Math 2233-12: Multivariable Calculus

Fall 2022

Lectures:	MW 12:45 – 2:00 PM	1957 E B17	
Recitations:	36: F 8:00 AM – 8:50 AM	Rome 351	
	37: F 9:35 AM – 10:25 AM	Rome 351	
	38: F 11:10 AM – 12:00 Noon	Rome 351	
Textbook:	OpenStax Calculus Volume 3	by Gilbert Strang and Edwin Herman	
Course Webpage:	`https://jaydaigle.net/multi/`		
Homework System:	WeBWorK	**Discord:**	`https://discord.gg/HD3dvYC`
Instructor:	Jay Daigle	**TA:**	Charlene Houchins
Email:	`jaydaigle@gwu.edu`		`chouchins98@email.gwu.edu`
Office:	Phillips 720E		Phillips 724A
Office hours:	TR 2:00–4:00 PM		F 1–2:30 PM
Often in Office:	MW, 2:30–4:20 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/HD3dvYC` 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.

While lectures will (hopefully) be entirely in-person, our classrooms are equipped with recording technology and lecture recordings will be uploaded to Blackboard.

Important resources

The following resources are available to help you succeed in Math 1231.

- Lecture and recitation
- Faculty and TA office hours (scheduled or by appointment)
- The calculus lab: `https://math.columbian.gwu.edu/calculus-lab-tutoring/`
- Academic Commons (including peer tutoring): `https://academiccommons.gwu.edu/`

In addition, the University's Mental Health Services offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include crisis and emergency mental health consultations confidential assessment, counseling services (individual and small group), and referrals. For additional information, see `https://counselingcenter.gwu.edu/` or call 202-994-5300.

Lecture schedule

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

Aug 29	Vectors	Oct 24	**Fall Break**
Aug 31	Dot Product and Cross Product	Oct 26	Polar, Cylindrical, and Spherical integrals
Sep 07	Equations of Lines and Planes	Oct 31	Centers of Mass and Moments of Inertia
Sep 12	Vector Functions and Space Curves	Nov 02	Change of Variables in Multiple Integrals
Sep 14	Calculus of curves	Nov 07	Vector Fields and Line Integrals
Sep 19	Multivariable Functions	Nov 09	Line Integrals
Sep 21	Partial Derivatives and Linear Approximation	Nov 14	Midterm
Sep 26	Directional Derivatives and the Gradient	Nov 16	Conservative Vector Fields
Sep 28	Chain Rule and Second Partials	Nov 21	Curl and Green's Theorem
Oct 03	Midterm	Nov 23	**Thanksgiving**
Oct 05	Maxima and Minima	Nov 28	Surface Parametrization and Surface Integrals
Oct 10	Global Extrema	Nov 30	Flux Integrals
Oct 12	Lagrange Multipliers	Dec 05	Stokes's Theorem
Oct 17	Riemann Sums and Multivariable Integrals	Dec 07	Divergence
Oct 19	Multivariable Integrals II	Dec 12	Divergence Theorem

There will not be class on Monday October 24 (Fall Break) or Thursday November 23 (Thanksgiving Eve).

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". The TA uses female pronouns; you can call her "Charlene".

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

There are just over 3 hours of class time each week. In addition, we expect a typical student 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 2233, and this may be more than 5 hours per week.

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 Tuesday and Thursday, weekly quizzes, 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.

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.

Academic integrity Code

Students are responsible for the honesty and integrity of their own academic work. In particular, it is unacceptable to present the work or ideas of others as if they were your own. The course staff take this *extremely seriously*, and you should as well. The best way to avoid problems is to clearly indicate on your work what sources/individuals/etc. you consulted. Failure to abide by rules for individual assignments is subject to sanction, including possibly failure of the class. If you have any questions, please do not hesitate to contact the instructor. The complete university code is at `https://studentconduct.gwu.edu/code-academic-integrity`

Religious holidays and other excused absences

If you will be unable to complete or submit an assignment, notify your TA or instructor *in advance* to discuss your options. Unexcused missing work will be assigned a score of 0. In accordance with University policy, students should notify faculty *during the first week of the semester* of their intention to be absent from class on their day(s) of religious observance. For details and policy, see "Religious Holidays" at `https://provost.gwu.edu/policies-procedures-and-guidelines`

Students with disabilities

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information, see `https://disabilitysupport.gwu.edu/`

Safety and Security

1. In an emergency: call GWPD 202-994-6111 or 911
2. For situation-specific actions: review the Emergency Response Handbook at `safety.gwu.edu/emergency-response-handbook`
3. In an active violence situation: Get Out, Hide Out, or Take Out. See `go.gwu.edu/shooterpret`
4. Stay informed: `safety.gwu.edu/stay-informed`

Final disclaimer

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