



Point Loma Nazarene University, Fall 2025

## Multivariate and Vector Calculus

Department of Mathematical, Information, and Computer Science – School of STEM

|                                 |  |                                |                 |
|---------------------------------|--|--------------------------------|-----------------|
| <b>Professor:</b> Kyle Havens   | <b>Course:</b> Math 2074   | <b>Section:</b> 1              | <b>Units:</b> 3 |
| <b>Office:</b> Rohr Science 284 | <b>Days:</b> Monday, Wednesday, Friday   | <b>Class Time:</b> 8:30-9:35am |                 |
| <b>Phone:</b> (619) 849-3362    | <b>Email:</b> <a href="mailto:kylehavens@pointloma.edu">kylehavens@pointloma.edu</a> | <b>Location:</b> RS 295        |                 |

**PLNU Mission – Teach, Shape, Send:** Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

**Department Mission:** The Mathematical, Information, and Computer Sciences department at Point Loma Nazarene University is committed to maintaining a curriculum that provides its students with the tools to be productive, the passion to continue learning, and Christian perspectives to provide a basis for making sound value judgments.

**Course Description:** Conceptual development of the calculus of functions of more than one variable supported by the use of a symbolic computer algebra system. Limits and continuity, partial derivatives, chain rule, extreme values, Taylor’s theorem, multiple integrals, line and surface integrals, Green’s Theorem and Stokes’ Theorem.

**Required Materials:** Textbook – *Calculus*, 9<sup>th</sup> Edition by Stewart, James (ISBN: 9781337624183)

**Office Hours:** Located in Rohr Science. Professor Havens has open office hours at the following times:

| Monday       | Tuesday       | Wednesday    | Thursday      | Friday      |
|--------------|---------------|--------------|---------------|-------------|
| 7:30-8:15am  | 10:45-11:45am | 12:30-2:30pm | 10:45-11:45am | 7:30-8:15am |
| 9:45-10:45am | 2:00-2:45pm   |              | 2:00-2:45pm   |             |

**Student Learning Outcomes:** Upon completion of this course, students will be able to:

1. Students will be able to demonstrate facility with analytical concepts.
2. Students will be able to demonstrate facility with algebraic structures.
3. Students will be able to apply their mathematical knowledge to solve problems.
4. Students will be able to use technology to solve problems.
5. Students will be able to speak about their work with precision, clarity and organization.
6. Students will be able to write about their work with precision, clarity and organization.
7. Students will collaborate effectively in teams.
8. Students will be able to identify, locate, evaluate, and effectively and responsibly use and cite information for the task at hand.
9. Students will be able to understand and create arguments supported by quantitative evidence, and they can clearly communicate those arguments in a variety of formats.

**Class Performance:** Your final grade in this course is calculated by the following system. Details on next page.

|     |                  |   |
|-----|------------------|---|
| 30% | Final Exam       | Cumulative. You must get a “D” on the final exam to pass. |
| 45% | Exam Average     | The average score of your three in-class exams            |
| 12% | Class Activities | Based on completion of individual and group activities.   |
| 10% | Written Homework | Traditional written homework from the textbook.           |
| 3%  | Participation    | Based on interactive activities and attendance.           |

**A Comment on Visualization:** We will try and avoid the following pitfall: “At the beginning college level, visualization is a big part of understanding. Consequently, students who are operating with few mental pictures are not really learning mathematics. Their calculus consists of a vast series of algorithms and a complicated cataloging system which tells them which procedure is used when. The effort put into this kind of teaching and learning is largely wasted: memorized algorithms are soon forgotten and, worse still, such courses perpetuate the idea that math involves doing calculations rather than thinking.” (Quote by Deborah Hughes Hallet, Visualization and Calculus Reform, in the collection Visualization in Teaching and Learning Mathematics, edited by Zimmerman and Cunningham, MAA Notes \#19)

**Prerequisite:** Math 1074 (or equivalent) with a grade of C- or higher.

**Good Attendance:** A student with no more than one unexcused absence is defined to have “good attendance.”

**Letter Grade:** The letter grade you receive in this course is based on the final percentage score you earned in the previously described weighted grading system. Requests for an opportunity to improve your grade due to personal circumstances will be denied. Borderline grades may be rounded up if student has good attendance.

|               |               |               |
|---------------|---------------|---------------|
| [92%,100%]: A | [82%,88%): B  | [70%,78%): C  |
| [90%,92%): A- | [80%,82%): B- | [68%,70%): C- |
| [88%,90%): B+ | [78%,80%): C+ | [60%,68%): D  |

**Final Exam:** The final exam is cumulative and will be held at the following time in our classroom:

**Monday, December 15<sup>th</sup> from 7:30am to 10:00am**

**Final Exam:** Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the [Traditional Undergraduate Records: Final Exam Schedules](#) site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

**Exams:** There will be three midterm exams during the semester covering roughly four weeks of content each. See the course schedule for more information. Graphing calculators are allowed on the exam, but CAS calculators such as the TI-Nspire are not allowed. You may be provided with a formula sheet with relevant information pertaining to each exam. No other notes are allowed. Contact me **before** missing an exam if you have a critical emergency. No make-up exams are allowed without prior consent. If you do not inform me that you will be missing an exam beforehand, you will get a zero on that exam. Exams are weighted equally at 15% of your total grade. If you have good attendance, I will adjust the weighted scale of the exams in your favor, 23% for the highest exam and 7% for the lowest. Practice questions will be posted on Canvas in advance of the exam designed to help you identify topics that you need to study further.

**Written Homework:** Written homework problems are assigned from the textbook and will be submitted to Canvas. The problems are to be done by hand and are assigned from your textbook. The due dates will be posted in Canvas, but typically you will have at least one week to complete the assignments from a chapter after it is covered in class. Each written problem set will consist of anywhere from five to twenty questions. A random sample 5-10 questions will be graded for correctness by a student grader, and the rest will be graded for completion. Late homework is not accepted without a well-documented emergency. Please be sure that written assignments are legible and organized. You are responsible for ensuring your submissions can be viewed by the grader. If your submission is illegible or causes an error it will receive a zero. I encourage you to work together on your homework, but directly copying an online source or another student's homework is considered plagiarism and will not be tolerated. Copying solutions from AI is also considered academic plagiarism. A maximum of two written homework assignments can be turned in late subject to a 10% penalty as long as they are submitted before the corresponding exam. Other late work is not accepted.

**Class Activities:** Mathematics requires active participation. Participation means asking questions, taking notes, making conjectures and checking them, providing solutions to problems, and sharing ideas with classmates. I will act as the expert facilitator during class time, with a mixture of lecture, group problem solving, use of technology, and integrated discussion. You will receive activity credit for your attendance by using the sign-in sheet. Each class we will work on a class activity directly related to the chapters of study. You are to work on them in your groups and submit them to Canvas by the last day of lecture on the subject. These may be fully graded or you may get credit for completion, depending on the activity.

**Course Credit Hour Information:** In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, this class meets the PLNU credit hour policy for a 4-unit class delivered over 15 weeks. It is anticipated that students will spend a minimum of 37.5 participation hours per credit hour on their coursework. For this course, students will spend 115 estimated total hours meeting the course learning outcomes.

**Artificial Intelligence Policy:** You are allowed to use Artificial Intelligence (AI) tools (e.g. ChatGPT, Gemini Pro 1.5, GrammarlyGo, Perplexity, etc.) to generate ideas, but you are **not allowed** to use AI tools to generate content (math, text, video, audio, images) that will end up in any work submitted to be graded for this course. If you have any doubts about using AI, please gain permission from the instructor.

**PLNU Academic Accommodations Policy:** PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center ([EAC@pointloma.edu](mailto:EAC@pointloma.edu) or 619-849-2533). Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines allowed accommodations. Professors are able to view a student's approved accommodations through Accommodate.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course. Accommodations are not retroactive so clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC. Students cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any accommodations.

### **LomaBooks Instructions for Students**

This course is part of our course material delivery program, **LomaBooks**. The bookstore will provide each student with a convenient package containing all required physical materials; all digitally delivered materials will be integrated into Canvas.

You should have received an email from the bookstore confirming the list of materials that will be provided for each of your courses and asking you to select how you would like to receive any printed components (in-store pick up or home delivery). If you have not done so already, please confirm your fulfillment preference so the bookstore can prepare your materials. For more information about **LomaBooks**, please go: [HERE](#)

**Additional Course Information:** Additional PLNU policies and practices that apply to this course can be found at the link below. The link includes PLNU's statement on spiritual care, state authorization, copyright policy, recording notification, academic honesty policy, language and belonging, sexual misconduct and discrimination, attendance and participation policy, course modality definitions, LomaBooks, use of technology, and the Loma Writing Center.

<https://docs.google.com/document/d/11BgAANLOJ9tjt837d24EZ181ukM2qzHF/edit?usp=sharing&oid=10991071565151117850&rtpof=true&sd=true>

**Course Schedule:** This course syllabus and schedule are subject to change due to unforeseen circumstances.

| <b>Week of</b> | <b>Monday</b>   | <b>Wednesday</b>   | <b>Friday</b>  |
|----------------|---|--|--|
| 9/1/2025       | <i>No Class</i><br>Labor Day                              | <b>Course Introduction and Calculus Review</b>                 | <b>12.1-12.2:</b> Three-Dimensional Coordinates and Vectors  |
| 9/8/2025       | <b>12.3-12.4:</b> The Dot and Cross Products              | <b>12.4-5:</b> Products and Equations of Lines and Planes      | <b>12.6:</b> Cylinders and Quadric Surfaces                  |
| 9/15/2025      | <b>13.1:</b> Vector Functions and Space Curves            | <b>13.2:</b> Derivatives and Integrals of Vector Functions     | <b>13.3:</b> Arc Length and Curvature                        |
| 9/22/2025      | <b>13.4:</b> Motion in Space<br>Velocity and Acceleration | <b>14.1:</b> Functions of Several Variables                    | <b>Ch12-13:</b> Catch Up and Review for Exam                 |
| 9/29/2025      | <b>Exam #1</b>  | <b>14.2:</b> Limits and Continuity with Multivariate Functions | <b>14.3:</b> Partial Derivatives                             |
| 10/6/2025      | <b>14.4:</b> Tangent Planes and Linear Approximation      | <b>14.5:</b> The Chain Rule in Multivariables                  | <b>14.6:</b> Directional Derivatives and the Gradient Vector |
| 10/13/2025     | <b>14.7:</b> Minimum and Maximum Values in Multivariables | <b>14.8:</b> The Method of Lagrange Multipliers                | <b>15.1:</b> Double Integrals over Rectangles                |
| 10/20/2025     | <b>15.2:</b> Double Integrals over General Regions        | <b>Ch14-15:</b> Catch Up and Review for Exam                   | <i>No Class</i><br>Fall Break                                |
| 10/27/2025     | <b>Exam #2</b>  | <b>15.3:</b> Integrals in Polar Coordinates                    | <b>15.4:</b> Applications of Double Integrals                |
| 11/3/2025      | <b>15.5:</b> Surface Area in Multivariables               | <b>15.6:</b> Triple Integrals in Rectangular Coordinates       | <b>15.7:</b> Triple Integrals in Cylindrical Coordinates     |
| 11/10/2025     | <b>15.8:</b> Triple Integrals in Spherical Coordinates    | <b>15.9:</b> Changing Variables with Multiple Integrals        | <b>16.1:</b> Intro to Vector Fields                          |
| 11/17/2025     | <b>16.2:</b> Line Integrals within Vector Fields          | <b>16.3:</b> The Fundamental Theorems - Line Integrals         | <b>Ch15-16:</b> Catch Up and Review for Exam                 |
| 11/24/2025     | <b>Exam #3</b>  | <i>No Class</i>  |  |

|            |  |  |  |
|------------|--|--|--|
|            |  | Thanksgiving Break                           |  |
| 12/1/2025  | <b>16.4:</b> The Fundamental Theorems - Green's Theorem        | <b>16.5:</b> Curl and Divergence             | <b>16.6-7:</b> Parametric Surfaces and Surface Integrals |
| 12/8/2025  | <b>16.8-9:</b> The Fundamental Theorems - Stokes' & Divergence | <b>Ch12-16:</b> Catch Up and Review for Exam | <i>No Class Study Day</i>                                |
| 12/15/2025 | <b><i>Final Exam</i></b><br>7:30-10:00am (Cumulative)          | <i>No Class: Finals Week</i>                 |  |