liberal arts & professional studies | YORK

Introductory Mathematical Economics II

AP/ECON 1540S

WINTER 2026

COURSE INFORMATION

Course Instructor: David K. Lee, Ph. D. Phone:
E-mail: dklee@yorku.ca

Course Time & Days: T/R 11:30am -12:50pm
Class Location: ACW005
Course eClass site:

Course Communication Plan and Office Hours

My office is VH 1129. Office hours may be done on-line. I encourage students who wish to see me can arrange an in-person or on-line meeting with me. Regularly check the eClass page for announcements. Zoom connection information will be available through eclass.

Online Tutorial Session: The tutorial session will be held online via Zoom by the course instructor. It will be held on Saturday evenings from 8:00 PM to 9:00 PM. This is not an official schedule, and attendance will not be checked. However, all students are encouraged to attend this session.

Tutorials, Labs and TA Contact Information

TBA

Land Acknowledgment

York University recognizes that many Indigenous Nations have longstanding relationships with the territories upon which York University campuses are located that precede the establishment of York University. York University acknowledges its presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, and the Huron-Wendat. It is now home to many First Nation, Inuit, and Métis communities. We acknowledge the current treaty holders, the Mississaugas of the Credit First Nation. This territory is subject of the Dish with One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region (LA&PS Land Acknowledgement).

Course Overview

Course Description

This course extends the analysis of basic Economics ideas, topics and problems begun in AP/ECON 1530 3.00. Again, relevant mathematical ideas and techniques are recalled and/or derived so as to provide a deeper understanding of Economic issues and how they can be resolved. The issues and problems covered require functions of more than one variable for their resolution. The notion of Quantity Supplied is combined with the notion of Quantity Demanded and notions of Market Equilibrium are introduced and discussed. Equilibria are evaluated through the introduction of mathematical notions and properties of systems of equations, eventually in matrix form. A deeper

understanding of theories of demand (supply) and the foundations of demand (supply) functions is developed through the introduction of mathematical notions of unconstrained and constrained optimization and linear and nonlinear programming. As in AP/ECON 1530 3.00, many topics and issues are addressed and problem framing and problem-solving abilities are enhanced.
Prerequisite: AP/ECON 1530 3.00 or equivalent.
Prerequisites or corequisites: AP/ECON 1000 3.00 or AP/ECON 1010 3.00, or equivalent.
No Credit Retained (NCR) Note: Students who have successfully completed or who are currently enrolled in SC/MATH 1021 3.00, SC/MATH 1025 3.00, or SC/MATH 2221 3.00. SC/MATH 1510 6.00 and SC/MATH 1520 3.00 may not be taken by any students who has passed or is currently taking AP/ECON 1540 3.00.

Course credit exclusions: SC/MATH 1505 6.00, SC/MATH 1540 3.00, SC/MATH 1550 6.00, GL/MATH 2650 3.00, GL/MODR 2650 3.00.

Note: Acceptable course substitutes are available in the Calendar.

Course Learning Objectives

By the end of this course, students should have a solid knowledge of matrix algebra and multivariate calculus and be able to set up and solve unconstrained and constrained optimization problems with particular emphasis on economic problems.

a. Matrix and vector algebra, determinants and inverse matrices, linear programming
b. Functions of many variables, tools for comparative statics, multivariable optimization
c. Constrained optimization

Course Organization

This course involves formal lectures presented by the course instructor. The classroom technology will be used extensively, such as PowerPoint, or MS word format presentation. There will be extensive usages of the course web site. Reading assignments, practice problems, problem solving, etc., for each lecture session, tutorial sessions or TA availability, etc., will be announced on the course web site.

Required Course Materials

Essential Mathematics for Economic Analysis, 6th edition
Published by Pearson (June 17, 2021) © 2021
Knut Sydsaeter, Peter Hammond, Arne Strom, Andrés Carvajal

Cost and availability:
This textbook is available at York bookstore (https://www.bookstore.yorku.ca), and publisher's website (https://www.pearson.com/en-ca/subject-catalog/p/essential-mathematics-for-economic-analysis/P200000005528/9781292359328)

York Bookstore: eclass: Day1Digital Ebook $62
Publisher: eTextbook, MyLab, or Print (Paperback): $99.99

Students are strongly advised to obtain a hardcopy version of the textbook, available at the bookstore or on-line. (Recent prices online were quite low.) There is a virtual version of the text available with a link provided on the eclass page. Students may only use non-programmable calculators during tests or midterms. (E.g. if a calculator can graph or compute derivatives or integrals, it is not permitted.) If you

are not certain if it is allowed, ask me before the test or exam. Cheap calculators available at a dollar store are usually quite adequate.

Technical Requirements
This course is, in principle, a face-to-face lecture in a classroom. However, online lecture deliveries can be made, and some student consultations are expected to take place online. The technical features, a computer with microphone and webcam, and a high speed and reliable internet connection, and/or a smart device with these features, are required for students to fully participate in the course. There are some live information sessions including Q & A that may be conducted through Zoom video conferencing, where students are expected to participate. If you are not comfortable with these requirements, you should not enroll in this section of the course.
Several platforms will be used in this course (e.g., eClass, Zoom, etc.) where students will interact with the course materials, the course director/TA, as well as with each other.

Here are some useful links for computing information, resources, and help:

- Student Guide to eClass
- Zoom@YorkU Best Practices
- Zoom@YorkU User Reference Guide
- eLearning Getting Started (LA&PS eServices)
- Student Guide to Remote and Online Learning

To determine Internet connection and speed, there are online tests, such as Speedtest, that can be run. If you need technical assistance, please consult the University Information Technology (UIT) Student Services web page or write to askit@yorku.ca.

Evaluation *

The grade for this course is composed of the mark received for each of the following components:

Type of Assessment	Percent/Weight	Date
Attendance	20%	
Midterm Exam I (Classroom, 90 minutes)	Best 2 only 40%	Sat Jan 31, 9:00-10?30
Midterm Exam II (Classroom, 90 minutes)		Sat Feb 28, 9:00-10:30
Midterm Exam III (Classroom, 90 minutes)		Sat Mar 28, 9:00-10:30
Final Exam (Classroom, 180 minutes)	40%	Apr 8-24
Total	**100%**	

Class attendance and participation is mandatory. Students are required to close any electronic devices apart from calculators and, say, one reader which may be used to mark up class notes. You should actively participate in class. Materials particularly germane to the midterms and final exam will often be covered exclusively in class. All tests and exams are based on all material covered up to and including the material covered in the class prior to the test/exam. It is your responsibility to be informed of what is covered in class.

Problem sets will be posted on the course web site throughout the semester. Some of them may be solved in class. These problems will not be graded; however, I encourage you to work through them. It will help you understand the course material and consequently increase the probability that you will do well on the course. Practice may not always make perfect, but it's a good start.

Tutorials and Labs
The Department of Economics will be running Peer Assisted Study Sessions (PASS). Students may also receive assistance at the Student Numeracy Assistance Centre at Keele (SNACK).

Missed Tests and Exams

No Makeup Midterms Offered
There are no makeups for missed midterm exams.
Students must complete at least two of the three midterm exams to avoid being penalized on the final course evaluation.

Requesting Deferred Final Exam
Students will be required to complete a Mach form requesting a deferred exam. For complete instructions for using the Mach form, please go to our website:
https://www.yorku.ca/laps/econ/undergraduate-programs/academic-resources/department-policies/deferred-standing/
A student must submit the form within 5 business days from the final exam date.

Grading

The grading scheme for this course conforms to the 9-point system used in undergraduate programs at York University. For a full description of the York grading system, visit the York University Academic Calendar.

Grade	Grade Point	Percent Range	Description
A+	9	90-100	Exceptional
A	8	80-89	Excellent
B+	7	75-79	Very Good
B	6	70-74	Good
C+	5	65-69	Competent
C	4	60-64	Fairly Competent
D+	3	55-59	Passing
D	2	50-54	Marginally Passing
E	1	(marginally below 50%)	Marginally Failing
F	0	(below 50%)	Failing

Course Schedule

Important Dates

Explore the York University Academic Calendar to find a list of important dates, such as class start/end dates, drop deadlines, holidays and more.

LECTURE SCHEDULE AND STUDY PLAN

Week	Description	Textbook Coverage
1 T/R Jan 6/8	Topic 1: Matrix Algebra – Part 1 • Systems of Linear Equations • Matrices and Matrix Operations • Matrix Multiplication	• Ch. 12:1-5
2 T/R Jan 13/15	Topic 2: Linear Algebra: Vectors and Matrices – Part 2 • Rules for Matrix Multiplication • The Transpose • Gaussian Elimination • Vectors	• Ch. 12:6-10
3 T/R Jan 20/22	Topic 3: Determinants and Matrix Inversion – Part 1 • Determinants of Order 2 • Determinants of Order 3 • Determinants of Order *n*	• Ch. 13:1-3
4 T/R Jan 27/29	Topic 4: Determinants and Matrix Inversion – Part 2 • Rules for Determinants • The Inverse of a Matrix • A General Formula for the Inverse • Cramer's Rule • Quadratic forms and principal minors	• Ch. 13: 4-8 • Ch. 13: 12
Exam 1: Sat Jan 31, 9:00am - 10:30am		
5 T/R Feb 3/5	Topic 5: Functions of Several Variables – Part 1 • Functions of 2 Variables Partial Derivatives with 2 Variables	• Ch 14:1-4
6 T/R Feb 10/12	Topic 6: Functions of Several Variables – Part 2 Functions of More Variables • Partial Derivatives with More Variables • Economic Applications • Partial Elasticities • Convex Sets (introduction)	• Ch 14: 5-10
Winter Reading Week: Feb 14-20		
7 T/R Feb 24/26	Topic 7: Tools for Comparative Statics – Part 1 • A Simple Chain Rule • Chain Rule for Many Variables • Implicit Differentiation Along a Level Curve	Ch 15:1-7

Exam 2: Sat Feb 28, 9:00am - 10:30am **Drop Deadline: Mon Mar 9**		
8 T/R Mar 3/5	Topic 8: Tools for Comparative Statics – Part 2 • Linear Approximations • Differentials • Systems of Equations • Differentiating Systems of Equations	• Ch 15: 8-11
9 T/R Mar 10/12	Topic 9: Multivariate Optimization – Part 1 • Two Variables: Necessary Conditions • Two Variables: Sufficient Conditions • Local Extreme Points	• Ch. 17: 1-3
10 T/R Mar 17/19	Topic 10 – – Multivariate Optimization – Part 2 • Linear Models with Quadratic Objectives • The Extreme Value Theorem • Three or More Variables • Comparative Statics and the Envelope Theorem	• Ch. 17: 4-7
11 T/R Mar 24/26	Topic 11: Constrained Optimization – Part 1 • The Lagrange Multiplier Method • Interpreting the Lagrange Multiplier • Why the LM Method Works	• Ch. 18: 1-4
Exam 3: Sat Mar 28, 9:00am – 10:30am		
12 T/R Mar 31/Apr 2	Topic 12: Constrained Optimization – Part 2 • Sufficient Conditions • More Variables and More Constraints • Comparative Statics	Ch. 18:5-7
Final Exam: Apr 8 - 24		

The above schedule may change slightly as the term progresses. Please check the course website for more information regarding the lecture notes, midterm tests and final exam coverage. The midterm tests cover all material from the first up to and including the class prior to the midterm. The final exam covers all course material.

New Information and Changes:

The schedule is subject to change –sometimes there are unexpected absences, or we bog down on an issue. Check your class notes, or contact me for up-dated work schedules.

It may be very possible to make some adjustments to lectures and/or exams schedules. Students may also have handouts for the topics discussed in the class. It is students' responsibility to be aware of any policy (or schedule change), or to collect handouts from classes. If you miss classes, contact the instructor before or immediate after, and check if there is any policy change or handout distributed.

There is no excuse for not knowing course policies or schedule changes, or for not having handouts.

Course Policies

Please review the course policies in this section. All students are expected to familiarize themselves with the following information:

- Student Rights & Responsibilities
- Academic Accommodation for Students with Disabilities

Academic Integrity

Academic integrity is a fundamental and important value of York University. To maintain a fair and honest learning environment, you are responsible for understanding and upholding academic integrity in all courses and academic activities. You are encouraged to connect with reliable on-campus resources that support your coursework and academic honesty. To better understand the serious consequences of breaching academic honesty policies, familiarize yourself with the *Senate Policy on Academic Conduct*. You can learn more about upholding academic integrity in your courses by exploring Guiding Principles for LA&PS and Academic Integrity for Students.

Generative Artificial Intelligence (GenAI)

Students are not permitted to use generative artificial intelligence (AI) in this course. Submitting any work created (in whole or part) through the use of generative AI tools will be considered a violation of York University's *Senate Policy on Academic Conduct*. Using AI apps such as ChatGPT, GPT-3, DALL-E, translation software among others to complete academic work **without your instructor's knowledge or permission**, is considered to be a breach of academic honesty. For more information, please review AI Technology & Academic Integrity: Information for Students.

If you're not sure whether using an AI app for your academic work is acceptable, it is recommended that you:

- Carefully review the guidelines for your assessments
- Check for any messages from your instructor on eClass
- Ask your instructor or TA if they are permitting the use of these tools

Turnitin

To promote academic integrity in this course, students will normally be required to submit their written assignments to Turnitin (via the course's eClass site) for a review of textual similarities and the detection of possible plagiarism. In so doing, students will allow their material to be included as source documents in the Turnitin.com reference database, where they will be used only for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin service are described on the Turnitin.com website. York students may opt out of using Turnitin. If you wish to opt out, you should contact your instructor as soon as possible.

Accessibility

York University is committed to creating a learning environment which provides equal opportunity to all members of its community. If you anticipate or experience any barriers to learning in this course, please discuss your concerns with your instructor as early as possible. For students with disabilities, contact Student Accessibility Services to coordinate academic accommodations and services.

Accommodations will be communicated to Course Directors through a Letter of Accommodation (LOA). Accommodations for tests/exams normally require three (3) weeks (or 21 days) before the scheduled test/exam to arrange.

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community and making reasonable and appropriate accommodations to adherents for observances of special significance. Should any of the dates specified in this syllabus for course examinations, tests, or deadlines conflict with a date of religious significance, please contact the instructor within the first three (3) weeks of class. If the date falls within the formal examination periods, you must complete and submit a Religious Accommodation for Examination Form at least three (3) weeks before the start of the exam period.

Intellectual Property

Course materials are designed for use as part of this particular course at York University and are the intellectual property of the instructor unless otherwise stated. Third-party copyrighted materials (such as book chapters, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian copyright law. Students may not publish, post on an Internet site, sell, or otherwise distribute any course materials or work without the instructor's express permission. Course materials should only be used by students enrolled in this course.

Copying this material for distribution (e.g., uploading material to a commercial third-party website) may lead to a charge of misconduct according to York's *Code of Student Rights and Responsibilities*, the *Senate Policy on Academic Conduct*, and/or legal consequences for copyright violations.

Student Support and Resources

York University offers a wide range of student supports resources and services, including everything from writing workshops and peer mentorship to wellness support and career guidance. Explore the links below to access these on-campus resources:

- Academic Advising is available to provide students support and guidance in making academic decisions and goals.
- Student Accessibility Services are available for support and accessibility accommodation when required.
- Student Counselling, Health & Wellbeing offers workshops, resources, and counselling to support your academic success.
- Peer-Assisted Study Sessions (PASS) Program provides student study sessions for students to collaborate and enhance their understanding of course content in certain courses.
- Student Numeracy Assistance Centre at Keele (SNACK) supports students in courses involving math, stats, and Excel.
- The Writing Centre provides multiple avenues of writing-based support including drop-in sessions, one-to-one appointments, a Multilingual Studio, and an Accessibility Specialist.
- Centre for Indigenous Student Services offers a community space with academic, spiritual, cultural, and physical support, including writing and learning skills programs.
- ESL Open Learning Centre (OLC) supports students with building proficiency in reading, writing, and speaking English.

- Learning Skills Services provides tips for time management, effective study and learning habits, keeping up with coursework, and other learning-related supports.
- Learning Commons provides links to supports for time management, writing, study skills, preparing for exams, and other learning-related resources.
- Roadmap to Student Success provides students with timely and targeted resources to help them achieve academic, personal, and professional success.
- Office of Student Community Relations (OSCR) is responsible for administering the *Code of Student Rights & Responsibilities* and provides critical incident support.
- Peer Mentorship helps students transition through their first year by connecting them with upper-year students. The mentors can help find supports and resources. They also lead a community hub on campus.
- goSAFE is staffed by York students and can accompany York community members to and from any on-campus location, such as the Village Shuttle pick-up hub, parking lots, bus stops, or residences.

For a full list of academic, wellness, and campus resources visit Student Support & Resources.