Math 1210: Calculus I

Department of Mathematics, University of Utah

Spring 2025

Instructor: Akil Narayan

This course instructs on the conceptual and methodological foundations of calculus.

Calculus is the mathematical study of *change*.

Successful completion of this course implies the ability to:

- use and understand definitions of a *limit*
- compute derivatives of functions
- compute critical and inflection points
- compute integrals and antiderivatives
- exercise these tools in applications: optimization, area and volume computation, rate analysis

(Cf. "learning objectives" on p3 of syllabus)

Today: We discuss the syllabus + logistics of this course.

This is a *coordinated* course:

- This course has multiple sections (this is section 023)
- You are registered for both a lecture section (this one, 023), and also a lab section (024 - 028)
- There are (many) other lecture sections: if you switch to a different lecture section, you must also change your lab section.
- To ensure uniformity: course material, textbook, labs, and general expectations are the same across sections.
- Some individualism: precise grading policies, homework assignments, and exams are specific to each section, with similarities across sections.

Grading anatomy for this course

Your assessments in this course that contribute to your final grade are:

- Weekly homework assignments
- Weekly lab sections (+ submitted lab reports)
- 3 Midterm exams
- 1 Final exam

Attendance at lecture meetings (MTWF) is *not* a factor in your grade.
(Attendance at lab sections (Th) is a factor in your grade.)

Attendance is strongly recommended for success in this course.

Homework assignments

Homework is worth 25% of your cumulative grade.

Homework assignments will be posted and due weekly (Fridays).

Assignments must be submitted through Gradescope on Canvas.

Each homework is equally weighted, and your lowest score over the semester will be dropped.

Grading of homework assignments is based partially on *completeness* (did you make a serious attempt to solve all problems?) and *accuracy* (did you correctly solve a particular subset of problems?).

The first homework assignments

The first two homework assignments are due on Friday.
They are essentially freebies, but require time.

This first assignment is a non-binding placement exam.

- "Homework 0a" is posted on Canvas now, due Friday. It is a Canvas quiz that ensures you have read instructions for the placement exam.
- Part of Homework 0a will have you complete the placement exam.
- "Homework 0b" evaluates you having completed the placement exam. This will be posted about a month to Canvas as a completed assignment. (This delay is required to ascertain completeness of the placement exams.)

Both Homework 0a and Homework 0b count as full-fledged homework assignments.

Your score/performance on the placement exam does not impact the grading of these assignments.

Lab assignments

Labs are worth 15% of your cumulative grade.

Thursdays are lab days: you will meet in smaller-group lab sections.

In each lab section you'll be further divided into small groups.

Each group will complete and submit a group lab report that will be graded.

If you do not attend a lab meeting, you cannot submit a lab report (and hence will receive zero credit for that week).

Lab sections are run by learning assistants (LA's).

Midterm exams

Midterm exams are collectively worth 39% of your cumulative grade.

There are three midterm exams this semester; each is worth 13%.

Midterm exams are held here, during class time (50 minutes).

All midterm exams are closed-book, closed-notes, and no calculators are allowed.

- Midterm exam 1: Friday, January 31
- Midterm exam 2: Friday, February 28
- Midterm exam 3: Friday, April 4

Final exam

The final exam is worth 21% of your cumulative grade.

The final exam is closed-book, closed-notes, and no calculators are allowed.

Final exam: Tuesday, April 29, 10:30am - 12:30pm (2 hours)
Location: Here, CTIHB 109

Prerequisites + expectations

You should be familiar with the following to feel comfortable in this class:

- polynomial functions, rational functions, trigonometic functions
- graphing basic functions
- miscellaneous algebraic skills: solving for roots of linear + quadratic polynomial equations, factoring, algebraic simplifications

The Homework 0a + 0b placement exam ("ALEKS") should give you a good idea if you are prepared for this course!

The textbook: REQUIRED

The textbook for this course is,

Calculus with Differential Equations, by Varberg, Purcell, and Rigdon (9th edition)

See
`https://www.math.utah.edu/resources/bookinfo.php`,
navigate down to "Math 1210".

Weekly plan

Here's generally how each week will work in this class:

- Sunday: no class (I will post lecture slides for the coming week)
- Monday: lecture (End of material for the coming Friday's homework assignment.)
- Tuesday: lecture
- Wednesday: lecture
- Thursday: lab section (Lab report assignment)
- Friday: lecture (Homework assignment due. Next week's homework assignment is posted.)

I will try to post marked slides from class in a timely manner after each class meeting.

How to succeed in this class

- Complete the homework assignments on time (if possible, use weekends to get a good start on them)
- Attend lab sections and participate in completing lab reports
- Attend lectures

We move along at a fairly brisk clip in this course: falling behind will disadvantage you quickly.

The material in this course is progressive: things are much easier in the first few weeks than they are in the last few weeks.

The tentative plan

Day	Date	Text Section(s)	Topic
Monday	January 6, 2025	—	Hello
Tuesday	January 7, 2025	1.1	Mathematical basics and introduction to limits
Wednesday	January 8, 2025	1.2	More formal discussion of limits
Friday	January 10, 2025	1.3	Limit theorems and results
Monday	January 13, 2025	0.7	Review: trigonometric functions
Tuesday	January 14, 2025	1.4	Limits involving trigonometric functions
Wednesday	January 15, 2025	1.4	Limits involving trigonometric functions
Friday	January 17, 2025	1.5	Limits at infinity; infinite limits
Monday	January 20, 2025	—	No class: MLK Jr. Day
Tuesday	January 21, 2025	1.6	Continuity of functions
Wednesday	January 22, 2025	2.1	Motivations of the derivative
Friday	January 14, 2025	2.2	Fundamentals of the derivative
Monday	January 27, 2025	2.3	Computing basic derivatives
Tuesday	January 28, 2025	2.3	Computing basic derivatives
Wednesday	January 29, 2025	—	Review
Friday	January 31, 2025	—	**Midterm Exam 1**
Monday	February 3, 2025	2.4	Derivatives of trigonometric functions
Tuesday	February 4, 2025	2.5	The chain rule
Wednesday	February 5, 2025	2.5	The chain rule
Friday	February 7, 2025	2.6	Higher order derivatives
Monday	February 10, 2025	2.7	Implicit differentiation
Tuesday	February 11, 2025	2.8	Related rates
Wednesday	February 12, 2025	2.8	Related reates
Friday	February 14, 2025	2.9	Differentials and approximations
Monday	February 17, 2025	—	No class: Presidents' Day
Tuesday	February 18, 2025	3.1	Extrema: Maxima and minima
Wednesday	February 19, 2025	3.2	Monotonicity and concavity
Friday	February 21, 2025	3.3	Local extrema and extrema on open intervals
Monday	February 24, 2025	3.4	Applications
Tuesday	February 25, 2025	3.4	Applications
Wednesday	February 26, 2025	—	Review
Friday	February 28, 2025	—	**Midterm Exam 2**

Day	Date	Text Section(s)	Topic
Monday	March 3, 2025	3.5	Graphing functions with calculus
Tuesday	March 4, 2025	3.5	Graphing functions with calculus
Wednesday	March 5, 2025	3.6	The Mean Value Theorem for derivatives
Friday	March 7, 2025	3.7	Solving equations numerically
Monday	March 10, 2025	—	No class: Spring break
Tuesday	March 11 2025	—	No class: Spring break
Wednesday	March 12, 2025	—	No class: Spring break
Friday	March 14, 2025	—	No class: Spring break
Monday	March 17, 2025	3.8	Antiderivatives
Tuesday	March 18, 2025	3.9	Introduction to differential equations
Wednesday	March 19, 2025	4.1	Introduction to area
Friday	March 21, 2025	4.1	Introduction to area
Monday	March 24, 2025	4.2	The definite integral
Tuesday	March 25, 2025	4.3	The Fundamental Theorem of Calculus
Wednesday	March 26, 2025	4.3	The Fundamental Theorem of Calculus
Friday	March 28, 2025	4.4	The Fundamental Theorem of Calculus
Monday	March 31, 2025	4.5	The Mean Value Theorem for Integrals
Tuesday	April 1, 2025	4.6	Numerical integration
Wednesday	April 2, 2025	—	Review
Friday	April 4, 2025	—	**Midterm Exam 3**
Monday	April 7, 2025	5.1	Area of a plane region
Tuesday	April 8, 2025	5.1	Area of a plane region
Wednesday	April 9, 2025	5.2	Volumes: slabs disks, washers
Friday	April 11, 2025	5.2	Volumes: slabs,disks, washers
Monday	April 14, 2025	5.3	Volumes of revolution: shells
Tuesday	April 15, 2025	5.3	Volumes of revolution: shells
Wednesday	April 16, 2025	5.4	Length of a plane curve
Friday	April 18, 2025	5.4	Length of a plane curve
Monday	April 21, 2025	5.5	Work and fluid force
Tuesday	April 22, 2025	—	Review
Tuesday	April 29, 2025	—	**Final Exam: 10:30am-12:30pm**

This first week

For this course, Math 1210, the first week is typically quite important.

You will be able to gauge how prepared you are for this course, and use this information to make decisions about whether to take this course for a grade.

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Unfortunately, I will not be here the rest of this week.
(I'll be on professional travel.)

Class will be held as normal, with substitute instructors delivering lectures.

I will be reachable via email/Canvas, and can answer any questions you have.

What good is calculus?

Calculus itself is just a set of tools.

These tools allow us to quantitatively model *change* in objects or environments.

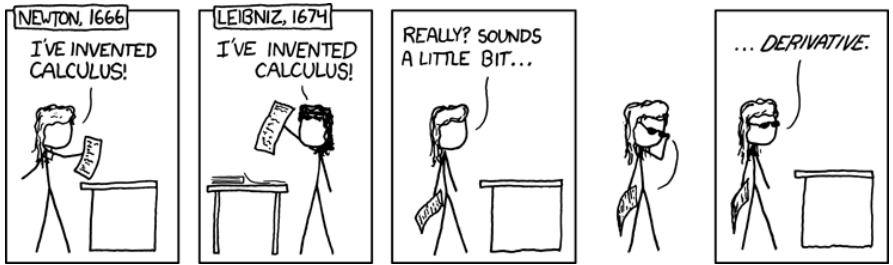
Hence, these tools are one of the foundational pillars for numerous scientific advances:

- aerospace engineering
- epidemiological modeling
- coronary blood flow modeling
- artificial intelligence and machine learning
- optimization (economics, finance, operations management, design)
- lasers, fiber optics, and electromagnetism
- combustion
- (numerical) weather prediction
- climate modeling

What good is calculus?

The "fathers" of calculus are Isaac Newton and Gottfried Wilhelm Leibniz.

A somewhat reductive summary is that calculus is all about taking *derivatives* and *integrals*.

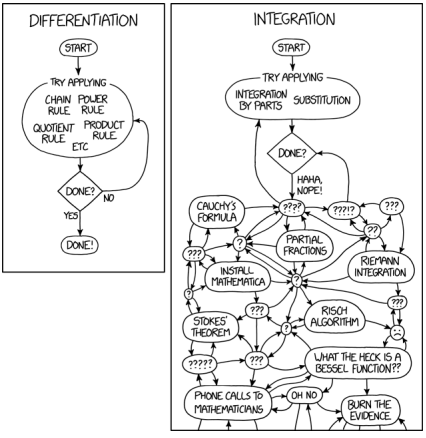


XKCD #626: `https://xkcd.com/626/`

What good is calculus?

Calculus is about *differentiation* and *integration*.

In terms of mechanics, one is essentially a rote science, the other is a subtle art.



XKCD #2117: `https://xkcd.com/2117/`

References I

 Varberg, D.E., E.J. Purcell, and S.E. Rigdon (2007). *Calculus*. 9th. MyMathLab Series. Pearson Prentice Hall. ISBN: 978-0-13-142924-6.