Math 2233-20: Multivariable Calculus

Summer 2025

Lectures:	MTWR 12:30 – 2:00 PM	Monroe 115	
Textbook:	OpenStax Calculus Volume 3	by Gilbert Strang and Edwin Herman	
Course Webpage:	`https://jaydaigle.net/multi/`		
Homework System:	WeBWorK	**Discord:**	`https://discord.gg/yVhNZp356S`
Instructor:	Jay Daigle	**Office:**	Phillips 720E
Email:	`jaydaigle@gwu.edu`	**Office hours:**	MTWR 2:15–3:30 PM

Textbook

The official textbook for Math 2233 is OpenStax Calculus Volume 3 by Gilbert Strang and Edwin Herman. It is available for free online at `https://openstax.org/details/books/calculus-volume-3`. I will be loosely following the textbook, but will often be giving my own take or focusing on topics the textbook doesn't emphasize. All my course notes will be posted to the course web page.

I will be assigning online homework through the WeBWorK web platform. 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. This service is hosted by GW and is free.

Course content

In this course we will extend our theory of calculus to cover functions of multiple variables. We will understand these functions algebraically and geometrically, and learn how to use the tools of differential and integral calculus to further understand them.

Topics will include: 3D graphing, planes, partial derivatives, vectors, directional derivatives, gradients, the chain rule, optimization and Lagrange multipliers, integration, parametrization, vector fields, line and surface integrals, and Green's, Stokes's, and the Divergence theorem.

Prerequisites

Students must have passed Math 1232: Single-Variable Calculus II, or the equivalent. You should be familiar with limits, derivatives, integrals, and series.

Technological requirements; recordings

I have set up a Discord server at `https://discord.gg/yVhNZp356S` to facilitate low-key discussions of class material. 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.

Lecture schedule

The list below gives a tentative outline of what is planned and when. (Please don't take it too literally.)

Communication

I use male pronouns. You can call me "Professor Daigle", "Dr. Daigle", or just "Jay". I will, however, be sad if you call me "Mr. Daigle".

June 30	Vectors and the Dot Product	July 21	Polar, Cylindrical, and Spherical Integrals
July 1	Dot Product and Cross Product	July 22	Change of Variables
July 2	Vector Function	July 23	Integral Applications
July 3	Calculus of Vector Functions	July 24	**Test 2**
July 7	Multivariable Functions	July 28	Vector Fields and Line Integrals
July 8	Partial Derivatives and the Gradient	July 29	Conservative Vector Fields
July 9	The Chain Rule and Second Partials	July 30	Curl and Green's Theorem
July 10	**Test 1**	July 31	Surface Parametrization and Integrals
July 14	Maxima and Minima	August 4	Flux Integrals
July 15	Extrema and Constrained Optimization	August 5	Stokes's Theorem
July 16	Riemann Sums and Multivariable Integrals	August 6	The Divergence Theorem
July 17	Double and Triple Integrals	August 7	**Final**

If you have never e-mailed a college professor before, this blog post provides a short, helpful guide to best practices: `http://tinyurl.com/h5w5nyo`.

Expected amount of work

This course is going to be fairly intensive. You have six hours of class time each week. That implies you should expect to do about twelve hours of work outside of class each week. There will be online homework due essentially every day, and written work due every other class day.

It's really important that you stay current on your work and on all the material, because later material will build on earlier material and we will have to move quickly. If you find yourself falling behind please talk to me as soon as you can, so we can try to get you caught up.

Course Structure

Attendance will not be monitored or enforced, but will be extremely helpful to progressing in your understanding of calculus. There will be online homework assignments due each day, two written quizzes each week, and two midterms and a comprehensive final exam.

WeBWorK Online Homework System

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

You will have an unlimited number of attempts to get credit for each problem. However, some problems will rerandomize numbers after a few failed attempts, so you can't just guess wildly and hope you eventually get it right. 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.

Each assignment will have a due date, generally a week after it is opened. Assuming the system works properly, you will have a grace period of two weeks after the due date during which you can submit your work for 90% credit. Consequently I will not give extensions except in extremely unusual circumstances.

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.

In this course I have identified 6 major concepts and 6 secondary concepts I would like you to master by the end of the course.

Major Topics

1. Vectors
2. Partial Derivatives
3. Optimization
4. Multivariable Integrals
5. Line Integrals
6. Surface Integrals

Secondary Topics

1. Vector Functions
2. Lines and Planes
3. Multivariable Functions
4. Applications of Integrals
5. Vector Fields
6. The Divergence Theorem

Each week there will be a quiz, with questions that will let you demonstrate proficiency with some of these topics. Each topic will be graded on a 2-point scale:

0: Demonstrates little to no understanding of this topic

1: Demonstrates progress on this topic, but without having fully mastered it

2: Demonstrates mastery of this topic

Your final course grade will reflect your two best attempts at each major topic, and your single best attempt at 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.

This approach has a few major advantages: It allows 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 completely made up for later. This approach also encourages you to actually 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.

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.

You will have an unlimited number of attempts to get credit for each problem. If you find yourself struggling with a particular problem or type of problem, *please* discuss it with me. 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.

Each assignment will have an official due date in the system, generally a week after it is opened. **You should try to complete every set as soon as we have introduced the relevant material** in order to stay current with the course material. Assuming the system works properly, you will have a grace period of one week after the due date during which you can submit your work for 90% credit. Consequently I will not give extensions except in extremely unusual circumstances.

Midterm and Final

There will be midterms on roughly October 3 and November 14, and a comprehensive final exam. 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, both tests should be fairly straightforward.

The final exam will be held on Monday, December 19, from 12:40 - 2:40 PM. I will update you when the registrar announces the final exam schedule. You will *not* be excused from the final if you schedule travel during finals week.

Computation of final grades

- WeBWorK Homework: 15%
- Mastery Quizzes: 30%
- Midterms: 15% each
- Final Exam: 25%

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

Attendance and engagement in class and recitation, while not formally part of the computation, may be used as deciding factors in borderline cases. No extra credit will be available under any circumstances.

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.