UNSW Business School
School of Economics

Math Refresher Course
February 2019

Course Objective

The math refresher course is aimed at explaining the most important mathematical concepts used to solve economic problems. In particular, it provides a review of the basic mathematical tools used in the core courses of the graduate program in Economics at UNSW.

The course starts with a general revision of logic, sets, and methods of proof. The course then proceeds with a revision of sequences, functions, and linear algebra which are useful for understanding optimization concepts. Afterwards, unconstrained and constrained static optimization techniques are reviewed.

Lecturer Details

Lecturer: Nadine Yamout
Desk: ASB - Desk 430D
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Location and Time

The course will extend from Monday, February 11 to Friday, February 15, 2019.

There will be a two-hours lecture from 10:00am to 12:00pm, followed by a one-hour tutorial from 1:00pm to 2:00pm.

The lecture and tutorial will be held in Old Main Building room 150.

Course Assessment

There are no assessments in this course. The course is voluntary and marks are not recorded.

Resources and Readings

Lecture slides will be provided during the course and will be used to introduce the material. In the tutorials, practice questions and exercises relating to the covered topics will be solved.

Some useful textbooks which relate to the material in this course are:

- Alpha Chiang, *Fundamental Methods of Mathematical Economics*, Third Edition, McGraw-Hill, 1984.
- Carl Simon and Lawrence Blume, *Mathematics for Economists*, New York: Norton, 1994.
- Knut Sydsæter, Peter Hammond, Atle Seierstad, and Arne Strom, *Further Mathematics for Economic Analysis*, Second Edition, Prentice Hall, 2008.
- Malcom Pemberton and Nicholas Rau, *Mathematics for Economists: An Introductory Textbook*, Manchester University Press, 2001
- Nancy Stokey and Robert Lucas, *Recursive Methods in Economic Dynamics*, Harvard University Press, 1989.
- Rangarajam Sundaram, *A First Course in Optimization Theory*, Cambridge University Press, 1996.

Course Schedule

The following provides a brief overview of the material covered in each lecture.

- Lecture 1: Logic, Proof, and Sets
  - Introduction to Logic
    - Conjunction, disjunction, negation and implication
    - Converse, inverse, and contrapositive of implication
    - Biconditional and contradiction
    - Logical Equivalence
  - Proof Techniques
    - Trivial and Vacuous proofs

        * Direct proof
        * Proofs by contrapositive
        * Proof by cases
        * Proof by contradiction
        * Disproof by counterexample
    - Basic Set Theory
        * Vocabulary of sets
        * Relations between sets
        * Operations with sets

- Lecture 2: Matrix Algebra
    - Matrices and Vectors
    - Matrix Operations
    - Identity matrices and null matrices
    - Transposes and inverses
    - Determinants
    - Solving Linear Systems
    - Eigenvalues and eigenvectors

- Lecture 3: Limits and Derivatives
    - The Concept of Limits
        * Evaluation of Limit
        * Existence of Limit
        * Limit Theorems
    - Derivatives
        * Difference Quotient and Derivative
        * Differentiation Rules
        * Chain Rule and Inverse Rule
    - Partial Derivatives
        * Techniques for partial differentiation
        * Gradient vector
        * Higher Order Partial Derivatives

- Lecture 4: Calculus and Functions
    - Graphs and Level Sets

  - Concavity and Convexity
  - Quasi-concavity and Quasi-convexity
  - Homogeneity of Functions
  - Linear Approximation
  - Taylor Approximation
  - Log-Linearization

- Lecture 5: Static Optimization
  - Unconstrained Optimization
    - Relative Versus Absolute Extremum
    - Extreme Values of a Function on One Variable
    - Extreme Values of a Function on Two Variables
  - Constrained Optimization
    - Optimization with Equality Constraints
    - Optimization with Inequality Constraints