



**Carleton  
University**

Department  
of Economics

## **ECON 1402 A**

### **Elementary Mathematics for Economics II**

**Fall 2026**

Instructor: Ahmad Malgarai, PhD **Lecture time:**

Office: D881 Loeb Building

**Wednesdays: 1805-2055 HRS (TBA)**

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#### **Tutorials:**

**Wednesdays 1635-1725 HRS (Tutorial, A01, SA 309)**

**Wednesdays 1535-1625 HRS (Tutorial, A02, LA B243)**

**Wednesdays 1435-1525 HRS (Tutorial, A03, LA B243)**

Office Hours: 16:30-17:30 (Wednesdays or by appointment)

TA: TBA

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Welcome to ECON 1402: Elementary Mathematics for Economics II.

#### **Land Acknowledgement**

I acknowledge that Carleton University is located on the unceded and surrendered territory of the Algonquin Anishinaabe Nation. I pay respect to the Algonquin people and all First Nations, Inuit, and Métis peoples, whose enduring presence, cultures, and contributions continue to enrich this land.

**Prerequisite(s):** ECON 1001 or ECON 1000 or FYSM 1003 with a grade of C- or higher, and ECON 1401 or MATH 1401 with a grade of C- or higher.

**Precludes additional credit** for BIT 1000, BIT 1001, BIT 1100, BIT 1101, BIT 1201, BIT 1200, MATH 1007, MATH 1009, MATH 1104, MATH 1107, MATH 1119, MATH 1052, MATH 1152.

Students who believe they have taken a similar background course or courses from another university should provide appropriate documentation to the Department of Economics

Undergraduate Administrator, Sean Hall, [seanhall3@cunet.carleton.ca](mailto:seanhall3@cunet.carleton.ca) to check that credit may be given for all courses.

#### **Brightspace Course Page**

<https://brightspace.carleton.ca/d2l/home/449352>

## Course Objectives

- Learn how to find derivatives of univariate functions and partial derivatives of multivariate functions.
- Learn concavity and convexity of functions and their importance in optimization problems.
- Apply these concepts to economic optimization problems without constraints.
- Apply these concepts in economic optimization problems with constraints.
- Emphasize in class participation in solving practice problems.

**The emphasis throughout the course is not only on mathematical techniques but also on their practical application to economic analysis.**

## Required textbook

The textbook required for the course is: *Maths for Economics, 5<sup>th</sup> edition* By Geoff Renshaw, Oxford University Press. ISBN: 978-0-19883950-7 Available from Carleton University Bookstore. Rent for 180 days: \$53.99; for 365 days \$62.30. Buy New \$105.75 Digital \$83.06.

## Course Content

Required readings are indicated with a star (\*). The coverage of some topics will be determined in class and on Brightspace.

### 1. Optimization with one independent variable

#### 1.1. Derivatives and differentiation

\*Textbook chapter 6

#### 1.2. Applications of derivatives:

**Optimization: maximum, minimum, point of inflection**

\*Textbook chapter 7

#### 1.3. Economic applications of functions and derivatives:

**Profit maximization, revenue maximization and cost minimization**

\*Textbook chapter 8

#### 1.4. Elasticity of supply, demand and other applications

\*Textbook chapter 9

#### 1.5. Derivatives of exponential and logarithmic functions and applications

\*Textbook chapter 13

**2. Optimization with two or more independent variables****2.1. Partial derivatives of functions of two or more independent variables**

\*Textbook chapter 14

**2.2. Maximum and minimum values, saddle points, the total differential**

**Economic applications: profit maximization, cost minimization**

\*Textbook chapter 15

**2.3. Constrained maximum and minimum and applications**

**The substitution method**

**The Lagrange method**

**Utility maximization or output maximization subject to a cost constraint**

**Cost minimization subject to an output constraint**

\*Textbook chapter 16

**2.4. Returns to scale, homogeneous functions and the proportionate differential**

\*Textbook chapter 17

**3. Integration with applications**

**Deriving the total cost function from the marginal cost function**

**Deriving the total revenue function from the marginal revenue function**

**The consumer surplus and producer surplus**

\*Textbook chapter 18

**Practice Problems**

Students are strongly encouraged to practice by solving as many of the exercises at the end of each chapter as possible. Regular practice is the best way to develop problem-solving skills, reinforce the course material, and prepare for quizzes, assignments, and exams.

**Tutorials**

There will be a weekly tutorial given by the TA. The tutorial will review solutions to specific problems assigned in class on a weekly basis. Attendance is highly recommended. There will also be an opportunity for you to ask questions to the TA about solutions to specific problems.

**Course Evaluation**

The basis for determining your final grade on this course is as follows:

**Note:** The dates for assignments, midterm examinations, and other assessments are **tentative** and may be adjusted depending on the pace of the course and the progress of the class. Any changes will be announced in class and posted on Brightspace well in advance.

| Assignment/Exam   | Date                                                      | Submission/Location                     | Weight (%) |
|-------------------|-----------------------------------------------------------|-----------------------------------------|------------|
| Assignment 1      | Posted: September 23<br>Due: October 7                    | Submit at the beginning of the tutorial | 10         |
| Midterm 1         | October 14                                                | In person                               | 20         |
| Assignment 2      | Posted: October 21<br>Due: November 4                     | Submit at the beginning of the tutorial | 10         |
| Midterm 2         | November 18                                               | In person                               | 20         |
| Final Examination | During the University's official final examination period | In person                               | 40         |
| Total             |                                                           |                                         | 100        |

## Assignments

There will be **two (2) assignments** during the term. Assignments are due **at the beginning of the tutorial** on the specified due dates.

Assignments will consist of problems based on material covered in lectures and the textbook. Your solutions must be **clearly written**, and **all steps** used to arrive at your answers must be shown. Marks may be deducted for incomplete or unsupported solutions, even if the final answer is correct.

Assignments must be completed **individually**, as their primary purpose is to help you develop your understanding of the course material.

**The solutions to the assignments will be discussed during the tutorial** on the due date.

The use of **generative artificial intelligence (AI) tools**, such as ChatGPT or similar services, is **not permitted** in the completion of assignments. Students are expected to submit their own original work.

**Late assignments will not be accepted**, as the solutions will be discussed during the tutorial on the due date.

Students who are unable to submit an assignment due to a **valid reason** (e.g., illness or a family emergency) should notify the instructor **by email as soon as possible**, preferably before the due

date. With appropriate documentation or satisfactory justification, the weight of the missed assignment will be transferred to the final exam.

### Midterms and Final Exam

The **midterm examinations** and the **final examination** are **closed-book** examinations.

The material covered on each midterm will depend on the pace of the course and the progress made in class. The instructor will inform students well in advance of each midterm regarding the chapters and sections that will be included.

The **final examination** is **comprehensive** and will cover all course material unless otherwise specified by the instructor.

The final examination will be held **in person** at the time scheduled by the University during the official examination period. Students should **not make travel plans during the examination period**, as travel is not considered a valid reason for missing a final examination.

Students who miss a midterm for a **valid reason** (e.g., illness or a family emergency) will have the weight of the missed midterm transferred to the final examination. If you are unable to write a midterm, please notify the instructor by email as soon as possible. The instructor reserves the right to request a Self-Declaration Form or a PMC Letter of Accommodation, depending on the circumstances and the length of the incapacitation.

Students who miss the final examination must apply for a **deferred final examination** through the Registrar's Office within **three (3) working days** of the scheduled exam. If a deferred examination is approved, it will be written during the period designated by the University. **Special midterm or final examinations will not be arranged outside of the University's deferred examination process.**

Standing in the course is determined by the instructor, subject to the approval of the Faculty Dean. Accordingly, grades submitted by the instructor may be subject to revision, and no grade is considered final until it has been approved by the Dean.

### Satisfactory Performance Criteria

Students must fulfill all of the course requirements, including the final exam, in order to achieve a passing grade (D- or higher).

### Deferred Finals

Students who do not write the final examination because of illness or other circumstances beyond their control may apply to write a deferred final examination by contacting the Registrar's Office <https://carleton.ca/registrar/> no later than three working days after the original final examination was scheduled. If a student writes a deferred examination, the deferred examination will carry the

same weight as the final examination in determining the course grade. Any deferred examination will not be identical to the original final examination.

Deferred finals (which must be applied for at the RO) are only available if the student is in good standing on the course, so if there is a minimum standard a student must meet in order to be in good standing, and entitled to write a deferred final exam, this standard must be stipulated here.

### **Brightspace and e-mail**

**This course will make use of Brightspace.**

Lecture notes, review questions, problems, references to additional readings and any other material will be posted on Brightspace. Class announcements will be sent by e-mail using Brightspace.

**It is each student's responsibility to check this website for posted material as well as the Carleton University email system for correspondence.** If you do not have a Brightspace account, visit <https://carleton.ca/brightspace/>

### **Re-marking**

Any request for the remark of exams or assignments must be submitted in writing within two weeks of that assignment or exam first being returned to the class. The request should contain a detailed explanation of why you feel you should receive a higher mark. Please note that remarking will apply to the entire assignment or exam, and not just to the contentious question. As a result, the revised mark may be higher than, lower than or the same as the original mark.

### **Intellectual Property Rights Regarding Course Material**

Please note: "Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered on the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s)."

(See <https://carleton.ca/provost/2015/calendar-dates-and-course-materials-sharing-website/>)

### **PLAGIARISM**

The University [Academic Integrity Policy](#) defines plagiarism as "*presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one's own.*" This includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the

source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, artworks, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations. Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else, including the unauthorized use of generative AI tools (e.g., ChatGPT);
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
- failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotations marks.

Plagiarism is a serious offence that cannot be resolved directly by the course's instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course.

For the full policy please refer to the [Academic Integrity Policy](#).

### Statement on Student Mental Health

As a university student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. Here is a list that may be helpful:

**Emergency Resources (on and off campus):** <https://carleton.ca/health/emergencies-andcrisis/emergency-numbers/>

### Carleton Resources

- Mental Health and Wellbeing: <https://carleton.ca/wellness/>
- Health & Counselling Services: <https://carleton.ca/health/>
- Paul Menton Centre: <https://carleton.ca/pmc/>
- Academic Advising Centre (AAC): <https://carleton.ca/academicadvising/>

- Centre for Student Academic Support (CSAS): <https://carleton.ca/csas/>
- Equity & Inclusivity Communities: <https://carleton.ca/equity/>

### Off Campus Resources

- Distress Centre of Ottawa and Region: (613) 238-3311 or TEXT: 343-3065550, <https://www.dcottawa.on.ca/>
- Mental Health Crisis Service: (613) 722-6914, 1-866-996-0991, <http://www.crisisline.ca/>
- Empower Me: 1-844-741-6389, <https://students.carleton.ca/services/empower-mecounselling-services/>
- Good2Talk: 1-866-925-5454, <https://good2talk.ca/>
- The Walk-In Counselling Clinic: <https://walkincounselling.com>

### Academic Accommodation

#### Pregnancy Accommodation

Students requiring academic accommodation due to pregnancy should contact the instructor in writing during the first two weeks of class, or as soon as the need for accommodation is known. For accommodations related to a formally scheduled final examination, students must complete the University's Pregnancy Accommodation Form.

#### Religious Accommodation

Students requesting academic accommodation based on religious obligations should contact the instructor in writing during the first two weeks of class, or as soon as the need for accommodation is known. Additional information is available through Carleton University's Academic Accommodation policies.

#### Academic Accommodations for Students with Disabilities

The **Paul Menton Centre for Students with Disabilities (PMC)** provides academic support services to students with documented disabilities, including learning disabilities, ADHD, Autism Spectrum Disorder (ASD), psychiatric or mental health disabilities, chronic medical conditions, and mobility, hearing, or vision impairments.

Students requiring academic accommodations should contact the Paul Menton Centre (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) as early as possible. Students who are already registered with the PMC should arrange for their Letter of Accommodation to be sent to the instructor at the beginning of the term, and no later than two weeks before the first in-class test or examination requiring accommodation. Students are also encouraged to meet with the instructor to discuss their accommodation arrangements.



**Survivors of Sexual Violence**

Carleton University is committed to maintaining a safe and respectful learning, working, and living environment. Survivors of sexual violence may be eligible for academic accommodations in accordance with the University's Sexual Violence Policy. Information about available supports and services can be found on the university's Sexual Assault Support Services website. Visit: <https://carleton.ca/equity/sexual-assault-support-services>

**Accommodation for Student Activities**

Carleton University recognizes the value of students participating in activities beyond the classroom, including national and international competitions and performances. Reasonable academic accommodations may be available. Students should contact the instructor in writing during the first two weeks of class, or as soon as the need for accommodation is known.

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>