Math Workshop Syllabus

Fall 2024/2025

Instructor: Ali Smaili
E-mail: al476849@dal.ca

Course Description

The content of the workshop will cover basic mathematical tools that are useful for your core courses, e.g. Macroeconomics, Microeconomics, and Econometrics, as well as other elective economics courses.

Course Outcome

The math workshop is designed to familiarize you with the fundamental mathematical applications in economics. The workshop will better prepare students for the mathematics in their economics courses throughout their Graduate studies.

Study Material

The material for this workshop is compiled from multiple sources. Lecture slides that cover each topic will be provided. Below, please find the recommended textbooks that cover the topics of this workshop. These textbooks are recommended, however not mandatory. The content provided in the workshop will be sufficient.

1. Alpha Chiang and Kevin Wainwright (2005), Fundamental Methods of Mathematical Economics. 4th Edition. McGraw-Hill, Inc.

2. Michael W. Klein (2002), Mathematical Methods for Economics. Pearson Education, Inc.

3. Carl P. Simon and Lawrence Blume (1994), Mathematics for Economists. N.W Norton & Company, Inc.

4. Jeffrey M. Wooldridge (2019), Introductory Econometrics: A Modern Approach

Students are also welcome to refer to a recommended website by Martin J. Osborne found below. This website provides a deep review of the math needed for an economics student and will be referred to during the workshop.

https://mjo.osborne.economics.utoronto.ca/index.php/tutorial/index/1/toc

Throughout this workshop, we will be solving numerous problems that you may encounter in your graduate courses. Also, students are welcome to use their own lecture notes from the "Mathematics for Economists" course.

Topics Covered and Suggested Readings

The material will cover several topics in mathematics such as properties of functions, Matrix Algebra, Differential Calculus, Optimization (static and dynamic), among other topics. The below suggested topics and extent of coverage of the content is tentative and subject to change.

Topic	Content	Suggested Readings
Basic Review	Mathematical notation; proofs; properties of functions; types of functions; graphical representation of functions	Chiang → Ch. 1-2, 6.4-6.6, 10 Klein → Ch. 1-3 Simon & Blume → Ch. 1-2, 5 Osborne → 1.1, 1.4, and 1.7
Matrix & Linear Algebra	Matrix operations; systems of linear equations; determinants; inverse of a matrix; rank; Cramer's rule; eigen values and eigen vectors	Chiang → Ch. 3-5 Klein → Ch. 4-5 Simon & Blume → Ch. 6-11 Osborne → 1.2 and 1.3
Differential Calculus	Derivatives; differentiation; rules of differentiation; chain rule; Taylor theorem; partial derivatives; homogenous functions; Euler's theorem; implicit functions; comparative statics	Chiang → Ch. 6-8 Klein → Ch.6-8 Simon & Blume→ Ch. 3-4, 14 Osborne → 1.5, 1.6, 2.1-2.5
Concavity & Convexity	Definitions; convex sets; definiteness and semi-definiteness of a matrix; concave and convex functions; quasiconcavity and quasiconvexity	Simon & Blume → Ch. 21 Osborne → 3.1-3.4 TBD
Optimization	Extreme values; first and second order conditions (uni- and multi-variate cases); necessary and sufficient conditions; Hessian matrix; unconstrained vs. constrained optimization; envelope theorem; bordered Hessian; Lagrange technique; Kuhn-Tucker method (inequality constraints); economic applications	Chiang → Ch. 9, 11, 12 Klein → Ch. 9-11 Simon & Blume → Ch. 17-19 Osborne → 4.1-4.3, 5.1-5.3, 6.1-6.3, 7.1-7.5
Integral Calculus	Indefinite integrals; definite integrals; rules of integration; improper integrals; economic applications	Chiang → Ch. 14 Osborne → 1.5 TBD
Dynamic Optimization & Dynamic Programming	Finite vs. infinite horizon models; discrete vs. continuous settings; etc.	TBD

Dates and Times

The math workshop will be lecture based and in-person beginning on September 3rd. A tentative schedule (dates, times, locations, and topics covered on each date) of the Math Workshop is found below. A more complete syllabus will be sent before the start of the Math Workshop.

Date	Time	Building	Room No.	Topics Covered
Sep. 3	16:05 - 18:05	LSC Common Area	C332	TBD
Sep. 5	16:05 - 18:05	LSC Common Area	C332	TBD
Sep. 6	9:00 - 12:00	LSC Common Area	C338	TBD
Sep. 10	16:05 - 18:05	LSC Common Area	C332	TBD
Sep. 12	16:05 - 18:05	LSC Common Area	C332	TBD
Sep. 13	9:00 - 12:00	LSC Common Area	C338	TBD
Sep. 17	16:05 - 18:05	LSC Common Area	C332	TBD
Sep. 19	16:05 - 18:05	LSC Common Area	C332	TBD
Sep. 20	9:00 - 12:00	LSC Common Area	C338	TBD
Sep. 24	16:05 - 17:25	LSC Common Area	C332	TBD
Sep. 26	16:05 - 17:25	LSC Common Area	C332	TBD
Sep. 27	9:00 - 12:00	LSC Common Area	C338	TBD
Oct. 1	16:05 - 17:25	LSC Common Area	C332	TBD
Oct. 3	16:05 - 17:25	LSC Common Area	C332	TBD
Oct. 4	9:00 - 12:00	LSC Common Area	C338	TBD
Oct. 8	16:05 - 17:25	LSC Common Area	C332	TBD
Oct. 10	16:05 - 17:25	LSC Common Area	C332	TBD
Oct. 11	9:00 - 12:00	LSC Common Area	C338	TBD