Calculus I

MATH-UA121, Section L01

NYU London: Fall 2021

Instruction Mode: In person

All updates, announcements, and material for this course will be available on Brightspace. Please contact nyul.academics@nyu.edu if you have trouble accessing the Brightspace site.

Instructor Information

- Dr. Daniele Turchetti
- Office Hours: Mondays 4:00-5:00 pm or by appointment on Zoom.

Course Details

- Hours: Mondays & Wednesdays 2:30 - 3:45pm
- All times are UK time (Daylight Saving Time ends 31 October).
- Location: Room 102 @ 6 Bedford Sq
- Remote Participants: Zoom links are provided in Brightspace.
- Seat Assignments: If you are attending in person, you will be assigned a seat on the first day and are expected to use that seat for the entire semester due to NYU COVID-19 safety protocol.

Prerequisites

As detailed in the departmental web page (see link).

Course Description

“The book of the universe is written in the language of mathematics.” Galileo wrote this four hundred years ago, even before Newton and Leibniz discovered calculus. The statement is as valid today as ever: We use functions in all the sciences, and calculus allows us to analyze the functions and draw scientific conclusions.
In this course, we will study the foundations of calculus, the study of functions and their rates of change. We want you to learn how to model situations in order to solve problems. If you

have already taken calculus before, we want you to gain an even deeper understanding of this fascinating subject and its numerous applications.
The derivative measures the instantaneous rate of change of a function. The definite integral measures the total accumulation of a function over an interval. These two ideas form the basis for nearly all mathematical formulas in science. The rules by which we can compute the derivative (respectively, the integral) of any function are called a calculus. The Fundamental Theorem of Calculus links the two processes of differentiation and integration in a beautiful way.

Course Objectives

Upon Completion of this Course, students will be able to:

- Recall the definitions of the fundamental objects in the theory of Calculus, such as limits, continuity, derivatives, and integrals.
- Formally state theorems describing the nature of the objects above, such as the mean value theorem, the extreme value theorem, and the two fundamental theorems of Calculus.
- Exploit the laws regulating the objects above to perform meaningful computations of limits, derivatives, and integrals.
- Apply the computations of limits, derivatives, and integrals to a wide range of disciplines, such as physics and economics.

Assessment Components

If you are an NYU London study-away student, you are expected to attend in person. If you are accessing the class remotely, you must attend synchronously.

Students in this course will:

- submit participation worksheets at the end of the class
- complete regularly-due WebAssign homework
- solve the exercises provided in form of weekly problem sheets
- write a project on a chosen real life application of calculus
- take a midterm exam (summative assessment), and
- a final exam (summative assessment).

Participation Worksheets

You are expected to attend class in person or remote synchronously. Your active participation in class and attendance will be reflected in this part of the course requirements.

Questions during lectures are actively encouraged and some degree of active participation is required from all students. However, it is appreciated that not all students feel comfortable with in-class interaction, and the aim of the course is to establish an environment based on collaboration rather than on competition. As a result, participation will be assessed solely

through the completion of short worksheets to be submitted by the end of class to your instructor or, if following remotely, on Brightspace.

Each worksheet contains two questions, about aspects that are fundamental for the understanding of the topic discussed. During the classroom, there will be two slots of 5 minutes where students are encouraged to complete the worksheet. During this time, they are encouraged to work with their classmates and they can ask questions to the instructor to complete the worksheet at their best. If a student makes a genuine attempt at all the questions, they will get full participation marks.

Homework
Assignments for the course will be of two kinds, all due on Fridays by 5:00pm (UK time).

- **Cengage WebAssign** There will be assignments administered through WebAssign (this comes together with the Cengage subscription that each student needs to purchase). WebAssign problems are computational in nature and assess the mathematical techniques introduced in class. You will get immediate feedback on your progress and will get up to 5 attempts at each problem. For your convenience, a link to WebAssign will be available on the course Brightspace page. **No extension can be granted for solving this type of homework, as the solutions will be made available shortly after the deadline.**

- **Written problem sheets** (submitted through Brightspace) These consist of problems that are closely related to the questions in the exams. They can be downloaded 10 days before the deadline from Brightspace. Students have to closely follow the instructions and write their answers neatly and clearly; solutions have to be uploaded to Brightspace **as a single PDF file**. They can be printed and scanned or photographed, as long as the writing is readable. **Please review your PDF to make sure it is complete and clear before submitting.** All solutions need to be properly justified. Failure to demonstrate all work and steps in the solution of a problem may result in zero credit for the problem. Students are encouraged to form study groups and work together on homework outside of class time, but **they cannot copy others' work, not even partially**. It is advised that students begin assignments soon after topics are covered in lecture. Due dates are chosen to help students review the material discussed during the week in a timely manner. In fairness to graders and other students in the course, late homework will be accepted only in case of extenuating circumstances. **Extensions can be granted only before the deadline and they can not amount to more than 5 days after the official deadline**, when solutions will be released. However, the 2 worksheets with lower marks will be dropped from the final count.

Individual projects

Calculus has a plethora of real world applications. On top of those that will be seen together in class, students will work in detail on an application of their own choice by completing an individual project containing a brief explanation of the topic and an example that uses the material learned in class. An outline of the project, consisting of a title, a description of

application, an abstract, and a tentative list of references has to be submitted by October 31. The final outcome of the project is to be submitted by November 30. Students have two options for how they would like to present their work:

- a written paper (~ 4-8 pages), or
- a video recording (~ 4-8 minutes).

These guidelines are not a hard limit, but the evaluation of the project will take length into account, as well as quality of content. The students will receive a list of suggested projects and personalized one-on-one guidance by the instructor. A detailed guide will be posted on Brightspace.

Exams

There will be two written exams, one midterm and one final. An excused absence for an exam requires notification to the instructor BEFORE the exam starts, followed by valid documentation. Otherwise, you will receive a "0" for any missed exams.

• Midterm: October 20th if in person (see schedule), or TBD if take-home.

• Final: during undergraduate final exam week, time: TBD

Assignments/ Activities	Description of Assignment	% of Final Grade	Due
Written examinations	One midterm (25%) and one final (30%) exam.	55%	Oct 20 (midterm) TBD (final)
Individual projects	Each project consists in an exploration of an application of calculus, to be chosen by the student. The final outcome will be a short paper or a video. Guidance will be offered by the instructor.	20%	Oct 30 (outline) Nov 30 (final project)
Participation	Participation will be assessed through worksheets that have to be completed during class.	5%	N/A
Homework	Online, via Cengage WebAssign (5%) Weekly problem sheets (15%)	20%	N/A

Assessment Expectations

Letter Grade	Grade Percentage	Description
A-range	A = 93-100% A- = 90-92%	The student has demonstrated an outstanding understanding of the topic, and has fully achieved the goals of the course
B-range	B+ = 87-89% B = 84-86% B- = 80-83%	The student has demonstrated a good understanding of the topic, and has fully achieved most goals of the course
C-range	C+ = 77-79% C = 74-76% C- = 70-73%	The student has demonstrated a good understanding of the topic, and has achieved some of the goals of the course
D-range	D+ = 67-69% D = 65-66%	The student has demonstrated sufficient understanding of the topic, and has achieved some of the goals of the course
F	F = below 65%	The student has not demonstrated enough understanding of the topic and/or has not achieved enough goals of the course

Course Materials

Required Textbooks & Materials

- ***Essential Calculus, Early Transcendentals (2nd ed)*** by James Stewart (details, access, and login via Brightspace). The textbook is included in your Cengage WebAssign subscription.

Optional Textbooks & Materials

- Useful resources can be found on the website for Essential Calculus, Early Transcendentals, Second Edition (www.stewartcalculus.com).
- Reference material for Lesson 9: www.maa.org/press/periodicals/loci/joma/the-sir-model-for-spread-of-disease
- Applications of calculus to classical mechanics are explained in the open source book Light and Matter by Ben Crowell

Resources

- **Access your course materials**: Brightspace
- **Homework online platform:** Cengage WebAssign (accessible from Brightspace)
- **Graphing calculator: Desmos**
- **NYU London and Living in London Info:** LDN
- **Databases, journal articles, and more**: Bobst Library

- **Assistance with strengthening your writing**: NYU Writing Center (nyu.mywconline.com)
- **Obtain 24/7 technology assistance:** IT Help Desk

Course Schedule

Reminder: Links to join class Zoom meetings will all be available in Brightspace.

Topics & Assignments

All sections in the 'Reading' column refer to the textbook "Essential Calculus: Early Transcendentals, 2ed" by James Stewart.

Week/Date	Topic	Reading	Assignment Due
Lesson 1 [Sept 8]	Functions	§1.1-1.2	Sept 17 (WebAssign + Problem Sheet #1)
Lesson 2 [Sept 13]	Limits	§1.3	
Lesson 3 [Sept 15]	Calculating Limits	§1.4	Sept 24 (WebAssign + Problem Sheet #2)
Lesson 4 [Sept 20]	Continuity of functions	§1.5	
Lesson 5 [Sept 22]	Limits involving infinity	§1.6	Oct 1 (WebAssign + Problem Sheet #3)
Lesson 6 [Sept 27]	Derivatives	§2.1 - 2.2	
Lesson 7 [Sept 29]	Explicit differentiation of known functions	§2.3	Oct 8 (WebAssign + Problem Sheet #4)
Lesson 8 [Oct 4]	Product, quotient, and chain rules	§2.4	
Lesson 9 [Oct 6]	Application: the SIR model for the spread of a disease	link (open access)	Oct 15 (WebAssign + Problem Sheet #5)
Lesson 10 [Oct 12]	Implicit differentiation	§2.6	
Lesson 11	Linear approximation	§2.8	Oct 22 (WebAssign only)

[Oct 13]			
Lesson 12 [Oct 18]	Application: marginal rate of substitution	link (open access)	Oct 31 (Project outline)
[Oct 20]	Midterm		Midterm exam #1 (on topics of §1 and §2)
Lesson 13 [Oct 25]	Exponential functions and logarithms	§3.1-3.2	
Lesson 14 [Oct 27]	Derivatives of Exp and Log	§3.3-3.4	Nov 5 (WebAssign + Problem Sheet #6)
Lesson 15 [Nov 1]	Inverse trigonometric functions	§3.5	
Lesson 16 [Nov 3]	L'Hôpital's Rule	§3.7	Nov 12 (WebAssign + Problem Sheet #7)
Lesson 17 [Nov 8]	Mean Value Theorem	§4.2	
Lesson 18 [Nov 10]	Graphing	§4.3-4.4	Nov 19 (WebAssign only)
[Nov 15]	Revision / Project discussion / field trip		Nov 30 (Project final)
Lesson 19 [Nov 17]	More graphing	§4.3-4.4	
Lesson 20 [Nov 22]	Application: optimization problems	§4.5	
Lesson 21 [Nov 24]	Antidifferentiation	§4.7	Dec 3 (WebAssign + Problem Sheet #8)
Lesson 22 [Nov 29]	Application: classical mechanics	Course notes & slides	
Lesson 23 [Dec 1]	Definite Integrals	§5.1-5.2	Dec 10 (WebAssign + Problem Sheet #9)
Lesson 24 [Dec 6]	Second Fundamental Theorem of Calculus	§5.3	
Lesson 25 [Dec 8]	First Fundamental Theorem of Calculus	§5.4	Dec 17 (WebAssign + Problem Sheet #10)

[Dec 13]	Revision session		
Final Assessment [TBD]	Finals Week		

Course Policies

Final exams

Final exams must be taken at their designated times. Should there be a conflict between your final exams, please bring this to the attention of the London Academics team (nyul.academics@nyu.edu). Final exams may not be taken early, and students should not plan to leave the site before the end of the finals period.

Academic Honesty, Plagiarism and Late Work

Students at Global Academic Centers must follow the University and school policies. You can find details on these topics and more on this section of our NYUL website (https://www.nyu.edu/london/academics/academic-policies.html) and on the Policies and Procedures section of the NYU website for students studying away at global sites (https://www.nyu.edu/academics/studying-abroad/upperclassmen-semester-academic-year-study-away/academic-resources/policies-and-procedures.html).

Attendance

Key information on NYU London's absence policy, how to report absences, and what kinds of absences can be excused can be found on our website (http://www.nyu.edu/london/academics/attendance-policy.html)

To ensure the integrity of the academic experience, class attendance is required and expected promptly when class begins. These rules apply to class excursions and activities as well.

Members of any religious group may, without penalty, excuse themselves from classes when required in compliance with their religious obligations, but must follow NYU London's absence reporting procedure. Please note that an absence is only excused for the holiday but not for any days of travel that may come before and/or after the holiday. See also University Calendar Policy on Religious Holidays

Moses Accommodations Statement

Academic accommodations are available for students with documented and registered disabilities. Please contact the Moses Center for Student Accessibility (+1 212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

Inclusivity Policies and Priorities

NYU's Office of Global Programs and NYU's global sites are committed to equity, diversity, and inclusion. In order to nurture a more inclusive global university, NYU affirms the value of sharing differing perspectives and encourages open dialogue through a variety of pedagogical approaches. Our goal is to make all students feel included and welcome in all aspects of academic life, including our syllabi, classrooms, and educational activities/spaces.

Pronouns and Name Pronunciation (Albert and Zoom)

You can edit your pronoun and name pronunciation information on your Albert account, making it visible for faculty and staff. Information on how to do this can be found on the Pronouns and Name Pronunciation web page, and for more information on how to make these changes in Zoom, please see the Personalizing Zoom Display Names website.

Bias Response

The New York University Bias Response Line provides a mechanism through which members of our community can share or report experiences and concerns of bias, discrimination, or harassing behavior that may occur within our community. For more information, including how to report an incident, visit the Bias Response Line website.

Your Lecturer

Daniele Turchetti completed his PhD at the *Université de Versailles* and the *Institut de Mathématiques de Jussieu* in Paris. He held positions at *Leiden University*, the *Max-Planck-Institute for Mathematics*, the *University of Caen*, and *Dalhousie University*. He is currently pursuing his research in arithmetic geometry at Warwick University, his teaching activities at NYU - London, and has partnered worldwide with many institutions to organize and deliver initiatives that promote mathematical thinking, with a special focus on applications to real-world problems.