Point Loma Nazarene University, Spring 2025

Topics in Geometry

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

Professor: Kyle Havens	**Course:** Math 4002	**Section:** 1	**Units:** 2
Office: Rohr Science 210	**Days:** Tuesday and Thursday	**Class Time:** 2:55pm-3:50pm	
Phone: (619) 849-2200	**Email:** kylehavens@pointloma.edu	**Location:** Rohr Science 395	

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: A study of the foundations of geometry, Affine, non-Euclidean and projective geometries. A synthetic development of advanced Euclidean geometry including geometric transformations, convexity, and constructions.

Required Materials:

1. *Taxicab Geometry: An Adventure in Non-Euclidean Geometry* by Krause, Eugene (ISBN: 9780486252025)
2. *Exploring Advanced Euclidean Geometry* with GeoGebra by Venema, Gerard (ISBN: 9780883857847)
3. Straight edge, compass, a laptop with access to GeoGebra (https://www.geogebra.org/download)

Office Hours: Located in Rohr Science 210. Professor Havens has open office hours at the following times:
• Mondays: 10:00-11:55am • Tuesdays & Thursdays: 12:30-2:30pm • Wednesdays & Fridays: 10:55-11:55am.

Student Learning Outcomes:

1. Students will be able to demonstrate facility with analytical concepts.
2. Students will be able to write proofs.
3. Students will be able to apply their mathematical knowledge to solve problems.

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

35%	Final Exam	Cumulative. You must get a "D" on the final exam to pass.
20%	Midterm Exam	An exam on the first half of the course material.
15%	First Portfolio	A compilation of all of your Taxicab Geometry problems.
25%	Second Portfolio	A compilation of all of your Euclidean Geometry problems.
5%	Class Activities	Based on completion of group activities and 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:

Tuesday, May 6th from 4:30pm to 7:00pm

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 one midterm exam during the semester covering roughly seven weeks of content. See the course schedule for more information. Graphing calculators are allowed on the exam. No 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.

Written Homework: The homework is designed to allow you to master the concepts of Geometry; it is not an end in itself. Assignments will be posted on Tuesday and Thursday. The work will be submitted as two portfolios. The first portfolio contains the Taxi-Cab problems and the second portfolio contains the Euclidean Geometry problems. Late submission of a portfolio will be assessed a $2^{n-1} \cdot 10\%$ deduction where n is the number of weekdays late. The day counter for late work begins at the start of class on the weekday it is due. For example, a portfolio submitted at 3:30 on the first weekday after the due date will incur a two-day late penalty deduction of 20%.

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 2-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 75 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 or 619-849-2486). 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. The EAC makes accommodations available to professors at the student's request. 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 special accommodations.

Sources of Help: If you find yourself struggling, consider asking for help using any of the following:

1. Your Professor. If you have questions, email me, ask in class, or come to my office hours.
2. Other classmates. Form study groups and work together both in and out of class.
3. Tutoring. Available in Rohr Science through the Tutoring Center whose hours will be posted on Canvas.
4. Online resources. Accessible on Canvas, or find them yourself via YouTube, Khan Academy, etc.
5. Practice exam questions. Look at them ahead of time and use them to assess your understanding.

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/18i1pUoY0iCfB8w7JKxVvACQW309X-JRB/edit?usp=sharing&ouid=116164865489739533893&rtpof=true&sd=true

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

Week of	*Tuesday*	*Thursday*	*Due Soon*	✓
1/13/2025	**Course Introduction & Ch.1:** Intro to Taxicab Geometry	**Krause Ch.1:** Taxi Circles *Work on Taxicab Ch.1*	Obtain Texts Obtain a Decent Compass	
1/20/2025	**K. Ch.2:** Applications *Work on Taxicab Ch.2*	**K. Ch.2:** Out of Class Application *Work on Taxicab Ch.2*	Written Homework Ch.1	
1/27/2025	**K. Ch.3:** More Geometric Figures *Work on Taxicab Ch.3*	**K. Ch.4:** Distance to a Line *Work on Taxicab Ch.4*	Written Homework Ch.2	
2/3/2025	**K. Ch.4-6:** More Distance *Work on Taxicab Ch.4*	**K. Ch.6**: Further Applications *Work on Taxicab Ch.6*	Written Homework Ch.3	
2/10/2025	**Venema Ch1:** GeoGebra Intro *Work on Venema Ch1.1-2*	**V. Ch1.3:** Calculation *Work on Venema Ch1.3*	Written Homework Ch.4,6	
2/17/2025	**V. Ch1.4:** Enhancements *Work on Venema Ch1.4*	**V. Ch2.1-2.2:** Triangles *Work on Venema Ch2.2*	**First Portfolio Due (Taxicab)** GeoGebra HW Ch1.1-3	
2/24/2025	**V. Ch2.3:** Altitudes *Work on Venema Ch2.3*	**V. Ch2.4:** Bisectors *Work on Venema Ch2.4*	GeoGebra HW Ch1.4-2.2	
3/3/2025	**Exam #1**	**V. Ch2.5:** Euler Line *Work on Venema Ch2.5*	GeoGebra HW Ch2.3-2.4	
3/10/2025	*No Class* *Spring Break*			
3/17/2025	**V. Ch4.1:** Circumscribed *Work on Venema Ch4.1*	**V. Ch4.2:** Inscribed *Work on Venema Ch4.2*	GeoGebra HW Ch2.5	
3/24/2025	**V. Ch4.3:** Escribed *Work on Venema Ch4.3*	**V. Ch5.1:** Medial Triangle *Work on Venema Ch5.1*	GeoGebra HW Ch4.1-4.2	
3/31/2025	**V. Ch5.2:** Orthic Triangle *Work on Venema Ch5.2*	**V. Ch5.3:** Cevian Triangle *Work on Venema Ch5.3*	GeoGebra HW Ch4.3-5.1	
4/7/2025	**V. Ch7.1-2:** Nine Points *Work on Venema Ch7.1-2*	**V. Ch7.3:** Feuerbach's Theorem *Work on Venema Ch7.3*	GeoGebra HW Ch5.2-3	
4/14/2025	**V. Ch8.1:** Ceva's Theorem *Work on Venema Ch8.1*	*No Class* *Easter Break*	GeoGebra HW Ch7.1-3	
4/21/2025	**Ch13.1-3:** Inversion, Orthogonal *Work on Venema Ch13.1-3*	**V. Ch14.1:** Poincare Disk *Work on Venema Ch14.2*	**Second Portfolio Due (Euclid)** GeoGebra HW Ch8.1	
4/28/2025	**Ch14.2:** Hyperbolic Straightedge *Work on Venema Ch14.2*	**Krause/Venema:** Review	GeoGebra HW Ch13.1-3	
5/5/2025	**Final Exam** 4:30pm-7:00pm	*Finals Week*	GeoGebra HW Ch14.2	