Math 1231-11: Single-Variable Calculus I

Fall 2026

Boring Important Stuff

Lectures:	MW 3:45 – 5:00 PM	1957 E St B12
Recitations:	33: F 8:00 AM – 8:50 AM	Phillips 110
	34: F 9:35 AM – 10:25 AM	MPA 302
	35: F 11:10 AM – 12:00 Noon	Bell 106
Textbook:	OpenStax Calculus Volume 1	by Gilbert Strang and Edwin Herman
Course Webpage:	`https://jaydaigle.net/calculus11/`	
Homework System:	WeBWorK	**Discord:** `https://discord.gg/23E9v5QuY`
Instructor:	Jay Daigle	**TA:** Xiaotian Yang
Email:	`jaydaigle@gwu.edu`	`xyang23@gwu.edu`
Office:	Phillips 720E	Phillips 725
Office hours:	TR 12:00–2:00	MW 1:00–2:00 PM

Prerequisites

Students must have received a score of 76 or above on the ALEKS placement exam to register for Math 1231. Students will be expected to be able to perform algebraic and trigonometric calculations accurately and effectively, and to be comfortable with concepts and theorems from geometry. (Weakness with algebra and trigonometry is the *number one source of difficulty* in calculus; if you find yourself struggling with these topics, come talk to us as soon as possible.)

Expected amount of work

There are just over 3 hours of class time each week. In addition, we expect a typical students to spend a minimum of 5 hours each week on independent work (primarily, homework assignments). Of course, you should spend as much time as you need to succeed in 1231, and this may be more than 5 hours per week.

What are we doing here?

We're learning calculus!

Most of you are probably learning calculus to fill some requirement. It might be a requirement for your major, or a prerequisite for a course you need to take, or just a distribution requirement. And some of you are here just because you're interested.

Either way, I want to make sure that when you finish this course, you have the skills you need to move on to what comes next. There are a few different ways of thinking about what we're doing, and what you should be getting out of this course.

First, we have a list of *ideas*. Calculus is the study of how things change over time; it includes the idea of estimates or approximate answers, rates of change, and accumulating small effects over time. We'll cover limits, derivatives, optimization, and integrals. Looked at this way, we might get the following course outline:

Course topics organized by idea

Limits Estimation, continuity, computing limits, the intermediate value theorem, the squeeze theorem

Derivatives and their applications Defining derivatives, computing derivatives, linear approximation, rates of change, implicit differentiation, related rates

Extrema and Optimization Finding extrema, the mean value theorem, curve sketching, physical optimization

Integration Riemann sums, integration, the Fundamental Theorem of Calculus, integral applications

All of these ideas are important, and you'll find this basic list of topics in any calculus course or textbook.

A second way of understanding the course is by thinking about the *skills* that you will be developing. There are core computational skills you will need to succeed in this course, or any other course that builds on it. There are foundational theoretical ideas that explain how and why calculus works, which you should be familiar with. There are applications of our calculus tools to other mathematical problems. And we can use these to model real-world situations, which is ultimate the reason most of you want calculus in the first place. That perspective might produce the following outline:

Course topics organized by skill

Core mechanical skills Computing limits, computing derivatives, implicit differentiation, finding extrema, integration

Theoretical ideas Estimation, intermediate value theorem, squeeze theorem, definition of derivative, mean value theorem, riemann sums, fundamental theorem of calculus

Applications Linear approximation, related rates, curve sketching, integral applications

Modeling Estimation, Rates of Change, Related Rates, Physical Optimization, Integral Applications

Finally, we can answer the biggest question many of you will have about these topics: "will this be on the test?" Specifically, we can organize our topics by *importance*.

I have divided the topics in this course into major topics (M), secondary topics (S), and enrichment topics (E). The major topics are the central skills of the course; you cannot succeed in this course without developing a high degree of fluency in those topics. The secondary topics are also important, but less central to the course; I expect you to become reasonably skilled in most of them; but you will probably struggle with a couple, and that's fine. The enrichment topics are things that I want you to be exposed to, but I don't expect you to master during this course.

Course topics organized by importance

Major Topics Computing limits, Computing Derivatives, Finding Extrema, Integration

Secondary Topics Estimation, Definition of derivative, Linear Approximation, Rates of Change, Implicit Differentiation, Related Rates, Curve Sketching, Physical Optimization, Riemann Sums, Integral Applications

Enrichment Topics Squeeze Theorem, Intermediate Value Theorem, Mean Value Theorem, Fundamental Theorem of Calculus

We can attempt to summarize all three perspectives in the following table:

	Topics in Math 1231			
	Mechanical Skill	**Theoretical Knowledge**	**Application**	**Modeling**
Limits	(M) Computing Limits	(S) Estimation (E) Intermediate Value Theorem (E) Squeeze Theorem		(S) Estimation
Derivatives	(M) Computing Derivatives (S) Implicit Differentiation	(S) Definition of Derivative	(S) Linear Approximation (S) Related Rates	(S) Rates of Change and Models (S) Related Rates
Optimization	(M) Finding Extrema	(E) Mean Value Theorem	(S) Curve Sketching	(S) Physical Optimization
Integrals	(M) Integration	(S) Riemann Sums (E) FTC	(S) Integral Applications	(S) Integral Applications

How are we doing it?

This course is organized around two key principles:

1. Learning is something you do, not something I do
2. Learning involves confusion and struggle.

Learning is something you do

A lot of people subconsciously have a model of learning where I, the teacher, take my knowledge and somehow deposit it in the heads of my students, where I'm transferring the knowledge and you are just a receptacle. This is totally wrong.

Learning is a process by which you, the student, develop knew skills, understandings, and perspectives. This can only happen by means of you doing activities that cause learning on your end. I can (and will!) provide resources, activities, and guidance in your quest to do this, but I cannot do it for you.

This course will feature multiple forms of weekly assignment. The primary purpose of these assignments is to give you the opportunity (and incentive) to engage in high-quality, focused practice. It is of course possible to cheat yourself of this practice, but then you will *not* be developing skills and you will struggle when you need to use those skills (including on the tests).

Learning involves confusion and struggle

During this course you will often find yourself confused. **Being confused isn't bad!** The moment of confusion really is the moment where learning occurs. If you're never confused, either you're never challenging yourself, or you're not thinking about what's happening and why. Either way is a form of avoiding learning.

This means that learning is challenging and sometimes unpleasant. You will need to put yourself in mentally uncomfortable situations you don't fully understand. Then you will need to pay a lot of attention to that feeling of confusion, and try to resolve it into something you do understand. Sometimes this will involve dramatically shifting the way you think about math, writing, reasoning, or other aspects of your intellectual life—a great deal of learning is actually *unlearning* flawed models that are impeding your progress.

While you are doing homework, you should not just try to get the right answer and move on. If you make a mistake it's important to identify to yourself, explicitly, what the mistake was and how you can avoid it in the future. Sometimes it's helpful to keep a separate page of notes while doing homework, where you keep track of what mistakes you make and how you can fix them in the future.

However, you should not be completely baffled. If you have no idea what's going on, or what to do, then you're also not learning productively. This is much like exercise: lifting weights that feel easy won't accomplish much, but if you can't lift the weight at all then you also won't get much out of it. If you find yourself completely lost, reach out to me or use one of the many other resources we have available.

What tools will help us do it?

Learning is something you need to do, and it will involve challenge, struggle, confusion, and effort. However, it's not effective to flounder around completely lost; if you have no idea what you're doing it's also hard to learn. This course is designed to provide you with the tools to learn successfully.

Lectures

We will have two lectures each week. These are a chance for me to introduce you to the ideas, techniques, and skills you will need to succeed at calculus.

Lecture, like all learning activities, will be most effective if you are an active participant. When I am solving problems or making arguments, you should try to work with or a little ahead of me.

I will frequently ask questions, or ask for the next step in some calculation. You might not wish to answer me out loud, and that's fine. And indeed, with a class of this size you certainly can't all answer me every time I ask a question. (In fact, if you notice you've answered the last three questions in a row, please back off and let the other students have a chance!)

However, you should definitely try to answer all my questions for yourself in your head, even if you don't say anything out loud. This is important for getting as much out of lecture as possible. It gives you a chance to practice and improve yourself. And if you get the answer wrong, that's a valuable source of feedback, so you know where you need to adjust.

Recitations

Once a week you will have a fifty-minute recitation section with the course TA. These sessions are designed to give you high-quality guided practice. You will get a worksheet, which you should do your best to work through, ideally collaborating with a few other students in the class.

Make sure you try to answer all the questions on the sheet. In addition to asking you to compute things, I'll also ask you to reflect on how you thought about something, or why things work the way they do. These questions aren't really "gradeable", but they're valuable for you to probe and improve your own understanding.

While you work on these sheets, the TA will circulate and answer your questions and steer you in the right direction. Please take advantage of this and ask them any questions you have.

At some points the TA will discuss the answers to these problems with the entire class. Please share the results of your work and participate in these as actively as you can.

WeBWorK online homework system

For each topic I will assign some homework through the WeBWorK online homework system. This system is free to students. It will give you an opportunity to practice basic skills you will need to succeed in the course.

It is important that you spend a good amount of time on the WeBWorK problems. This is where most of your learning will actually occur. Consequently, you should try very hard both to get the right answer, and to understand *why* that answer is correct.

To facilitate practice, you will have an unlimited number of attempts to get credit for each problem. Use these to make sure you understand the problem and the correct answer. If you find yourself struggling with a particular problem or type of problem, *please* discuss it with me, your TA, or one of the other academic resources suggested above. The purpose of this system is to give you an opportunity to *practice*; if you get the points without understanding, it's not fulfilling its purpose.

Office Hours

Both your TA and I will hold regular, weekly office hours. These are times we are waiting and available to help you with the course material. Any time during office hours you are free to come by and ask whatever questions you want, or discuss whatever would be helpful to you.

This is one of the most valuable resources you have; we are able to assist you with thinking through material and shoring up your weaknesses in a direct, personalized way you can't easily get elsewhere.

Office hours also have less obvious benefits beyond help with the course. For instance, in office hours, we can make you aware of campus resources you might not have known about. Office hours are also helpful for building relationships with faculty. Many students need letters of recommendation for jobs, internships, etc., and we cannot write useful or effective letters for students we do not know. Attending office hours helps make sure your professors know you and are able to provide you with recommendations or other forms of assistance or advice you may need in the future.

Email and Discord

You may email me at any time with course questions. I will try to get back to you promptly, but at some points during the term this will be more prompt than others.

I have set up a Discord server at `https://discord.gg/23E9v5QuY` to facilitate low-key discussions of class material, with me and other students. This is totally optional, but you can go there to talk about the class with each other or with me; I'll be keeping an eye on it most of the time and it's usually the easiest and fastest way to get in touch with me.

Calculus Lab and peer tutoring

The math department runs a calculus lab Monday through Thursday evenings when classes are in session. Math graduate students are standing by to help you with questions about your calculus work. You can find more information at `https://math.columbian.gwu.edu/calculus-lab-tutoring`

There is peer tutoring and other resources available through the Academic Commons. See `https://academiccommons.gwu.edu/`

The Openstax Textbook

The official textbook for Math 1231 is OpenStax Calculus Volume 1 by Gilbert Strang and Edwin Herman. It is available for free online at `https://openstax.org/details/books/calculus-volume-1`. You can also buy copies from Amazon; a paperback is a little under $30.

You can use this as an independent source of explanations of the material, that takes a slightly different perspective from mine. You can also use it as a source of extra practice problems; odd-numbered exercises have answers in the "back" of the book.

Technology

AI Chatbots

AI systems like ChatGPT are capable of answering many of the problems that will be assigned in this course. These tools might be helpful if used carefully, but more typically they get in the way and make it actually harder for you to learn, often without you even noticing until you find yourself completely lost on a test.

Homework is assigned to help you practice skills and prepare for exams and future courses. If you get the answer to a problem from an AI system (or a friend, or solution manual) you will not be engaging with the problem in a way that gives you effective practice and helps you prepare for exams. It may feel like you are learning when you read an answer from AI, but it generally does not help you very much. You will get much more out of struggling with the problem and working it out on your own.

Sometimes you do need help, but even then, being merely told the answer generally is not very helpful. That is why in office hours our answers are often in the form of a sequence of questions or prompts that aim to help you see the answer for yourself, and to foster in you the habit of asking smaller questions that will ultimately allow you to resolve your own problems (as you need to do on exams!). If you use AI, you want to mimic that; try to ask it to give you the smallest possible hint, or show it your work and ask it where you might be making a mistake. If it just tells you how to do the problem, you will not learn much, but a small hint, or a diagnosis of an error, can help.

Technology in the Classroom

I strongly encourage you to avoid all use of laptops and cell phones during class time. This includes using technology to engage with class, like taking notes and looking up course content. Frequently these uses of technology can feel like they are helping you learn, but they actually make you less focused and engaged with the actual material.

I will not be enforcing a ban on tech use but I suspect most of you will learn more and perform better in the course if you come in with a notebook, a pencil, and a determination to be mentally present for the duration of class.

How will we know we've done it?

Mastery Quizzes

The quiz grading will follow an approach called "mastery" grading, which is a little complicated but which I think will make learning both easier and less stressful.

Mastery grading will allow you to focus your work on the topics you need to improve on; it gives you room to improve and have that improvement reflected in your grade; it reduces the stress of each quiz because a poor performance can be made up for later. This approach also encourages you to thoroughly master the fundamental skills and ideas of calculus.

The major disadvantage of mastery grading is that it is different and complicated. I will try to make it as clear as possible, but if you have any confusion about how things work or what your grade looks like at any given time, please let me know and I'd be happy to clarify.

So how does it work? I've identified 4 major concepts and 10 secondary concepts I would like you to master.

Major Topics

1. Computing Limits
2. Computing Derivatives
3. Extrema and optimization
4. Integration

Secondary Topics

1. Estimation
2. Definition of derivative
3. Linear Approximation
4. Rates of Change and Models
5. Implicit Differentiation
6. Related Rates
7. Curve Sketching
8. Physical Optimization
9. Riemann Sums
10. Integral Applications

Each Tuesday, I will post a worksheet to the course web page, with a collection of problems on these topics. You may work on these questions however you wish, including collaborating with fellow students or even working with AI chatbots, but you will *not* submit that work to me.

Each recitation section will end with a short quiz, with questions primarily drawn from that week's worksheet. *You may not use or consult any materials or notes while completing the in-class quizzes.*

Each question will be graded on a 3-point scale:

0: Blank or makes no progress.

1: Makes some progress but doesn't finish, or makes multiple significant errors.

2: Makes significant progress but makes either a significant error or multiple minor errors. Demonstrates understanding but not mastery.

3: Essentially completely correct and fully justified, demonstrating mastery of the topic.

Grading mastery quizzes

Your mastery quizzes will affect your final course grade in two ways.

1. You will get a course *quiz participation* grade for showing up and making a reasonable attempt at each quiz. For your quiz participation, a 1 is worth 50% and a 2 or 3 is worth 100%.

   Your two lowest quiz scores will be dropped, so missing one quiz should not significantly affect your score.

2. You will get a *mastery score*. This score will be the sum of your two best scores on each major topic, and your best score on each secondary topic.

   You will get at least four attempts on each major topic, and two attempts on each minor topic, purely through the weekly quizzes.

WeBWorK Online Homework System

I will assign homework for each topic homework through the free WeBWorK online homework system. You can log into WeBWorK by following the link on Blackboard. Once you've followed the Blackboard link, you can create a password so you can log in directly, but you can also continue to access it from Blackboard.

Homework will be due roughly twice a week. Assignments will generally be due a week after they are opened. However, **you should complete these assignments well before the official due date**, so you are prepared to learn the more advanced material we will be covering in class. There will be a grace period of one week after the due date during which you can submit your work for partial credit. Consequently I will not give extensions except in extremely unusual circumstances.

The primary purpose of the WeBWorK system is to encourage you to practice your skills. I encourage all forms of collaboration on WeBWorK problems

Midterm and Final

There will be two midterms in class on October 5 and November 9, and a comprehensive final exam as scheduled by the registrar, tentatively on Wednesday, December 16, at 5:20 PM. I will distribute a practice test with solutions before each test so you will know what format to expect going in. If you have mastered the rest of the course material, these tests should be fairly straightforward.

Midterms cannot be rescheduled. If you miss a midterm for an acceptable medical or family reason, your final exam will replace the missed midterm and be worth 40% of your course grade.

You will *not* be excused from the final if you travel during finals week; if you must buy a plane ticket before the registrar announces final exam, please make sure it departs after December 17.

No Technology During Quizzes and Tests

Cell phones, laptops, smart glasses, headphones, ear buds/air pods, and other devices that may store, send, or receive information or connect to the internet are strictly banned during quizzes and tests. All such devices in your possession must be in your book bag, which must be zipped shut. If I see your cell phone or any other device under any circumstances, you will get a zero on the assignment and I will file academic integrity charges for having banned devices out during a quiz or exam. If due to a medical reason you need regular access to your phone, please discuss this with me and DSS as soon as possible.

Grading Policies

This course is primarily focused on providing clear justifications for our conclusions. Consequently, you will primarily be evaluated on your arguments and justifications; little credit will be given for correct answers without justification.

Computation of final grades

- WeBWork Homework: 10%
- Mastery Quiz Participation: 10%
- Mastery Score: 25%
- Midterms 1: 15%
- Midterms 2: 15%
- Final Exam: 25%

Minimum scores for each letter grade are roughly: A, 94%; A−, 90%; B+, 87%; B, 84%; B−, 80%; C+, 77%; C, 74%; C−, 70%; D+, 67%; D, 64%; D−, 60%.

No extra credit will be available under any circumstances.

When will we do it?

1	Aug 24	Functions	Aug 26	Estimation
2	Aug 31	Continuity and Computing Limits	Sept 2	More on Limits
3	~~Sept 7~~	*No Class for Labor Day*	Sept 9	Infinite Limits
4	Sept 14	Intro to Derivatives	Sept 16	Computing Derivatives
5	Sept 21	Trig Derivatives and the Chain Rule	Sept 23	Linear Approximations and Speed
6	Sept 28	Rates of Change and Tangent Lines	Sept 30	Implicit Differentiation
7	Oct 5	**Midterm 1**	Oct 7	Related Rates
8	~~Oct 12~~	*No Class for Fall Break*	Oct 14	Absolute Extrema
9	Oct 19	Mean Value Theorem	Oct 21	Classifying Extrema
10	Oct 26	Concavity and Curve Sketching	Oct 28	Physical Optimization
11	Nov 2	The Area Problem	Nov 4	The Definite Integral
12	Nov 9	**Midterm 2**	Nov 11	The Fundamental Theorem of Calculus I
13	Nov 16	FTC II and the Antiderivative	Nov 18	Integration by Substitution
	~~Nov 23~~	*No Class; Thanskgiving Break*	~~Nov 25~~	*No Class; Thanskgiving Break*
14	Nov 30	Finding Areas	Dec 2	Applications of the Integral
15	Dec 7	Volumes by Slicing	Dec 9	Volumes by Shells

Will we have to change any of it?

The course staff reserves the right to change course policies in light of unforseen events; in this case, announcements will be sent out through Blackboard explaining the change.

University Policies

Academic Integrity Code

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the Code of Academic Integrity. If you have any questions about whether particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact Conflict Education and Student Accountability (CESA) to learn more about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the University and may include a transcript notation. For more information, refer to the CESA website at students.gwu.edu/code-academic-integrity or contact CESA by email cesa@gwu.edu or phone 202-994-6757.

University policy on observance of religious holidays

Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see `provost.gwu.edu/policies-procedures-and-guidelines`.

Use of Electronic Course Materials and Class Recordings

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

Academic Support

Academic Commons

Academic Commons is the central location for academic support resources for GW students. To schedule a peer tutoring session for a variety of courses visit go.gwu.edu/tutoring. Visit academiccommons.gwu.edu for study skills tips, finding help with research, and connecting with other campus resources. For questions email academiccommons@gwu.edu.

GW Writing Center

GW Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside

peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online at gwu.mywconline.

Support for students in and outside the classroom

Disability Support Services (DSS) 202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility and to coordinate reasonable accommodations.

Student Health Center 202-994-5300, 24/7

The Student Health Center (SHC) offers medical, counseling/psychological, and psychiatric services to GW students. More information about the SHC is available at healthcenter.gwu.edu. Students experiencing a medical or mental health emergency on campus should contact GW Emergency Services at 202-994-6111, or off campus at 911.

GW Campus Emergency Information

GW Emergency Services: 202-994-6111

For situation-specific instructions, refer to GW's Emergency Procedures guide.

GW Alert

GW Alert is an emergency notification system that sends alerts to the GW community. GW requests students, faculty, and staff maintain current contact information by logging on to alert.gwu.edu. Alerts are sent via email, text, social media, and other means, including the Guardian app. The Guardian app is a safety app that allows you to communicate quickly with GW Emergency Services, 911, and other resources. Learn more at safety.gwu.edu.

Protective Actions

GW prescribes four protective actions that can be issued by university officials depending on the type of emergency. All GW community members are expected to follow directions according to the specified protective action. The protective actions are Shelter, Evacuate, Secure, and Lockdown (details below). Learn more at safety.gwu.edu/gw-standard-emergency-statuses.

Shelter

- Protection from a specific hazard
- The hazard could be a tornado, earthquake, hazardous material spill, or other environmental emergency.
- Specific safety guidance will be shared on a case-by-case basis.

  Action:

  - Follow safety guidance for the hazard.

Evacuate

- Need to move people from one location to another.
- Students and staff should be prepared to follow specific instructions given by first responders and University officials.

  Action:

  - Evacuate to a designated location.
  - Leave belongings behind.
  - Follow additional instructions from first responders.

Secure

- Threat or hazard outside of buildings or around campus.
- Increased security, secured building perimeter, increased situational awareness, and restricted access to entry doors.

  Action:

  - Go inside and stay inside.
  - Activities inside may continue.

Lockdown

- Threat or hazard with the potential to impact individuals inside buildings.
- Room-based protocol that requires locking interior doors, turning off lights, and staying out of sight of corridor window.

  Action:

  - Locks, lights, out of sight
  - Consider Run, Hide, Fight
- Classroom emergency lockdown buttons All classrooms have been equipped with classroom emergency lockdown buttons. If the button is pushed, GWorld Card access to the room will be disabled, and GW Dispatch will be alerted. The door must be manually closed if it is not closed when the button is pushed. Anyone in the classroom will be able to exit, but no one will be able to get in.