations

16. Systems of First Order Differential Equations: linear system, phase diagram, linearization of non-linear systems

17. First Order Linear Difference Equations

18. Second Order Linear Difference Equations

References

[**BS**] Bartle, R. G., and Sherbert, D. R. (2000). *Introduction to Real Analysis,* 3rd edition. John Wiley & Sons, New York.

[**CW**] Chiang, A. C., and Wainwright, K. (2005). *Fundamental Methods of Mathematical Economics,* 4th edition. McGraw Hill Companies, New York.

[**M**] Mas-Colell, A., Whintson, M. D., and Green, J. (1995). *Microeconomic Theory.* Oxford University Press, New York.

[**R**] Rudin, W. (1976). *Principles of Mathematical Analysis,* 3rd edition. McGraw-Hill, New York.

[**SB**] Simon, C. P., and Blume, L. (1994). *Mathematics for Economists.* W. W. Norton & Company, New York.

[**SHSS**] Sydsæter, K., Hammond P., Seierstad, A., and Strøm, A. (2008). *Further Mathematics for Economic Analysis,* 2nd edition. Financial Times/Prentice Hall, New York.