Math 3302 - Calculus III (Spring 2022)

Instructor: Ross Parker (rhparker@smu.edu)
Course hours: Tue/Thu 8:00 am - 9:20 am
Location: Dallas Hall 0142
Website: Canvas
Help Sessions: Mon 4-5 pm, Wed 5-6 pm, Thu 6-7 pm in Clements Hall 225
Office Hours: Tuesday 2-3 pm, Wed 3-4 pm, Thu 3-4 pm

Course Description

In Calculus I and II, you studied functions with a single input and a single output, i.e. functions that look like $y = f(x)$. First, you learned about the derivative of a function, which is the slope of the tangent line to the function at a specific point, and how to apply it to find maximum and minimum values of a function. You then learned about integration, which is the "area under the curve" of a function, and used it to compute quantities such as volumes and surface areas of revolution. This course extends these ideas to functions with more than one input and/or more than one output. It is a very *visual* course, and you will be required to draw pictures and diagrams throughout the course. Topics to be covered include parametric functions, partial differentiation, multiple integrals, and line and surface integrals. This course will also cover vector calculus, including vector fields, divergence, curl, and the divergence and Stokes theorems.

Learning goals

- Sketch vectors and vector functions and compute sums, products, derivatives, and integrals of these quantities.
- Compute partial derivatives and directional derivatives at a point on a surface $z = f(x, y)$, and find maximum and minimum values.
- Evaluate double and triple integrals over simple 2D and 3D regions, as well as parametric, line and surface integrals.
- State and use the main theorems of vector calculus.
- Have fun (or as much fun as possible) doing these things!

Nuts and Bolts

Class format: This course will be taught in two 80-minute sessions per week. In accordance with current university policy, classes will be taught in-person. Accommodations will only be provided for COVID-related absences. For the sanity of everyone involved, there will be a brief break of some form in the middle of each class session. I will incorporate class participation and in-class activities as much as possible. Although I like to think I'm entertaining, no one wants to hear anyone lecture for 80 minutes straight!

Please feel free to interrupt me at any time to ask me to repeat something, clarify a point, request I slow down, fix my handwriting, point out a mistake I have made, etc. I will post surveys a few times throughout the course and welcome your feedback and suggestions for improvement.

- Although I will not formally take attendance, I *strongly* recommend attending class. You will only be able to participate in class activities and ask questions if you attend class.
- I request that during class you refrain from using electronic devices for non course-related purposes. I know that I cannot compete with TikTok and Snapchat for your attention, but I like to think that I am engaging and entertaining, and I will do the best I can to make the time we have together as useful as possible.
- All exams will be taken during regularly scheduled class time. If you have accommodations for extra time, please contact me to make the necessary arrangements. Final exam must be taken during the block of time scheduled by the university.
- Homework assignments can be submitted either on paper or electronically via Canvas. See below for more details.
- Office hours will start the second week of class. Please come to office hours for any questions about the course material, the homework, etc. I am always happy to procrastinate my own research to talk with students! If you would like to meet but cannot attend scheduled office hours, please contact me to schedule an alternative time.

Prerequisites: C- or higher in MATH 1338 or MATH 1340. You should, at minimum, be comfortable with the following concepts from Calculus I and II: definition of derivative; computing derivatives of elementary functions, including trig functions, inverse trig functions, logs, and exponential functions; power rule, product rule, quotient rule, and chain rule for derivatives; implicit differentiation; fundamental theorem of calculus; basic antiderivatives; computing integrals by substitution and parts; Taylor series; parametric equations and polar coordinates.

Textbook: This course will be taught using the open source textbook *Calculus, Volume 3*, from the Openstax Project, which is available free online at https://openstax.org/details/calculus-volume-3. You can read the textbook online and download a PDF of the complete text book for free. Physical copies can be purchased for about $30.

Reading: Specific reading assignments will be given on the main Canvas page for the course. Reading assignments are designed to help you understand the course material.

Resources: Here are some resources to help you succeed in this class. In addition, class notes will be posted after each class on Canvas.

- Help sessions for Calculus III with Elyssa Sliheet: Mon 4-5 pm, Wed 5-6 pm, Thu 6-7 pm in Clements Hall 225. Please take advantage of these for help with problem sets, course concepts, exam review, etc.
- YouTube playlists for Calculus III. These may cover different topics in different orders.
  - Paul's online math notes.
  - Videos from Trevor Bazett.
  - Math TV with Professor V.
  - Videos from Krista King.
  - Videos for calculus with Dr. Marchese.

Homework: There will be problem sets due every **Friday at 5 pm**, starting the second week of class. These will be posted at least one week in advance. Homework must be submitted electronically on Canvas. To ease in grading, **please submit your assignment as a single PDF file**. If you write your problems on paper, I recommend the CamScanner app to scan them to PDF.

Learning mathematics, like getting to Carnegie Hall, is all about practice, practice, practice. For all assigned problems, you must **show all of your work**. This means you should display the process used, not just state a final result. Your goal is to convince me you know how to do the problem, not just what the answer is.

You are encouraged to discuss assignments with other students, but you must write up your own solution independently. When you have collaborated with other students, please acknowledge this by adding a note such as "I discussed question X with person A and person B." If you use any electronic resources, please indicate that as well. Identical or clearly copied assignments will be treated as violations of the honor code.

Do not postpone the problem sets until the last minute, as some answers may not come to you immediately, but then become clear a day later. If you are stuck on a problem, seek help from office hours or discussing with other students. Finally if you are not able to complete a question, write a short note to describe what you tried and what you think may be important. Credit on assignments will come from a serious effort as much as anything else.

Homework grading: Each homework problem will be graded on a five-point holistic scale. Grading for exam problems will be similar.

- Excellent (5): Problem shows good effort and understanding and is essentially correct (except perhaps for typos or equivalent). All relevant work is shown.
- Good (4): Problem shows good effort. There are some mistakes but no significant gaps in understanding.
- Satisfactory (3): Problem shows good effort, but there is at least one significant gap in understanding.
- Fair (2): Either problem shows only moderate effort, or there are many significant gaps in understanding.
- Poor (1): Problem was submitted, but minimal effort is shown.
- No credit (0): Problem was not submitted.

Homework policy: Late assignments will in general not be accepted. If you turn in every assignment, your lowest homework grade will be dropped.

Midterm exams: There will be two midterm exams, which will be administered during regular class time.

- Tuesday, February 22
- Tuesday, April 5

Please contact me if you have an accommodation for extra time to make the appropriate arrangements. The exams will not be cumulative, although you may need to use techniques which were tested on the first exam on the second exam. All students are expected to take exams as scheduled, except as noted below. If you must miss an exam for one of these reasons, or for serious illness or injury, please contact me as soon as possible.

Final exam: The final exam has been scheduled by the university for Monday, May 9 from 8:00 am to 11:00 am. By university policy, the final exam must be taken during this block of time. The final exam is cumulative, although it will emphasize material taught since the second midterm.

Exam policy: The following policies will be in effect for the midterm and the final exams.

- You may use a calculator during the exam if you wish, although it is unlikely to be helpful.
- You may use a study sheet for each exam. You must make the study sheet yourself. Study sheets must be one side of a single standard 8.5x11 sheet of paper. You may only write on one side of the paper. You may write whatever you want on it. You will be asked to turn in your study sheet on Canvas along with the exam.
- You may not use the textbook, class notes, or any other paper references during the exam.

Grades: The grade for this class is computed as follows:

Homework	20%
Midterm Exams	40% (20% each)
Final Exam	40%

If your final exam grade is higher than your lowest midterm exam grade, that midterm grade will be replaced with the final exam grade. Letter grades are determined using a standard grading scale.

Outline: We will cover (roughly) the following topics in this course, in this order.

1. Vectors in the plane and 3D space (2.1, 2.2)
2. Dot product (2.3)
3. Cross product (2.4)
4. Lines and planes in 3D (2.5)
5. Quadric surfaces (2.6)
6. Partial derivatives (4.3)
7. Tangent planes (4.4)
8. Chain rule (4.5)
9. Gradient and directional derivatives (4.7)
10. Maximization/minimization (4.8)
11. Constrained optimization/Lagrange multipliers (4.9)
12. Double integrals, including polar coordinates (5.1, 5.2, 5.3)
13. Cylindrical and spherical coordinates (2.7)
14. Triple integrals (5.4)
15. Vector fields (6.1)
16. Parametric equations, arc length (1.1, 3.3)
17. Line integrals (6.2)
18. Green's theorem (6.4)
19. Divergence and curl (6.5)

20. Conservative fields (6.3)
21. Surface integrals (6.6)
22. Stokes's theorem and the divergence theorem (6.7, 6.8)

Communication: Email is the best way to reach me. During the week, I will try to respond within 24 hours. Email responses may be slower on the weekends, but I will try to reply by Sunday evening. For complex questions, I may ask you to talk with me during office hours.

COVID-19

Masks are required in this course. This masking policy is subject to change during the semester, and any changes will be posted clearly in Canvas announcements.

Diversity Statement

While mathematics, in its idealized form, is objective, the practice and teaching of mathematics is not immune from social issues of race, gender, disability, nationality, and socioeconomic status. Pop culture and the media have not made this any better, from Teen Talk Barbie telling us that "math class is tough" to mathematicians and scientists being portrayed in movies and television as "nerdy white males" such as Tony Stark. I will use the following four axioms by Federico Ardila-Mantilla (San Francisco State University) as a foundation for our time together.

- Axiom 1. Mathematical talent is distributed equally among different groups, irrespective of geographic, ̀demographic, and economic boundaries.
- Axiom 2. Everyone can have joyful, meaningful, and empowering mathematical experiences.
- Axiom 3. Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.
- Axiom 4. Every student deserves to be treated with dignity and respect.

It is my intent that students from all diverse backgrounds and perspectives be well-served by this course. I am committed to a climate of mutual respect both inside and outside of the classroom. To that end,

- I want you to feel comfortable to ask any question you want, to ask me for clarification, or to ask me to slow down, both in class and in office hours. There are no bad questions!
- I want you to feel comfortable "making mistakes" when participating in class. There will be no judgment on my part. I make mistakes all the time. It is a natural part of the learning process.
- If you feel like your performance in the class is being impacted by your experiences outside of class, please do not hesitate to come and talk with me.
- If something was said in class (by me or anyone else) that made you feel uncomfortable, please talk to me about it. If you prefer to speak with someone outside of the course, the Diversity and Inclusion Officers are an excellent resource.
- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let me know.

- If you have any learning differences that you believe will affect your performance in this class, please come talk to me about how best to accommodate these.
- I will provide a web address at which you can submit anonymous feedback.

Honor Code

The SMU Honor Code applies to all homework and exams in this course. Work submitted for evaluation must represent your own individual effort. Any giving or receiving of aid without my express consent on academic work submitted for evaluation shall constitute a breach of the SMU Honor Code.

I take honor code violations very seriously, and will report all violations to the SMU Honor Council. The minimum penalty for a violation is a grade of 0 on the assignment, and the maximum penalty is immediate failure of the course. These penalties are in addition to those imposed by the SMU Honor Council. Examples of honor code violations include:

- Copying homework solutions from any source: online, another student, or a tutor.
- Allowing another student to copy your homework.
- Cheating on an exam.

See the SMU Honor Code website for more information.

Disability Accommodations

Students needing academic accommodations for a disability must first register with Disability Accommodations and Success Strategies (DASS). Students can call 214-768-1470 or visit to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

Religious Observance

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (see University Undergraduate Catalogue.)