Math 121 - Calculus I

Fall 2023

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Office Hours: M 9:00-10:00am, Tu 1:00-2:30pm, Th 11:15am-12:45pm, and by appointment

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Course Description

Calculus is the mathematical study of change. The central question we will explore in this class is: if two variables are in relation with each other and one changes, how does the other change in response?

In general, the relationship between the two variables in question will be described by a function, and the relationship between their instantaneous change is given by the *derviative* of the function. We will spend roughly two-thirds of the course learning about the derivative. We will develop the definition of the derivative, which is based on the important mathematical concept of the *limit*, and place the definition in the larger context of continuity and differentiability. We will then explore the derivative more carefully, considering various ways we can interpret it, compute it, and apply it.

In the last portion of the class, we will turn the question around and ask: if you know the derivative of a function at every point, what can you say about total accumulated change? This will lead us naturally to the definition of the *integral*. We will end the course with a study of the integral and the Fundamental Theorem of Calculus, which explicitly and beautifully relates the derivative and the integral together.

Course Website

The website for this course can be found at:

http://f23.middlebury.edu/MATH0121C/

Here you will find course information and homework assignments.

Text

We will cover most of Chapters 1 through 6 *Calculus, 7th ed.* by James Stewart. We will use *APEX Calculus, 4th ed.* by Gregory Hartman, freely available online, as a supplemental text.

Course Objectives

The goals of this course are to help you develop:

- familiarity with and understanding of the concepts, notation, and theory of calculus,
- the ability to apply your understanding to solve straightforward and complex problems,
- increasing fluidity and confidence with the tools of mathematics,
- skills in collaboration and communication, and
- the enjoyment that comes with growing through academic challenge.

Homework

Homework is due at the beginning of each Monday, Wednesday, and Friday class. Assignments will be posted on the course website after each non-Tuesday class. Expect to spend about 2 to 3 hours between classes reviewing your notes, reading the text, and writing up homework problems (about 8 to 10 hours per week).

Doing your homework diligently is the best way to succeed in this course. Math is most easily absorbed in small, consistent chunks. By looking at the material for a little while each day and keeping up with the problem sets, over time you will build intuition for the subject. If you keep a steady rhythm with the homework, you will be much more well-prepared for the exams.

Please **write neatly** and **staple your work**. The best way to prepare for tests is to take your homework seriously.

I am here to help. If you have problems with an assignment or with some of the material that we cover in class, please come see me in office hours. I will be very happy to see you there. The math department also hosts student-run help sessions for calculus classes on Sunday, Tuesday, and Thursday evenings in Warner Hall.

Homework problems are graded on a 0-1-2 scale. A zero is given for little or no work shown (even if the answer is correct), a one is given if the exercise is attempted but incomplete, and a two is given for a mostly or totally correct answer.

Please note that no late homework will be accepted. Late homework will receive an overall score of zero. You may however, hand in homework early if a conflict arises. When computing your final grade for the course, I will drop your three lowest homework scores.

Assessment

There will be two mid-semester projects, three midterm exams, and one final exam. The midterm exams will be in class and are scheduled for

Tuesday, October 3

Tuesday, October 24

Tuesday, November 14.

The final exam is scheduled for

Wednesday, December 13, 9am-12pm.

Please note that vacation plans are not a legitimate excuse for rescheduling an exam so please plan to be on campus for all exams including the final.

Attendance

I expect you to attend all classes. This is an active learning class, so your success in this class will depend on your active participation. Your attentive presence in class also makes a significant contribution to class as a whole.

Honor Code

You may (in fact you are encouraged to!) work together in pairs or groups while you are figuring out homework assignments. However, your final write-up of each assignment must be your own. You are expected to complete exams completely on your own. All exams will be closed-book and there will be no calculators allowed.

The use of AI tools (e.g. ChatGPT) is not allowed in this course. Use of such tools for any assignment or exam in this course will be considered a breach of the Honor Code.

Students with Disabilities

Students who have Letters of Accommodation in this class are encouraged to contact me as early in the semester as possible to ensure that such accommodations are implemented in a timely fashion. For those without Letters of Accommodation, assistance is available to eligible students through the Disability Resource Center (DRC). Please contact ADA Coordinators Jodi Litchfield, Peter Ploegman, and Deirdre Kelly of the DRC at ada@middlebury.edu for more information. All discussions will remain confidential.

Grading

At the end of the semester, I will calculate final averages as follows.

Homework and Projects	20%
Exam 1	20%
Exam 2	20%
Exam 3	20%
Class Participation	5%
Final Exam	15%

Tentative Schedule of Topics

Week Beginning	Topics
Sep 11	Working with functions, the tangent and velocity problems, the limit of a function
Sep 18	Calculating limits, continuity, intermediate value theorem
Sep 25	Derivatives and rates of change, the derivative as a function
Oct 2	(Exam 1), Differentiation formulas, differentiating trig and exponential functions
Oct 9	The chain rule, implicit differentiation (Fall Break)
Oct 16	Linearization, extreme values, mean value theorem, derivatives and graphs
Oct 23	(Exam 2), limits at infinity, horizontal asymptotes
Oct 30	Curve sketching, optimization problems, antiderivatives
Nov 6	Areas and distance, the definite integral, the Fundamental Theorem of Calculus
Nov 13	(Exam 3), Indefinite integrals, the substitution rule, areas between curves
Nov 20	(Thanksgiving)
Nov 27	Volumes, inverse functions
Dec 4	The natural logarithmic function, the natural exponential function
Dec 11	Review