

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.

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

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

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

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.

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.

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.

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.

I. 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 5-7

- 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.

II. MM Combinatorics

- Distinguish permutations and combinations. Apply four formulas.

3. Linear Algebra week 8-11

- 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. These marks are distributed as follows

What	When	Note	Marks
MM I	asynchronously	Deadline: Jan 30th	5
MM II	asynchronously	Deadline: Mar 5th	5
21 online activities	approx. 2 per week	1.5 marks per assignment, lowest one is dropped	30
Module 1 Quiz	Feb 7 th	There are no make-up quizzes. Students who miss a quiz must submit a writing assignment. Instructions are available on eClass. Students can submit at most 2 writing assignments.	10
Module 2 Quiz	Mar 6 th		10
Module 3 Quiz	Apr 3 rd		10
Final Exam	Final exam period	Final exam is comprehensive	30
Bonus: Prep 1	asynchronously	Deadline: Jan 23 rd	2
Bonus: Prep 2	asynchronously	Deadline: Feb 6 th	2
Total			100

Minimodules are small units you learn asynchronously on our eClass site. You earn marks by completing a quiz and a forum discussion activity on time. You earn up to 5 points per mini module.

Online activities include practice quizzes and forum discussions. There is one such activity associated with each 90 min class period (except for the three periods when the quizzes are written). For forum discussions your contribution is evaluated based on completion, effort, and engagement. For quizzes you have unlimited attempts to earn a passing mark. You are encouraged to discuss the quiz questions with your peers. But once you earn a passing mark, you must submit evidence of your work for some or all of the questions. You can earn up to 1.5 marks per activity. The lowest score is dropped.

Module quizzes are in-person written exams (approx. 70 min) that cover the material of the respective module. No notes, no calculators allowed.

Final exam takes place during the final exam period. (approx. 150 min). The final exam is comprehensive and covers the material of all modules and minimodules. No notes, no calculators allowed.

Bonus opportunities. You can earn up to 4 bonus points by completing online quizzes that encourage you to review Econ 1530 material. If you earn a passing mark on all the quizzes in each of the two units, you can earn up to 2 bonus marks for each unit.

Course Policies.

You must pass “Ready for Econ 1540” quiz.

At the end of class in week 2 and 3, and after class in week 7 and 9, students are offered a 15 min, 10 question quick quiz that covers fundamental concepts from Econ 1530 and before. To pass you must answer 8 of 10 questions correctly. You must pass this “Ready for Econ 1540” quiz once. After you have passed it, you do not need to write it again. Students who do not pass this quiz earn at most a D in this class.

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

You can replace at most two Module quizzes with writing assignments.

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, you will automatically receive a 0 for the Module 3 quiz.

Your written in-person score must be at least half of your overall score.

Your weighted average performance in the final exam and best module quiz must be at least half as strong as your overall performance. For example, if your overall grade is an 82%, then you must have earned a 41% or 16.4 marks in the final exam (worth 30 points) and your best module quiz (worth 10 points) together.

Grades are computed with two digits and rounded to nearest integer.

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

You can appeal a grade within two weeks after its release.

Students can appeal quiz and online completion grades within two weeks after the grades have been released. Please note that following an appeal, your test score can increase, decrease, or stay constant.



Email Policy and Etiquette.

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

Instead, attend digital office hours or post on our discord server. If you have a concern, others will share your concern. I am checking questions posted to the discord server frequently and typically answer questions posted there before responding to emails. The questions and discussions posted to the discord server serve as our course repository of clarifications, tips, strategies, and answers.

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

- 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 eClass.

Course Format

In-person synchronous classes.

This course offers a mix of synchronous and asynchronous components. Weekly lectures are synchronous and in-person. Based on past experience, an attendance rate of less than 80% is associated with a very high failure rate in this course.

Asynchronous online activities.

A variety of online materials and practice activities available on eClass. You can complete these on your own schedule. PASS sessions and office hours are offered to support you in your studies.

Same-paced.

We progress through the course together, completing the same assignments each week.

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.

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.
- **ChatGPT**

The use of ChatGPT and similar services is permitted in preparing a writing assignment for this course. Please note that assignments are graded with the availability of that technology in mind.

You Need

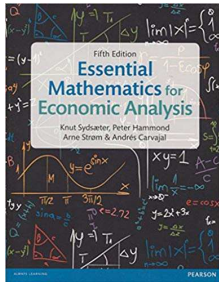
Required



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 Sydsæter, Peter Hammond, Andrés Carvajal: Essential Mathematics for Economic Analysis, 5th edition

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 and complete online activities.

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.

Course Summary

Instructor

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

Contact

Email: bkaren@yorku.ca

Time and Location

Lectures & Discussion: Wed 11:30-14:30 LAS C.

Office hours: Mo 15:00-16:00 VH 1070

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

Online activities:	21 x 1.5	30
Minimodules:	2 x 5	10
Module Quizzes:	3 x 10	30
Final:		30
Bonus (reviews)	2 x 2	4
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

Jan 10 th	First class
Jan 22 nd	Last day to add course
Mar 11 th	Last day to drop course
Apr 8 th	Last day to withdraw
Apr 10-26 th	Final Exam Period