Mathematics for Economists II

The Ap/Econ 1540 Outline: What you need to know to succeed

- **Motivation**
  Mathematics is the language of choice for economists.

The language of math is understood world-wide.

The purpose of economics as a field is to help us understand and navigate the world of (economic) human behavior. To do that, economists need a way, a language to describe the world and human behavior, human choices. The most convenient language for that is the language of mathematics:

- Using numbers, economists can count, e.g., number of firms, inventory hold, pieces of information shared, etc.
- Using functions, we can express relationships, such as between income, education level, and life expectance or between foreign investments, domestic infrastructure, and GDP.
- With optimization methods we can more precisely describe the choices made by consumers, firms, and governments.
- Comparative statics help us predict how those optimal choices change as the environment and the context changes.
- Finally, vectors and matrices are an extremely convenient short-hand notation to organize and manipulate data, e.g., the number of people employed in various sectors of the economy over time.

- **Why**
  you will benefit from Econ 1540

Strengthening your mathematical skills has three benefits: (1) It increases your proficiency in the language of mathematics. As a result, you will be a better student of economics and, eventually, a producer of better economic arguments. (2) It strengthens your abstraction skills. Building on these skills, it will be easier for you to acquire other (highly valuable) technical skills such as programming or data analysis skills. (3) It helps you further develop a sophisticated understanding of reality. As a result, you will be better able to detect patterns, discern risks, and make better decisions in your personal and professional life.

- **How**
  you will achieve those benefits.

One learns math only by doing it. You develop your mastery of mathematical tools by solving practice problems. It is much more valuable for students to solve problems instead of watching the instructor solve problems. This course will offer plenty opportunities for student-centered problem solving inside and outside of class.

- **What**
  we will cover in this course.

In this second part of mathematics for economists, we master functions of more than one variable and expand derivatives and optimization methods to such functions. Finally, we introduce vectors and matrices as convenient short-hand notation and learn how to manipulate and interpret them.

Learning Objectives,

As a successful student, at the end of this course you will

Foundational Knowledge	• Have developed a thorough mastery of the mathematical tools covered. • Be able to execute manipulation of formal expression and to reliably solve mathematical and formal economic problems.
Integration and Application	• Be able to connect mathematical notation to real-world observations. • Be able to use mathematical tools to capture essential aspects of real-world observations and critically assess their limitations.
Professional Development	• Have developed confidence and proficiency in using mathematical language to express relationships, observations, etc. • Be able to translate between mathematical language and plain English.

Course Structure,

The course consists of three modules and two minimodules (MM), with the following content:

0. Introduction	• Meet classmates and instructor. Understand course structure.
II. MM Logic	• Distinguish necessary and sufficient conditions. Practice logic reasoning.
1. Functions of two or more variables week 1-4	• Understand and interpret functions of multiple variables. • Calculate partial and total derivatives, partial elasticities. Apply Young's Theorem. Calculate elasticity of substitution. Apply implicit differentiation. • Identify and characterize homogenous and homothetic functions. • Find and apply linear approximations.
2. Optimization week 5-8	• Solve unconstrained and constrained optimization problems. • Apply Lagrangian Multiplier method. Interpret Lagrangian Multiplier. • Apply and interpret comparative static and envelope theorem. • Apply methodology to problems of economic analysis.
I. MM Combinatorics	• Distinguish permutations and combinations. Apply four formulas.
3. Linear Algebra week 9-12	• Understand and interpret vectors and matrices as short-hand notation of data, geometric objects, short-hand notation for systems of equations. • Find: Addition. Angles. Parallel and orthogonal vectors. Planes. Scalar multiplication. Transpose. Matrix multiplication. Inverse matrices. • Solve LSE using substitution, Gaussian elimination, inverse matrices. • Calculate determinants of matrices of order 2 and higher.

and Course Components

You can earn 100 points or marks in this course. In each module, you can earn 30 points: 10 for participation and 20 for demonstrating mastery. You earn 5 points for completing each of the two minimodules on time. You can also earn up to 6 bonus marks for completing optional activities (introduction, review for module 1, review for module 2) on schedule.

Participation
30 points
10 per module

Participation is important in this course: It supports your learning progress and makes you part of our learning community.

- Each week you are asked to contribute to a group discussion forum, e.g.,
  - By explaining some terminology,
  - By demonstrating the solution of a practice problem,
  - By discussing an application of a mathematical concept.
- At the end of each module, your contributions to your group discussions will be evaluated. You will earn:
  - 6 points for completing all participation-activities in each module.
  - 2 points for demonstrating effort and engagement in each activity.
  - 2 points for engaging in discussions with other students through thoughtful comments and responses.
- Please make sure to read the activity instructions carefully and fulfill all aspects of the activity. For example, if the activity asks you to post a picture and comment on it, it is not enough to just post an image.

Minimodules
10 points
5 per module

- Spend approx. 5 hours completing the mini-module activities.
- Earn a passing grade on the practice quizzes.
- Post a forum contribution as instructed.

Mastery
60 points
20 per module

Demonstrate:
- *comprehension* of mathematical terminology
- *ability to apply* concepts,
- *capability to manipulate* formal expressions and *to reliably solve* mathematical and formal economic problems.

- For each module, demonstrate mastery by completing an online term test or a writing assignment. You must complete at least one online test.
- Online tests include multiple choice, short-answer, and numeric questions. Online tests are open book. Calculators are allowed.
- Each writing assignment has three deadlines. Submitting after the first deadline, you are not getting feedback, though no penalty. For the third deadline, grading is on pass (10 of 20 pts)/ fail (0 pts) basis only.
- Deadlines are as follows

	Term Test (on Moodle)	Writing Assignment Deadline 1 (grading, feedback)	Deadline 2 (grading, no feedback)	Deadline 3 (Pass/Fail, no feedback)	complete
Module 1 WA1	8-Feb	15-Feb	22-Feb	1-Mar	1 of 2
Module 2 WA 2	15-Mar	22-Mar	29-Mar	5-Apr	1 of 2
Module 3 WA3	Final Exam Period	21-Apr	26-Apr	1-May	1 of 2

Course Format

Synchronous.
Asynchronous.
Students choose which resources to use to master the material availability.

This course offers a mix of synchronous and asynchronous components. You can access the course material and complete the assignments on your own schedule. I strongly recommended attending weekly lectures. PASS sessions and course center hours are offered to support you in your studies.

Same-paced.
Students progress through the course together, completing the same assignments each week.

We start and finish each module together. Within each module there is some flexibility to work ahead or catch up, though generally all students complete the same activities each week.

Module-based.
Our course is structured around modules.

Our course consists of three modules and two minimodules. Each module in turn covers several topics and three components for each topic covered: learning the terminology, understanding the concepts, and practising the concepts. Activities include: reading, writing, explaining, computing, explaining, listening, and reflecting. This range of activities strengthens the neural networks that form the basis of your learning.

Course Policies.

! You do not need to submit documentation. It is your choice how you demonstrate mastery.

Missed Term Tests.

If you miss an online term test, you must submit the corresponding writing assignment to earn a grade.

You must write at least one of the term tests. If you miss all three term tests, the writing assignment for module 3 is subject to a 30% penalty.

Missed Participation.

No make-up credit will be given for any reason for missed participation.

Email Policy and Etiquette.

Email is not an effective way to discuss economics or mathematics.

Instead, attend digital office hours or post on the "Questions? Answers!" section in our Moodle course. If you have a concern, others will share your concern. I am checking questions posted in the "Questions? Answers!" section frequently and typically answer questions posted there before responding to emails. The "Questions? Answers!" section is our course repository of clarifications, tips, strategies, and answers.

Please reserve email communication for brief personal questions and concerns. When you email, please

- follow the guidelines for emailing your instructor posted on Moodle.
- do include Econ1540 in the subject line.
- be as specific as possible.
- do not send attachments unless requested.

I strive to reply to e-mail within 48 hours, except on weekends. Emails between instructors and students constitute professional communication; please treat them as such. If you are not sure what constitutes professional communication, please refer to the "Guideline on emailing an instructor" posted on Moodle.

Rounding Policy.

To arrive at your final mark, I will round your final score to the nearest integer, e.g., an overall score of 69.4 is a final mark of 69. No exceptions.

Appealing a Grade

You must submit any appeals within two weeks of the grade having been posted

Students can appeal test grades and grades for the midterm by submitting an electronically fillable Test Remark Request form available through the Moodle website. Please note that following an appeal, your test score can increase, decrease, or stay constant.

Academic Integrity.

- **Why**

Upholding high standards of Academic Integrity is essential for successful academic discourse, and to the pursuit of learning and scholarship. Respecting and enforcing these standards at our University also ensures that the degree you earn from York University is a strong signal your learning and academic achievement.

- **How**

You uphold high standards of Academic Integrity by:

- doing and submitting only your own work
- not permitting others to use your answers
- giving credit to others for their ideas and works
- quoting your sources, correctly paraphrasing and summarizing

- **More Information**

If you have questions or concerns about what constitutes appropriate academic behaviour, please consult with me or seek additional resources.

- **Enforcement**

York University takes its responsibility to uphold high academic standards very seriously. The Senate Policy outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Sanctions in cases of cheating can include temporary and permanent records on your transcript, suspension from the course, up to suspension from the University.

- **Not up the instructor**

If I observe behaviour that might involve academic dishonesty, I am required to report it. It is not up to me to judge whether the behavior was unintended, a minor infraction, a first-time infraction, etc. I am professionally bound to report any suspicious behavior.

- **Turn-it-in**

To promote academic integrity in this course, students who opt into a writing assignment are required to submit their written assignments to Turnitin (via the course Moodle) for a review of textual similarity and the detection of possible plagiarism. In so doing, students 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.

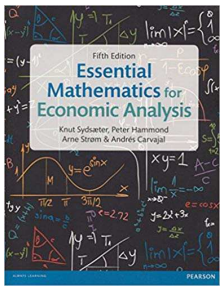
You Need ….

Required

Pen and Paper. Pencil and Eraser.

Handwriting is demonstrably more effective in helping you learn than typing notes. Even when reading an e-book, practicing on eclass, or while watching a video online, it will be helpful for you to take handwritten notes in your own words.

Required



Knut Sydsaeter, Peter Hammond, Andrés Carvajal:
Essential Mathematics for Economic Analysis

We closely follow chapter 11-16. Each module, there will be assigned reading from the textbook. You are especially encouraged to work through the practice questions worked out in the book. Many quiz and midterm are similar to those practice questions.

Required

8 hours of time. Every week.

Full time student = full time work. So: 5 courses = 40 hours each week.
As the instructor I thus design the course such that the average student can perform satisfactorily (= C) by spending 8h each week.

I am aware that many of you take six courses, work part- or full-time, are involved in clubs, and/or have family obligations. Please be aware of your opportunity cost and work effectively with the time you have.

Required

Reliable internet access

You need to be able to regularly stream videos from our Moodle eclass site, participate in Zoom office hours, and complete online quizzes.

Also useful

Patience and a Sense of humor
Learning mathematics is a process that takes time. Between the pandemic and school closures, what will happen this term is somewhat uncertain. Be patient and kind with yourself and others.

Technical Requirements.

Several platforms will be used in this course (e.g., Moodle, Zoom, etc.) through which you will interact with the course materials, the course director/TA, as well as with one another.

To successfully participate in this course, you will need:

Hardware

- a laptop or desktop in good working order. You will not be able to complete course assessments with just a tablet or smartphone.
- a webcam with microphone or smartphone for our Zoom meetings.
- a camera with which to take pictures of your work to upload to our Moodle website.
- a reliable internet connection.

Software

- Moodle. This is our course website. It is provided by York University.
- Zoom. Zoom is available to all York students for free. https://yorku.zoom.us/
- MS Word. For two of the four modules you will have a choice to demonstrate your mastery through an online test or through a writing assignment. To complete the writing assignments, you will need MS Word. It is available to all York students at https://uit.yorku.ca/student-services/software/.

Note

Please review the technology requirements and FAQs for Moodle.

Students shall note the following:

- Zoom is hosted on servers in the U.S. This includes recordings done through Zoom. If you have privacy concerns about your data, provide only your first name when you join a session.
- The system is configured in a way that all participants are automatically notified when a session is being recorded. In other words, a session cannot be recorded without you knowing about it.

Course Summary

Instructor

Karen Bernhardt-Walther, Assistant Professor of Economics (teaching stream)

Contact

Email: bkaren@yorku.ca

Time and Location

Lectures & Discussion:	Tue 11:30-14:30 on Zoom.
Office hours:	Th 14:30-15:30 on Zoom.
Zoom Meeting ID:	972 1219 3790
Zoom Passcode:	135908

To schedule 1-on-1 meeting (up to 2 weeks in advance): https://calendly.com/learning-econ/1-on-1-office-hours

I enjoy discussing economics/ life/ college … with you and look forward to seeing you in office hours!

Course Structure

Part 0:	Introduction.
MM I:	Logic.
Mod 1:	Multivariate calculus.
Mod 2:	Optimization.
MM II:	Combinatorics.
Mod 3:	Linear Algebra.

Class Format

This course includes asynchronous and synchronously components. Weekly activities support your learning through reading, writing, reflecting, watching videos, solving practice problems, and debating material with your classmates.

Our learning community engages in respectful, friendly, constructive, and supportive exchanges. Schedule time to work on this course on at least 3-4 days each week.

Marking Scheme

Participation:	3 x 10	30
Minimodules:	2 x 5	10
Mastery:	3 x 20	60
Bonus (introduction, reviews)	3 x 2	6
Total:		100

Course Website: Moodle (eclass)

On Moodle you will find group discussions, practice tests, assignments, guidelines, etc. Check the Moodle website regularly and read announcements carefully.

Key Dates

Jan 10th	Start of first course-week
Jan 23rd	Last day to add course
Mar 18th	Last day to drop course
Apr 10th	Last day to withdraw
Apr 12-29th	Final Exam Period