

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 expectancy 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.

MM I 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.

MM II 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.
- Read the activity instructions carefully and fulfill all aspects of the activity.

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

10 per module quiz

30 for cumulative final

Demonstrate:

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

- **Module quizzes:** In class. 60 minutes. May include multiple choice, short-answer, numeric questions. Closed book. Calculators are allowed. Alternative: Writing assignment – see deadlines below. After first deadline, you are not getting feedback, though no penalty. After second deadline, grading is on pass (10 of 20 pts)/ fail (0 pts) basis only. No submissions are accepted after the third deadline.
- **Final exam:** Most likely in-person, though may be online. Cumulative. May include multiple choice, short-answer, and numeric questions. Closed book. Calculators are allowed. Alternative: If you miss the final exam, you must submit documentation and write the make-up exam during reading week in February.
- Deadlines are as follows

	Module quiz (in person)	Writing Assignment			complete
		Deadline 1 (grading, feedback)	Deadline 2 (grading, no feedback)	Deadline 3 (Pass/Fail, no feedback)	
Module 1 WA1	17-Oct	24-Oct	31-Oct	7-Nov	1 of 2
Module 2 WA 2	7-Nov	14-Nov	21-Nov	28-Nov	1 of 2
Module 3 WA3	5-Dec	12-Dec	17-Dec	22-Dec	1 of 2
Final Exam	Final's period				

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. Weekly lectures are synchronous and in-person. You should attend weekly lectures. There are a variety of online materials and practice activities available on eClass that you complete on your own schedule. PASS sessions and office 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 on the online activities, 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.



For quizzes, you do not need to submit documentation. It is your choice how you demonstrate mastery.

Missed Module Quiz.

If you miss a module quiz, you must submit the corresponding writing assignment to earn a grade.

You must write at least one of the module quizzes. If you miss all quizzes, 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.



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

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 eClass 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 eClass.
- 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.

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

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

Health Policy

COVID-19 continues to spread in our community. The University encourages community members to wear a mask in indoor spaces, especially where physical distancing is not possible. This includes lectures and in-person quizzes and exams.

If you are not feeling well, show symptoms, or test positive, please stay home. Instructions (lectures) may switch to online (Zoom) lectures on short notice should the instructor fall ill or test positive.

Academic Integrity.

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| <ul style="list-style-type: none">• Why | <p>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.</p> |
| <ul style="list-style-type: none">• How | <p>You uphold high standards of Academic Integrity by:</p> <ul style="list-style-type: none">• 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 |
| <ul style="list-style-type: none">• More Information | <p>If you have questions or concerns about what constitutes appropriate academic behaviour, please consult with me or seek additional resources.</p> |
| <ul style="list-style-type: none">• Enforcement | <p>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.</p> |
| <ul style="list-style-type: none">• Not up the instructor | <p>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.</p> |
| <ul style="list-style-type: none">• Turn-it-in | <p>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 eClass) 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.</p> |

You Need

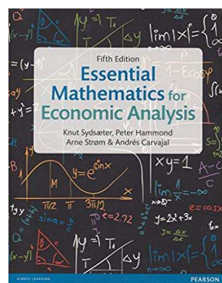
Required



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 exam questions 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 access and participate in online activities on our eClass site.

Also useful



Patience and a Sense of humor

Learning mathematics is a process that takes time. Be patient and kind with yourself and others.

Course Summary

Instructor

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

Contact

Email: bkaren@yorku.ca

Time and Location

Lectures & Discussion: Mo 11:30-14:30 SLH A.

Office hours: Th 13:30-14:30 on Zoom.

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 synchronous 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 10	30
Final:		30
Bonus (introduction, reviews)	3 x 2	6
Total:		100

Course Website: eClass

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

Key Dates

Sept 12 th	First class
Sept 20 th	Last day to add course
Nov 11 th	Last day to drop course
Dec 7 th	Last day to withdraw
Dec 8 th -23 rd	Final Exam Period