MATH 221.01
Calculus 3
Fall 2021
Fully Online Asynchronous Class

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COURSE INFORMATION

Course Description: The main objective of Calculus 3 is to combine ideas of calculus and geometry to deal with functions whose values are a point in the plane or a vector in space, and functions whose arguments are several variables or a vector. These ideas are applied to study curves in space, motion, integrals over solids and surfaces, and minimization of functions of several variables and functions defined on surfaces in space. Calculus 3 is particularly fun because it is so visual and practical.

This material is covered in two active learning journals that I wrote specifically for this online course: *Deconstruct this Calculus 3 Journal: multivariable functions* and *Deconstruct this Calculus 3.5 Journal: vector functions*.

As a fully online asynchronous class, you will access materials on your own time. A new module will be released every two weeks and assignments will always be due on Wednesdays and Sundays at 11:59 pm EST. There will be several group assignments that you must complete with classmates, either synchronously or asynchronously. Many more details follow, but in general, plan to spend 8-10 hours per week on this class.

Course Credit: 4
Prerequisites: MATH 220 Calculus 2

STUDENT LEARNING OUTCOMES

Student Learning Outcomes from the CofC Mathematics Program

This course can be used to satisfy requirements of the undergraduate mathematics program, for which there are several broad goals. The idea is to use algebra, geometry, calculus, and other subdisciplines of mathematics to:

- model phenomena in mathematical terms;
- derive correct answers to challenging questions by applying the models from the previous learning outcome;
- write complete, grammatically, and logically correct arguments to prove conclusions.

These will be assessed with several group Challenge Problems, which are described later.

Content-specific Student Learning Outcomes for this MATH 221 course

Then there are some outcomes that are specific to this class. You will be able to:

Identify, sketch and parametrize surfaces and space curves. Identify and plot vector fields.

Algebraically manipulate vectors using the dot product, scalar product, and cross product to answer geometric questions.

Apply differentiation and integration to parametrized curves to draw conclusions about the geometry of the curve or about the trajectory of a particle.

Compute, interpret, and apply various kinds of derivatives of multivariable functions (whether scalar functions or vector functions).

Solve multi-variable optimization problems, both constrained and unconstrained.

Set up, evaluate, and apply integrals over two or three dimensional regions, using various coordinate systems and various orders of integration.

Convert multiple integrals between different orders of integration and/or different coordinate systems.

Evaluate and apply line integrals and surface integrals of both scalar functions and vector fields.

Evaluate integrals by selecting an appropriate version of the Fundamental Theorem of Calculus (FTC for Vector Fields, Green's Theorem, Stokes' Theorem, or the Divergence Theorem) to transform the integral into an easier one with a domain of integration having a different dimension.

These will be assessed with weekly quizzes, surveys, practice problems, activities, group challenge problems, and a final exam, all of which are described later.

My General Course Objectives: In addition to the above learning outcomes, I also have several additional goals for each of you. I have designed materials and assignments so that you will:

- appreciate "meta-mathematics" by understanding how your definition of mathematics affects how you do it, and hopefully broaden your definition of what mathematics is and how various people do it;
- improve your scientific communication skills, both written and oral;
- improve your teamwork;
- improve your problem-solving skills.

These will be assessed with group challenge problems and discussion forums.

COURSE REQUIREMENTS

Course Texts: There is no e-text, only a hard copy because the texts are designed for you to physically interact with, e.g., by folding pages to visualize planes and bending pages to visualize surfaces. Visit the CofC Bookstore to get your copy of each journal below or contact Stephen Jones, jonessc@cofc.edu, to have a hard copy mailed to you. In order to keep the cost of course materials low for you, these journals are produced and provided at cost to you. (The College and I do not make one cent from them. You merely pay what it costs to produce them.)

1. Amy N. Langville. *Deconstruct this Calculus 3 Journal: multivariable functions*. College of Charleston Copy Center, 2021.
2. Amy N. Langville. *Deconstruct this Calculus 3.5 Journal: vector functions*. College of Charleston Copy Center, 2021.

Hardware:

1. Computer with high speed internet access, sound card, microphone and external speakers or headphones.
2. Scanner for ability to take photos and upload or email with a computer or smartphone. A great app for converting smartphone pictures to pdf files is Camscanner.

Software:

1. Consistent and reliable access to high speed internet.
2. Adobe Acrobat Reader to view assigned readings.
3. Web browser to access OAKS and free tech tools like CalcPlot3D and WolframAlpha.
4. Word processing software to construct written assignments.
5. Zoom to record individual and group video assignments.

Calculator: not required, but you may use one if you like. Your *Deconstruct journals* will teach you how to use several powerful and free online tech tools, such as Wolfram Alpha and CalcPlot3D.

Netiquette Guidelines: Even though this class is an asynchronous fully online course, we will still do a good bit of teamwork in this class. As a result, it is important to follow common netiquette standards when communicating with your teammates in discussion boards, group projects, and emails or text messages.

- Before posting your question to a discussion board, check if anyone has already asked it and received a reply.
- Stay on topic. Don't post irrelevant links, comments, thoughts or pictures.
- Don't type in ALL CAPS; it looks like you're screaming.
- Don't write anything that sounds angry or sarcastic even as a joke, because without hearing your tone of voice, your peers might not realize you're joking.
- Always remember to say "please" and "thank you" when soliciting help from your classmates.
- Respect the opinion of your classmates. If you feel the need to disagree, do so respectfully and acknowledge the valid points in your classmate's argument. If you reply to a question from a classmate, make sure your answer is accurate.
- Before asking a question, check the class FAQs or search the Internet to see if the answer is obvious or easy to find.
- Be forgiving. We all make mistakes from time to time.
- Run a spelling and grammar check before posting anything to the discussion board.

How to Get Help: Do not make the mistake of thinking that because this is an online class, it's going to be easier than taking it in person. After all, this is Calculus 3--the pinnacle of calculus. This course is rigorous and will require self-discipline on your part to ensure your success. If you have questions about assignments or the course content, it is imperative that you reach out for help. Please use the following process for getting help:

1. Consult the class schedule and syllabus as you may find your answer there.
2. Check OAKS for announcements and instructions, including discussion boards.
3. Confer with classmates, particularly teammates:
   Content Question: Post it on the Discussion Board for the corresponding module.
   Other Question: Post it on the Q&A Discussion Board.
4. The College of Charleston Math Lab is within the Center for Student Learning, which is located on the first floor of Addlestone Library (Room 116), has a walk-in tutoring center. They also have virtual office hours. Make an appointment at https://csl.cofc.edu/labs/math-lab/index.php
5. If you still don't know the answer to your question, contact me through email or OAKS. All correspondence will be answered within 48 hours so plan accordingly.
6. In general, ask yourself this: Is the content of my question personal or confidential? If so, contact me. On the other hand, if the content of your question is public and something that you would have asked in a face-to-face class, then this question belongs in a public space, like a discussion board since its answer could benefit your classmates too and could be answered by anyone, student or instructor.

Discussion Boards in OAKS: Each module will have at least one discussion board. For the module-specific board, I will start the discussion with a prompt that is either about the content or about meta-mathematics. These prompts will help us get to know each other, how we think about math, how we each do math, what we like and dislike about math, etc. Though we don't meet face-to-face, I want to get to know each of you and I want you to know each other. Connectedness and community are key to success, particularly with the group challenge problems. You will learn essential teamwork and communication skills that will apply beyond this class. I will facilitate these discussions; you are the drivers.

Zoom: We will use Zoom in this class in several ways. I will record videos with Zoom and I will hold virtual office hours in Zoom because it not only allows for synchronous face–to–face interactions, but also provides an online "whiteboard" where we can work on problems together synchronously. In addition, you will periodically submit Zoom team videos demonstrating your solution to Challenge problems. Recording of Classes: Any Zoom sessions may be recorded via both voice and video recording. By attending and remaining in this class, the student consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class. Help with Zoom:
http://blogs.cofc.edu/sits/zoom-video-resources/

Email/Text Messages: We will use a buddy system in this class. You must submit challenge problems as a group but you are invited to contact your teammates beyond that for other individual assignments, checking in by email or text. For example, you might email your buddy something like "done with activity 9, took about 10 minutes, pretty straightforward" or "having trouble with tech tool for graphing r(t) for problem 6. Have you done it yet?"

Technical Issues: Resolve technical problems promptly. *Computer failure/unavailability does not constitute an excuse for not completing assignments by the due date.*

- Resource for students taking distance education classes: The College of Charleston has put together a helpful guide for students enrolled in a distance education course. Check it out: http://blogs.cofc.edu/studentreadinessforonlinelearning
- https://blogs.cofc.edu/sits/2020/06/16/tips-on-how-to-be-successful-in-online-learning/
- OAKS tutorials: https://blogs.cofc.edu/sits/2020/06/20/introduction-to-oaks-for-students/
- College of Charleston HelpDesk (843–953–3375) can help with MyCharleston, OAKS, and CofC email accounts.
- Zoom tutorials: http://blogs.cofc.edu/sits/zoom-video-resources/
  Technology information and tutorials on many topics are available at: https://continuity.cofc.edu/learning-remotely/index.php and https://blogs.cofc.edu/sits/

- You may also contact the Information Desk at the Addlestone Library (in person, by phone, email or chat), which is manned by Library and Student Computing Support staff. For example, click on the "Ask Us" tab on the library homepage https://library.cofc.edu/

Attendance: The great advantage of taking classes online is that you can attend at your convenience. That advantage, however, requires great responsibility. There is no professor taking attendance at a certain place or time so the impetus for completing assignments on time is on you.

Late Submissions: *Late submissions will not be accepted, so plan ahead.* Waiting until the last minute to prepare an assignment is not wise. You may lose power, have problems with your computer, or an emergency may arise. To help you stay motivated and disciplined in this fully asynchronous learning environment, we will use a "buddy system" that will be described during orientation week.

CLASS POLICIES

- The College of Charleston Student Handbook is a guide to your responsibilities and rights as a student.

- **Academic Honesty:** Faculty members are required to report violations of the honor code to the Office of Student Affairs. If you are found guilty, your grade in the class will be XXF and this will be indicated on your transcript. Examples of cheating include giving or receiving aid during an individual graded activity, using any type of "cheat sheet", copying from or looking at another person's graded activity, or submitting another person's work as your own. Students may find a complete version of the Honor Code and all related processes in the Student Handbook.

- **Disability:** In compliance with the Americans with Disabilities ACT (ADA), all qualified students enrolled in this course are entitled to "reasonable accommodations." Students should apply at the Center for Disability Services, also known as the SNAP Center (843-953-1431), located on the first floor of the Lightsey Center. Please notify me during the first three days of the course of accommodations that you need.

- **Pronoun Usage:** Let me know your preferred name and gender pronoun. Mine is she/her.

- **Email Usage:** I am only allowed to communicate about this course through your College of Charleston email address, so please email me from your college account.

KEYS TO SUCCESS

To succeed in this class, I recommend the following.

1. Log into our OAKS class 4 times a week to be sure you are working with the material in manageable amounts, and staying informed of announcements, and participating adequately.
2. Spend 8-10 hours a week on class.
3. Work with teammates. Most students say this is not only the most rewarding and fun part of class, but also the most efficient way to learn the concepts.
4. Interact with your journals. These are designed for active learning so when the journal asks (in gray font) for you to do something like cut an orange in half, draw on your hand, or fold the page, do it. When you do, I promise that you will understand and remember the key concept.

ASSESSMENT & GRADING

Grading Criteria and Scale: I will calculate your grade using the University Plus/Minus grading scale (A, A-, B+, etc.). Your final grade will be adjusted up or down for participation (OAKS provides analytics such as number of videos viewed, number of posts read, etc.). Please contact me if you feel there is an error with any of your recorded grades.

Course Overview: The first few modules contain a checklist in the content section of OAKS to assist you in staying organized. More specific instructions for each assignment will be posted under the content section within OAKS.

Course material will be organized into 8 modules, released every two weeks. Every week assignments will be due on Wednesdays and Sundays at 11:59pm EST. A typical module typically consists of readings in your journals, 1-2 quizzes, a survey, several activities and calculation pages from your journals, participation opportunities in discussions, and a group challenge problem.

General Descriptions of Course Assignments: many more details are included with each assignment as we proceed through the course materials in OAKS.

Final Exam 25%: There will be a cumulative final exam in OAKS during the final exam schedule. The exam will consist of a variety of types of questions including but not limited to true/false, matching, multiple choice, fill in the blank, and short answer. At the end of the final, you must also upload your work for each question in order to receive credit. You may not use any resources, other than those indicated, or work with other students when completing your online final exam. You must pass the final exam in order to pass the course.

Quizzes 10%: There is a large amount of material presented in this class and preparation is key. If you're not prepared, you will struggle to keep up. There will be 1 or 2 quizzes for each content module. Each quiz is related to the assigned readings in the journal and will be due by 11:59pm EST in accordance with the course schedule. There will be no makeup quizzes. Quizzes are open

note, open journal, open tech tool but you may not use any resources, other than those indicated, or work with other students when completing your online quiz. You will have a limited time to complete your quiz so pay attention to the posted timer. The quiz will auto-submit when the quiz time runs out. To practice, during our first orientation week, there will be a quiz on the information covered in this syllabus. You have an unlimited number of attempts and must earn a 100% before accessing the subsequent modules in OAKS.

Activities 15%: Each module covers one chapter in a *Deconstruct Calculus* journal. Several pages in each chapter are activity pages, where you will construct or deconstruct a 3D object, like an orange, to understand a key concept in Calculus 3. For each module, several such activity pages will be assigned for submission in an OAKS dropbox.

Calculation Practice 10%: Again, each module covers one chapter in a *Deconstruct Calculus* journal and each chapter contains several calculation pages, where you practice fundamental calculations, such derivatives, with specific functions. For each module, several such calculation pages will be assigned for submission in an OAKS dropbox.

Group Challenge Problems 25%: Note that these are the only group assignments in the class and one will be due about every two weeks. Each journal chapter contains a few challenge problems at the end. You must choose one to submit with your team. Instructions will be provided with each challenge assignment on the format for submission. Some will require an oral communication of your team's work and others, a written communication. For each challenge submission, a contribution section must be included that details the contributions of each team member.

Discussion Boards 10%: Regular and active participation is an essential part of this online class. There will be a few discussion assignments for each module. Typically to earn credit you must make your post to my discussion prompt and respond to at least one classmate's post. I will post your participation grade within the OAKS gradebook on a regular basis.

Orientation Module Assignments 5%: The orientation assignments have two purposes: (1) to familiarize you with the course learning tools and (2) to get to know each other, building community and teams. With these assignments, you will practice submitting journal pages, making a team video in zoom, and using discussion boards.

COURSE SCHEDULE

Module 0. Orientation. Aug. 18, 2021
Module 1. Journal 3, Chapter 1, Aug. 25, 2021
Module 2. Journal 3, Chapter 2, Sept. 8, 2021
Module 3. Journal 3, Chapter 3, Sept. 22, 2021
Module 4. Journal 3, Chapter 4, Oct. 6, 2021
Module 5. Journal 3.5, Chapter 1, Oct. 20, 2021
Module 6. Journal 3.5, Chapter 2, Nov. 3, 2021
Module 7. Journal 3.5, Chapter 3, Nov. 17, 2021

Module 8. Review for Final, Dec. 1, 2021
Final Exam/Project due during final exam week, testing window TBA

ABOUT ME

I'm Amy, your instructor for this Calculus 3 class. I've been teaching calculus every semester, multiple times a semester, for over 20 years. That's a lot of calculus. But this is the first time I'll be doing it fully online. And that's why this semester will be so interesting. We, me as instructor and facilitator and you as students and team members, should think of ourselves as engaged in a fun exciting experiment to help each other understand calculus and improve each other's learning. Each time I teach calculus, I collect feedback from students like you, so that I can refine my methods and materials. My goal is to make this subject come alive in a fun, participatory manner. And I also hope to deepen your appreciation for mathematics in general and how you do it.

When I'm not teaching calculus or graduate classes in optimization, I'm doing research on ranking and clustering. Years ago I started studying the mathematics of how search engines, like the Addlestone library search engine and Google, work. I wrote a book, *Google's PageRank and Beyond: The Science of Search Engine Rankings*. This led into research on general ranking methods. I wondered: how does the US News and World Report rank colleges? How are teams seeded for the March Madness tournament? How are Olympic athletes ranked to receive funding from the USOC? I wrote another book, *Who's #1: The Science of Rating and Ranking*.

And when I'm not teaching or doing research, I'm surfing. Or more specifically, whenever there's a rideable wave on Folly or around the world, I'm surfing it. In fact, for my last sabbatical year my husband and I packed boards and two dogs into a van that we lived in. We traveled up and down the East and West coasts of the U.S. and Canada, moving from one surf break to the next, doing math and hiking when the surf was flat.