# Math 255: Calculus for Biological Scientists

Colorado State University

Fall 2025 Syllabus

## 1 Course Details

### 1.1 Class Meetings

MTWF 12:00 PM - 12:50 PM, ENGRG E 205

### 1.2 Course Instructor

**Dr. Geoff Krall**

I've been an educator in some form or fashion for over 20 years. After teaching in Austin, TX, I moved to Fort Collins where I obtained my Master's degree from Colorado State University in the field of Atmospheric Science. In 2024 I earned my doctorate in Mathematics Education from the University of Wyoming. I love teaching this class as well as MATH 155 as it marries my love of science with my love of mathematics.

I've lived in Fort Collins since 2008. I have two daughters and a spouse who is a professor of nursing at the University of Northern Colorado.

### 1.3 Office Hours

If you would like to receive extra support, you may attend walk-in office hours at Friday at 1pm, directly after class, or make an appointment. These office hours may be used to go over problems, discuss the course, or chat generally about math and science.

### 1.4 Communication

E-mail (geoff.krall@colostate.edu) is the best way to contact me. You, in turn, are also expected to check your university email and our Canvas course regularly and respond in a timely manner.

### 1.5 Prerequisites

The course requires prerequisite courses of Math 155 and MATH 126 or MATH 127 (may be taken concurrently).

### 1.6 Textbook

There is no textbook for this course. Rather, the course is constructed using open source textbooks Active Calculus Single Variable Calculus[1], Multivariable Calculus[2], and OpenStax[3].

### 1.7 Course Website

We will use Canvas[4] for all course material and grades. This is a great place to stay organized and know what is due when.

[1] https://activecalculus.org/single/book-1.html
[2] https://activecalculus.org/multi/book-1.html
[3] https://openstax.org/details/books/calculus-volume-2
[4] canvas.colostate.edu

### 1.8 Course Ethos

MATH 255 is a Calculus 2 course geared towards the scientific endeavors of biological scientists. Special attention will be paid to the application of Calculus concepts toward scientific scenarios. There will be time in class to work through course material.

Because this course serves scientists, a significant portion of the course will be structured around "labs" in which students will apply learned Calculus 2 material to authentic scientific scenarios.

### 1.9 Course Structure

Research shows that people learn mathematics best when they are actively engaged in the material. In other words, you learn by doing and interacting, not by watching. Therefore, our course is not comprised solely of lecture content, but instead provides multiple opportunities for individual and group work in which you will be actively engaged, solving problems, and understanding connections.

We will typically start each class with an Investigation, or warm-up activity. These investigations are essential at connecting prior content with the day's material. These investigations will be followed by a lecture, example problems, and (time permitting), in class time to work on practice problems.

### 1.10 Course Content

This course explores derivatives and integrals of functions of several variables, differential equations, matrices and linear algebra, and applications in the biosciences.

### 1.11 Calculator and Technology

You should have access to technology that can graph functions to explore ideas inside and outside of class. Examples of such technology include a calculator such as a TI-83 or better, a graphing calculator application for a smartphone, and web sites such as Wolfram Alpha[5] and Desmos[6].

## 2 Assignments and Assessments

### 2.1 Math Labs

This course is motivated by your status as scientists. The mathematics you learn is intended to serve your Science exploration. As such, a significant portion of this class will be geared towards "labs." While not labs in the scientific sense involving data collection, hypothesis testing, etc., the labs in MATH 255 are scenario-based and intended to apply the mathematics learning to scientific situation.

These labs will take 1-2 days of in-class coursework. They will be partially completed on paper and partially completed in Canvas.

Labs will constitute 40% of your final grade.

### 2.2 Homework Assignments

There will be 11 homework assignments over the course of the semester, with the lowest score dropped. The homework assignments will be completed in MyOpenMath: https://www.myopenmath.com/

The course ID is 281280 and the password is calcyalater!

These homework assignments are intended to reinforce skills learned in class. The problems tend to be more rote than the kind we will engage with on Labs and assessments.

Homework Assignments are due on Wednesdays at 11:50pm and will constitute 15% of your final grade.

### 2.3 In-person Assessments (Mid-Term and Final Exam)

There will be two in-person exam: one midterm exams and one final exam. Both exams will cover the span of two class periods. You are welcome to study the material in-between class sessions.

The exam dates are listed below; please put them in your calendar now.

[5] www.wolframalpha.com
[6] www.desmos.com

1. Mid-term Exams 10/3/2025 and 11/7/2025
2. Final Exam 12/10/2025 and 12/12/2025

The final exam will be cumulative. Both exams are worth 15% of your final grade.

# 3 Grades

## 3.1 Grades

Overall grade percentages will be calculated based on the following weighting:

- Labs (8) (40%)
- Homework Assignments (10)[7] (20%)
- Mid Term Exams (2) (25% - 12.5% each)
- Final Exam (15%)

Letter grades will be assigned according to a scale no stricter than the following:

| | |
|---|---|
| A+ | [98,100] |
| A | [92,98) |
| A- | [90, 92) |
| B+ | [88,90) |
| B | [82, 88) |
| B- | [80,82) |
| C+ | [78, 80) |
| C | [70,78) |
| D | [60,70) |
| F | [0,60) |

## 3.2 Attendance and Late Work Policy

Regular attendance is an expectation for MATH 255. In particular, labs are to be completed and turned in during class. All late work and missed lab days must be accompanied with a university excused absence. Generally, the sooner you let your instructor know, the better.

If something unexpected does come up during the semester, you should consider opening a case with CSU Student Case Management[8]. They are very helpful in supporting students and can help you obtain excused absences not just for this class, but all your classes.

# 4 Course Calendar (Fall 2025)

The following dates and subject matter are subject to change.

| Week | Monday | Tuesday | Wednesday | Friday |
|---|---|---|---|---|
| 1 (8/25) | 0.1 Functions and Trig Review | 0.2 Derivative Review | 0.3 Integral Review | Lab 1 - Numerical Integration and Derivatives |

[7] There are 11 homework assignments; the lowest score will be dropped from your grade
[8] https://studentcasemanagement.colostate.edu/

| Week | Monday | Tuesday | Wednesday | Friday |
|---|---|---|---|---|
| 2 (9/1) | Labor Day | 0.4 Advanced Integration Techniques (Substitution) | 0.5 Advanced Integration Techniques (Parts)<br><br>HW1 due | 0.6 Advanced Integration Techniques (Alternative Methods) |
| 3 (9/8) | 1.1 Using Definite Integrals to Find Area | 1.2 Using Definite Integrals to Find Length | Lab 2 - Area Between Curves and Arc Length<br><br>HW2 due | Lab 2 - Area Between Curves and Arc Length |
| 4 (9/15) | 1.3 Using Definite Integrals to Find Volume (Disk Method) | 1.4 Using Definite Integrals to Find Volume (Washer Method) | 1.5 Density and Center of Mass<br><br>HW3 due | 1.6 Center of Mass (2D) |
| 5 (9/22) | 1.7 Improper Integrals | Flex day | Lab 3 - Volume, density, and Center of mass<br><br>HW4 due | Lab 3 - Volume, density, and Center of mass |
| 6 (9/29) | 2.1 An Introduction to Differential Equations | 2.2 Slope Fields | Review<br><br>HW5 due | Mid Term Exam 1 (0.1-1.7) |
| 7 (10/6) | 2.3 Separable differential equations | 2.4 Modeling with differential equations | 2.5 Population Growth and the Logistic Equation | 2.5 (cont) Population Growth and the Logistic Equation |
| 8 (10/13) | 3.1 Intro to Multivariable Functions | 3.2 Partial Derivatives | Lab 4 - Differential Equations in Biological Systems<br><br>HW6 due | Lab 4 - Differential Equations in Biological |
| 9 (10/20) | 3.3 Higher order Partial Derivatives | 3.4 The Chain Rule | 4.1 Double Reimann Sums<br><br>HW7 due | 4.2 Double Integrals in a Rectangular Region |
| 10 (10/27) | 4.3 Double Integral over General Regions | 4.3 Double Integral over General Regions | Lab 5 - Double Integrals<br><br>HW8 due | Lab 5 - Double Integrals |
| 11 (11/3) | 5.1 Polar Coordinates | 5.2 Integrating with Polar Coords | Review<br><br>HW9 due | Mid Term Exam 2 (2.1-4.3) |

| Week | Monday | Tuesday | Wednesday | Friday |
|---|---|---|---|---|
| 12 (11/10) | 5.3 Spherical and Cylindrical Coordinates | 6.1 Sequences | 6.2 Geometric Series | Lab 6 - Cylindrical Coordinates in Biochemical Structures |
| 13 (11/17) | 6.3 Infinite Series | 6.4 Alternating Series | 6.5 Taylor Series<br>HW10 due | Lab 7 - Taylor Series Approximations |
| 14 (11/24) | Fall Break | | | |
| 15 (12/1) | 7.1 Intro to Matrices | 7.2 Matrix Operations | 7.3 Matrices and Determinants | 7.4 Matrices and Eigenvalues |
| 16 (12/8) | Lab 8 - Matrices | Review | Final Exam (Part 1)<br>HW11 due | Final Exam (Part 2) |
| Finals Week | | | | |

# 5 Course and University Policies and Standards

## 5.1 CSU COVID Guidance

For the latest information about the University's COVID resources and information, please visit the CSU COVID-19 site[9].

## 5.2 Basic Needs Security

Any student who faces challenges securing their food or housing can receive support from the Rams Against Hunger program[10]. Services include a food pantry, a meal-swipe program, pocket pantries, and in-person assistance with navigating federal aid eligibility. The RAH page includes numerous resources as well as county, state and federal programs which are described and linked. Furthermore, please notify the instructor if you are comfortable in doing so.

## 5.3 Classroom Behavior, Respect for Diversity and Inclusion

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on classroom behavior and the student code at the catalog[11] and at the SRC[12]4.

We acknowledge that many students have had experiences that have left them feeling excluded from the field of mathematics. We also acknowledge that students from minority groups have been disproportionately impacted. We are making this explicit statement because this unfortunate reality is inconsistent with the truth that you can be successful in mathematics, regardless of your race, ethnicity, gender, or sexual orientation. We are committed to decolonizing mathematics into a field where every student feels

[9] covid.colostate.edu
[10] lsc.colostate.edu/slice/slice-engagement/rams-against-hunger/
[11] catalog.colostate.edu/general-catalog/policies/students-responsibilities
[12] resolutioncenter.colostate.edu/student-conduct-code/

supported in accomplishing the hard work necessary to become better problem solvers. We learn more by listening to diverse perspectives, and we hope you will be ready and willing to share yours in this course.

Here are several resources that highlight the past and current contributions to the mathematics community from underrepresented groups:

1. Meet A Mathematician[13]
2. Mathematically Gifted and Black[14]
3. Lathisms[15]
4. Indigenous Mathematicians[16]
5. Spectra[17]
6. Association for Women in Mathematics[18]
7. Mathematicians of the African Diaspora[19]

## 5.4 Accommodation of Disabilities

If you are a student who will need accommodations in this class due to a disability or chronic health condition, your instructor will need an accommodation letter from the Student Disability Center (SDC) before they are implemented. Please meet with your instructor during office hours or after class to provide the letter and/or to further discuss your needs.

If you do not already have these letters, please contact the SDC as soon as possible to initiate the accommodation process. The SDC is located in room 121 of the TILT building. Contact them at 970-491-6385 or visit the SDC website[20].

## 5.5 Student Parents/Guardians/Caregivers

We realize that student parents/guardians and caregivers face distinctive challenges in succeeding academically, and we are committed to supporting those of you who are parents to achieve our course's learning outcomes. If you en- counter challenges in meeting course expectations, please contact us as soon as possible. We'll develop a plan together so you can be successful in the course.

## 5.6 Student Case Management

Student case management[21] is available to help students with extenuating life circumstances and connect them with resources. In some cases, after we dis- cuss your situation, we may request verifiable documentation for class absences from the SCM office if you request considerations for absences or missed course- work.

## 5.7 Mental Health and Wellness

CSU is a community that cares. You are not alone. CSU Health Network Counseling Services has trained professionals who can help. Your student fees provide access to a wide range of support services. Call Counseling Services at (970) 491-6053, and they will work together with you to find out which services are right for you. Visit counseling services[22] to learn more and mental health resources[23] for additional student mental health and well-being resources. If you are concerned about a friend or peer, use Tell

[13] sites.google.com/view/meetamathematician/home
[14] mathematicallygiftedandblack.com/
[15] www.lathisms.org/
[16] www.indigenousmathematicians.org/
[17] lgbtmath.org/
[18] awm-math.org/
[19] www.mathad.com/home
[20] disabilitycenter.colostate.edu/
[21] studentcasemanagement.colostate.edu/
[22] health.colostate.edu/about-counseling-services
[23] health.colostate.edu/mental-health-resources/

Someone by calling (970) 491-1350 or visiting Tell Someone[24] to share your concerns with a professional who can discreetly connect the distressed individual with the proper resources. Rams Take Care of Rams. Reach out and ask for help if you or someone you know is having a difficult time.

## 5.8 Religious Observances and Class Attendance

CSU has a legal obligation to accommodate students' absences due to religious observances. For such an accommodation, it is the student's responsibility to complete the Religious Accommodation Request Form at the beginning of each semester and submit the request via the Office of the Vice President for Student Affairs website. The Dean of Students will communicate with the instructor regarding the student's absence and the student is instructed to discuss how best to ensure an accommodation related to class conflicts. For religious observances that cannot reasonably be anticipated at the beginning of the semester, students must follow the procedure above as soon as possible after the course conflict is identified. If a student knows that a particular course or section of the course will have multiple conflicts with his or her religious obligations, the student is advised to locate another course section or defer taking the course to a different semester. In the event of a conflict in regards to this policy, individuals may appeal using established CSU procedures. Instructors are ad- vised to provide reasonable accommodations to ensure compliance with CSU's obligations. See more details regarding attendance policies at the catalog [25]

## 5.9 Discrimination and Harassment

CSU is committed to providing an environment that respects the dignity and worth of every member of its community. CSU strives to create and maintain a work and study environment that is fair, inclusive, and responsible so that each member of the CSU community is treated with dignity and respect and is rewarded for relevant considerations such as ability and performance. CSU has adopted a comprehensive policy to define the types of conduct that are prohibited and to prevent harm arising from discrimination, harassment, sexual harassment, sexual misconduct, domestic violence, dating violence, stalking, and retaliation. Conduct that is discriminatory or harmful under the policy inhibits the achievement of the stated goals. All students, faculty, staff, and other persons having business with CSU are expected to know and follow this policy.

Details regarding what is involved in bringing a complaint and the procedures for informal and formal resolution are available from the Office of Support and Safety Assessment for student-to-student behavior and the Office of Equal Opportunity for matters involving non-students such as faculty, staff, affiliates, or visitors and matters involving a student and non-student person. See more details at the catalog[26].

## 5.10 Academic Integrity and the Honor Code

This course will adhere to the CSU Academic Integrity Policy as found in the Colorado State University General Catalog and the Student Conduct Code. At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services. See more details at the catalog[27] and TILT[28].

[24] supportandsafety.colostate.edu/tell-someone/
[25] catalog.colostate.edu/general-catalog/academic-standards/academic-policies/
[26] catalog.colostate.edu/general-catalog/policies/discrimination-harassment/
[27] catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity
[28] tilt.colostate.edu/Integrity/Pledge