MAT-160: Calculus III, Fall 2022

TR 1:40-2:55 PM

Watson 147

Instructor: Claire Merriman

Email: clmerriman@davidson.edu

Office: Chambers 3043

Office Hours: M 2-3, R 3:30-4:30

Embedded Tutor: Caroline Cox

Email: cacox@davidson.edu

Location: Chambers 3198

Office Hours: MW 12-1:30, others announced via Slack

Course Grades:

Preparation Assignments	5%
In Class Activities	5%
Homework	10%
Written Investigations	15%
Midterm Reviews	45%
Final Review	20%

Grading Scale:

A	93-100	A-	90-92		
B+	87-89	B	83-86	B-	80-82
C+	77-79	C	73-76	C-	70-72
D+	67-69	D	60-66	F	0-59

Written Investigation (WI) and Take-Home Review Due Dates:

September 22: WI & Review 1

November 1: WI & Review 2

December 6: WI & Review 3

December 12-16: WI & Final Review

Course Information

This course will be a study of the differential and integral calculus of functions of several variables together with an introduction to vector calculus. Topics include partial derivatives, directional derivatives, gradients, tangent planes to surfaces, double and triple integrals, change of variables in multiple integrals, vector fields, line integrals, Green's Theorem, and surface integrals. In particular, we will discuss Chapters 12-15 of our textbook, but we will likely not finish all of Chapter 15. We will cover parts of Chapter 11 throughout the course.

Textbook, Software, and other Materials

Textbook: *Calculus: Early Transcendentals, Eleventh Edition*, by Howard Anton, Irl Bivens and Stephen Davis. You should be able to purchase this from the bookstore or from an online bookstore. This book is the standard Calculus textbook at Davidson as two of the authors are emeritus faculty in the math/cs department.

3D Graphing: We will use GeoGeobra as an online calculator. You can use the browser version or the apps. While you do not need to make an account to complete the assignments for class, it would be helpful to make an account and save your work. Guided GeoGebra activities are at: https://www.geogebra.org/m/fhhhkfdc.

In Class Work: You will work on problems with your classmates in class. You should bring a pen or pencil to work on the paper copies of any individual problems, as well as contribute to groupwork.

Online Homework Submission: All assignments will be submitted on Gradescope. You will also find your grades and feedback on assignments on Gradescope. To get started, follow the invite link to create an account on Gradescope using your Davidson College email address or join our course using the code 2KKEV2. To submit assignments, you can use your phone to upload photos or a computer to upload single pdfs.

Learning Outcomes

Upon successful completion of the course, students will be able to:

- Compute partial derivatives, directional derivatives, gradients, arc lengths, tangent planes to surfaces, double and triple integrals in multiple coordinate systems, integrals involving Jacobians, line integrals and surface integrals.
- Model the motion of particles in two and three dimensions via vectors in rectangular and polar coordinates.
- Apply the delta-epsilon proof technique to compute limits in two and three dimensions.
- Apply the definition of differentiability to prove basic related results.
- Write clear, concise homework solutions to computational problems.
- Solve problems related to physical applications including computing centers of mass, constructing equations of motion and determining directions of greatest increase and decrease via the gradient.

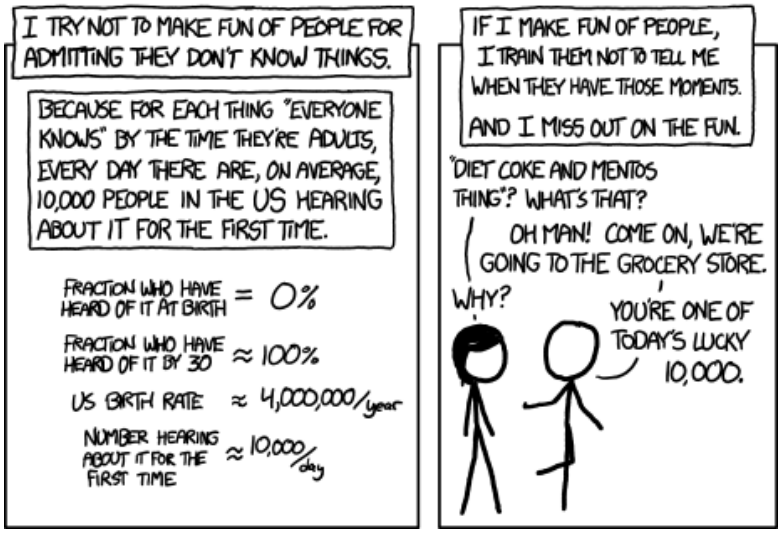
Classroom Expectations

Learning mathematics requires you *do* mathematics. This means that you will spend part of class working on math problems, and you will have times that you struggle to solve them. The goal is for this to be a *productive struggle*, where you emerge with a greater understanding of the concepts.

It is also important that you come to class on time having completed the preparation assignment for the day and stay until the end of class.

I expect this course to be a place where you will be treated with respect. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

The topics in this course may also be more or less familiar depending on what other courses you have taken. If you have already seen a concept that we cover in class, view this as an opportunity to learn about it from a different perspective and practice explaining math to others.



Conduct violating the Student Handbook, including Honor Code violations and discrimination or harassment based on race, color, national origin, religion, gender, orientation, age or disability will not be tolerated. Contributing to a hostile classroom environment may result in lost points on In Class Activities.

Assignment Descriptions

Preparation

You will have short assignments due before the start of each class to get familiar with the topics we will cover in class. Sometimes these questions will be short calculations, but they will often ask you to explain steps in the examples given in the textbook. These questions will be graded on a mix of completion and accuracy with the following rubrics:

0 points: Missing or minimal effort, such as only writing down the problem or a definition.
1 point: Contains a reasonable attempt to answer at least one question with significant mathematical errors or omissions (such as only answering one of two questions).
2 points: Contains a reasonable attempt to answer all questions with some mathematical errors.
3 points: Answers to all questions demonstrate understanding of the mathematical concepts, possibly with some minor errors.

Preparation assignments for the week will be available on the preceding Saturday. These assignments have a soft deadline of 12:40 pm the day of class and will **not be accepted more than 5 minutes after the start of class**. I will do my best to grade any assignments submitted by the soft deadline before the start of class and use the answers to adjust the lecture for the day. Class will start by going over the answers to these questions.

The lowest 3 grades will be dropped.

In Class Activities

You will have problems to work on throughout class time. These will range from calculation problems done individually that check for understanding to more in-depth problems done in groups. I will provide paper copies at the start of each class and collect them at the end of class. We may also do some other activities throughout class.

For group questions, I will only grade one submission per group, so you should all work together. These problems typically require some amount of discussion. Often homework problems are continuations of the group questions.

In class activities are primarily graded on completion. These are an opportunity for feedback before homework.

Lowest 3 grades will be dropped.

Homework

Homework assignments will cover the material from the previous lecture, in class activities, and preparation assignments. You are encouraged to work together on the problems; however, you must write up your own solutions and submit them individually.

All homework assignments must have a correctly completed **Homework Cover Sheet**, found in the General Course Materials section of Moodle.

There will be two parts of the homework assignments:

- In-Depth Exploration: These problems require more writing than you might be used to in a math class. For examples, look at the “Focus on Concepts” problems in our textbook. These problems might ask you to prove why formulas are true, create a model in GeoGebra, or complete several exercises to discover a formula on your own. Sometimes these problems will cover material from multiple classes or sections that are not covered in lecture (such as parts of §12.5-6).
- Exercises: These problems are probably the types of problems you are used to in a math class. They might still require GeoGebra, diagrams, or a calculator. Not all exercises will be graded.

Homework is due on Gradescope by the beginning of class. There are no homework assignments during the weeks with a Review. Late homework assignments will receive a 20 percentage-point penalty per day, unless you are using one of your late passes or I have granted an extension before the assignment is due. You may not use more than one late pass per assignment.

Assignments should be legible–you should work out problems then write up a new, final version. Homework should be on a separate page or in a separate file from you course notes. Problems or assignments that are messy may result in lower grades.

You may rewrite up to six of your homework assignments. The rewrite is due at the beginning of the next class after assignments are returned, typically one week after the original due date. Deadlines for all rewrites will be in Gradescope. You must have submitted a reasonable attempt at every problem on the first submission and turned it in on time (unless using a late pass). A reasonable attempt at a problem includes enough work for the grader to provide feedback—this could be an explanation of approaches you have tried or information that you know is relevant to the problem. You are responsible for keeping track of when you have used all of your rewrites.

Written Investigations

Written investigations are an untimed assignment that cover the same material as the corresponding midterm review, due on Gradescope by the beginning of class on the same day as the midterm reviews. The final written investigation will only cover Chapter 15 and will be due at the same time as the final review. You will be given at least a week to complete these written investigations. These assignments have similar problems to the In-Depth Exploration problems on the homework and some in class activities. The problems may involve short writing assignments or applications of the material to other fields.

You may work with your classmates on the problems; however, you must write up your own solutions and submit them individually. You may not use any outside sources, unless directed by the problem instructions. GeoGebra and standard graphing calculators are allowed.

Late written investigations will receive a 20 percentage-point penalty per 24 hours, unless you are using one of your late passes or I have granted an extension before the assignment is available for completion. You may not use more than one late pass per assignment. You may rewrite your written investigation at the cost of two homework rewrites.

Midterm Reviews

There will be three midterm reviews. These reviews are timed (preliminarily three hours), take-home, closed book, and closed internet. The questions will be similar to the homework exercises, preparation assignments, and in class activities. You may use a calculator without internet access, such as a basic four function calculator, scientific calculator, or TI-89. You will be able to use a single 8.5" by 11" sheet of notes (with writing on both sides) on each review.

You will be given at least a two-day window to complete these assignments. You may not discuss the problems on the midterm reviews with anyone until after the graded assignments are returned.

Late reviews will receive a 20 percentage-point deduction per 24 hours.

Final Review

The final exam in this course is cumulative and will follow the same format as the midterm reviews.

Ways to get help

The best way to succeed in this course is to ask for help before you fall behind. This includes working with your classmates and asking questions during class. Here are other ways to get help:

- **Office hours**: Office hours are a time I am in my office to help you with the material in the course. They can also be a time to meet or work with other students in the class.
- **Embedded tutor**: This course will have an embedded tutor. They will have office hours just for this course, where you can ask questions or work with other students on the homework.
- **Slack and email**: For questions about course material or logistics, check the Slack—someone else may have already asked the same question. If not, you should post, as other students likely have the same question. For grades, absences, and similar matters, contact me by email. I will respond to Slack messages and emails within 24 hours on weekdays.
- **Study Groups**: I strongly encourage you to work with your peers on homework and when studying for reviews
- **Math and Science Center (MSC)**: Our embedded tutors should be your primary source for peer assistance and learning support this semester. The Math & Science Center (MSC) will also have a small number of additional peer tutors available on a drop-in or by-appointment basis. Located in the Center for Teaching & Learning (CTL) on the first floor of the College Library, the MSC's drop-in hours are Sunday through Thursday, 8-11 PM. Visit https://www.davidson.edu/offices-and-services/center-teaching-and-learning/student-resources/ and navigate to the Math, Science, & Economics Center to determine when a tutor for our course will be present or to schedule an appointment with a tutor. Peer assistance is free to Davidson students. For more information, contact Dr. Mark Barsoum, Director of the MSC (mabarsoum@davidson.edu or ext. 2796).

Other course policies

Late Work

All students get 3 late passes that allow them to turn in a homework, rewrites, or written investigation up to 24 hours late. To use a late pass, write “Late Pass” at the top of the assignment. You are responsible for keeping track of when you have used all of your late passes.

Late homework, written investigations, and reviews will receive a 20 percentage-point deduction per 24 hours. This also means no late assignments will be accepted more than five days after the deadline.

Late homework and written investigation rewrites will not be accepted, except when using a late pass.

Preparation assignments will not be accepted more than 5 minutes after the start of class. In Class Activities are due at the end of class. See Make-up Policy.

Make-up Policy

If you need to miss class due to excused absence, we will schedule a time to make-up the in-class activities. In the case of illness or emergencies, we will discuss how to handle preparation assignments. For predictable absences, such as college sponsored travel or religious holidays, you will still need to complete the preparation assignments on time. Excused absences may require documentation.

If you are dealing with longer term illnesses or other life events that are interfering with your ability to attend class or complete assignments, reach out to me about how to handle assignments. These may require documentation.

If you need an extension on the Written Investigations (other than using a late pass) or Reviews, you must ask before the assignments are available to students. I will only grant extensions after the assignments are available in extreme circumstances (such as car accident).

Honor Code

The Honor Pledge of Davidson College states: “On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others.” This pledge applies to all work for our course.

All assignments, other than the In Class Activities, will be submitted individually. For Preparation assignments, Homework, and Written Investigations, you may discuss your solutions with any of your classmates, but you are expected to write your final submissions on your own. If you work on a problem with someone else (in or out of class) you should acknowledge this collaboration on the cover page for the Homework assignments and on the Preparation assignments. You may not discuss the Review problems with other people until after they are graded.

Any copying of work which is not your own is an Honor Code violation. In addition, allowing others to copy your work (in person or by making it available electronically) is an Honor Code violation. Honor Code violations will be reported to the Honor Council. Assignments will Honor Code violations will receive a 0.

If you use a source that is not our textbook, course notes, or a resource on Moodle, you must cite them on the cover page for the assignment. You do not need to use any specific format for your citations–just provide enough information that I can find the resource. You may not look up solutions to any problem assigned in the course on the internet. Once you have seen a full solution, it is not possible to independently develop a solution.

Academic Access

The college welcomes requests for accommodations related to disability and will grant those that are determined to be reasonable and maintain the integrity of a program or curriculum. To make such a request or to begin a conversation about a possible request, please contact the Office of Academic Access and Disability Resources, which is located in the Center for Teaching and Learning in the E.H. Little Library: Beth Bleil, Director, bebleil@davidson.edu, 704-894-2129; or Alysen Beaty, Assistant Director, albeaty@davidson.edu,

704-894-2939. It is best to submit accommodation requests within the drop/add period; however, requests can be made at any time in the semester. Please keep in mind that accommodations are not retroactive.

Important Dates

August 29	Classes Begin
August 29-September 2 (5 pm)	Add/Drop Week 1 available to all students on Banner Self-Service
September 2 (5pm)**- September 9** (5 pm)	Add/Drop Week 2 available through the Add/Drop Permission Form only ($20 fee). Adds or Drops not permitted after September 9.
October 10-11	Fall Break, No Classes
November 23-25	Thanksgiving Break, No Classes
December 9	Reading Day—No Classes
December 12-16	Self-Scheduled Final Exams

Tentative Course Schedule—Subject to change

August 30	Introduction to the course, Vector arithmetic (Parts of §11.2-3)
September 1	Cross-Product and Parametric Equations (Parts of §11.3-6), §12.1 Vector-Valued Functions
September 6	§12.2 Calculus of Vector Valued Functions
September 8	§12.3 Change of Parameter, Arc Length
September 13	§12.4 Unit Tangent, Normal, and Binormal Vectors, §12.6 Motion Along a Curve
September 15	§12.6 Motion Along a Curve
September 20	§13.1 Functions of Two or More Variables
September 22	**Written Investigation and Review 1 Due at the Start of Class** §13.2 Limits and Continuity
September 27	§13.3 Partial Derivatives
September 29	§13.3 Partial Derivatives, §13.4 Differentiability, Differentials
October 4	§13.4 Local Linearity, §13.5 Chain Rule
October 6	§13.5 Implicit Differentiation, §13.6 Directional Derivatives and Gradients
October 11	**No Class—Fall Break**
October 13	§13.6 Gradients with contour plots, §13.7 Tangent Planes and Normal Vectors
October 18	§13.7 Tangent Planes and Normal Vectors, §13.8 Maxima and Minima of Functions of Two Variables
October 20	§13.8 Maxima and Minima of Functions of Two Variables. §13.9 Lagrange Multipliers
October 25	§14.1 Double Integrals, §14.2 Double Integrals over Nonrectangular Regions
October 27	§14.2 Double Integrals over Nonrectangular Regions
November 1	**Written Investigation and Review 2 Due at the Start of Class** §14.3 Double Integrals in Polar Coordinates
November 3	§14.4 Surface Area; Parametric Surfaces
November 8	§14.5 Triple Integrals, §11.8 Cylindrical and Spherical Coordinates
November 10	§14.6 Triple Integrals in Cylindrical and Spherical Coordinates
November 15	§14.6 Triple Integrals in Cylindrical and Spherical Coordinates
November 17	§14.7 Change of Variables in Multiple Integrals; Jacobian
November 22	§15.1 Vector Fields
November 24	**No Class—Thanksgiving**
November 29	§15.2 Line Integrals, §15.3 Independence of Path; Conservative Vector Fields
December 1	§15. 4 Green's Theorem
December 6	**Written Investigation and Review 3 Due at the Start of Class** §15.7 Divergence Theorem
December 8	Course Evaluation §15.8 Stokes' Theorem

December 12-16	**Written Investigation and Final Review Due at 5 pm on December 16**