

UNDERGRADUATE MATH SEMINAR

The seminar that was planned for this week has been cancelled. Upcoming seminars will be announced in the newsletter and on posters throughout Bailey Hall. Keep your eyes open – we'll be back soon!

Pieces from Thesis

Helen Smith wrote her senior thesis in the fall term under the direction of Professor Louisa Catalano.

My thesis went into detail regarding matrix Lie Groups and the Cartan-Dieudonné Theorem for Matrices. Mainly using information from John Stillwell's *Naive Lie Theory* and Jean Gallier's *Isometries of Euclidean and Hermitian Spaces*, my paper focused mainly on the understanding of Lie Groups and what they are. Then, through reading *Naive Lie Theory*, I came across the Cartan-Dieudonné Theorem, where my thesis drifted into a long proof that I translated from function analysis to matrix theory. I enjoyed going through this experience and learning about a topic I had not previously known.

Lie Groups are essentially a subgroup of perfect-square matrices with entries from the complex numbers. These groups are isometries, indicating that any transformation made in a higher dimension, the groups preserve their geometric shape. In a sense, matrix Lie Groups study reflections within a space, which eventually brought about the Cartan-Dieudonné Theorem for matrices.

Lie Groups have been around for years, and the two main focuses of my paper regarding Lie Groups were complex numbers and quaternions, which are an extension of complex numbers. I began my paper by discussing the history of complex numbers and the history of quaternions. Using some outside sources, I was able to develop some background information that would help with the understanding of matrix Lie Groups and quaternions later in my paper. When I came across the Cartan-Dieudonné Theorem in *Naive Lie Theory*, Professor Catalano gave me *Isometries of Euclidean and Hermitian Spaces*, which dealt with the proof for this theorem. The proof used function analysis to derive their findings, so one big project within my paper was translating the proof into matrix notation. After completely transcribing this proof, I put my results as a full section of my paper.

One of my favorite parts of doing this thesis was transcribing the proof. I am not the biggest fan of proofs, nor have I been the best at them, so this was a huge challenge for myself. Once I was able to get it done, I felt very accomplished. It took a few weeks to finally get everything translated into matrix notation, and the wait was worth it. I learned a lot about matrix Lie Groups and how we can understand something so complex that it cannot be drawn.

For upcoming seniors, or juniors beginning their thesis, one thing I highly recommend is talking to your advisor. I would not have gotten through my fall-term thesis without the help of Professor Catalano. Every time I had a question, she would answer and not move on until I had a better understanding of what I asked. And if she did not have an answer right away, she would look for materials and come back with a response at our next meeting. I feel like my communication, proof-writing, learning, and research skills have improved drastically since my thesis. Thesis is not supposed to be a grueling time, as one should enjoy their work. With a professor you like, a topic you are interested in learning, thesis can help one improve their mathematical and communication skills drastically.

The next meeting of the Math Club is
Thursday, February 17 at 5pm
Math Common Room – Bailey 204

Turn the page,
there's more!

Spring Term Prescheduling: Advising, Waitlist Sign-up

It is that time of the current term when we start to look forward to next term and students plan their course schedule. Academic advising is underway and Waitlisting for courses (“Student Planning” on Self-Service) is this week.

Timeline:

- February 7-25: *Academic Advising*. Students consult with faculty advisors.
- February 14-18: Waitlist course sign-up on Student Planning (Self-Service).
- February 21-25: Waitlist course review and approval.
- February 28-March 3: Spring term prescheduling on Student Planning, by appointment.

Some Math and Statistics Courses: This spring, the math department will be offering several interesting courses beyond the calculus sequence that are suitable for math majors and minors.

Math 199 is the department’s “bridge course,” intended to help students make the transition from computationally oriented courses to more theoretical proof-writing courses. It is a **required** course for all math majors and minors that is *usually* taken *after* a student has taken Math 115. Two sections: 199-01 MWF 8:00-9:15, and 199-02 MWF 9:15-10:20.

Beyond Math 199: There are several courses being offered that have a Math 199 prerequisite:

- **Math 228 (Probability Theory).** **NEW COURSE!** This course is an introduction to probability theory intended for math majors and minors, offered by Professor Phaniel Mariano. The focus of this course will be on both the theoretical aspects of probability and problem solving. The prerequisites are Math 197 or Math 199, and Math 117, which may be taken concurrently. NOTE: this course is not open to students who have passed Math 128 and vice versa. Choose wisely (a probability pun!). MWF 1:50-2:55.
- **Math 238 (Methods of Applied Mathematics)** is an introduction to the fundamental concepts and techniques in applied mathematics. The emphasis will be on quantifying and solving problems arising from physical, chemical, biological, and economic phenomena. The prerequisites are a course in differential equations (Math 130 or 234), and Math 197 or 199. MWF 11:45-12:50.
- **Math 332 (Abstract Algebra 1)** is a beautiful course that generalizes what you know about algebra in the integers and real numbers to a more abstract setting. The main objects of study in this course are groups, rings, and fields. This course is required for the major. The prerequisite for this course is one of Math 219, 221, 224, 235, or 248. MWF 9:15-10:20
- **Math 437 (Real Analysis 2)** **NEW COURSE!** Are you sad that Math 336 ended? Continue the fun in a second course in analysis with Professor Jeff Jauregui. This course is perfect for students considering honors in the math major and/or considering graduate studies in math. MWF 10:30-11:35.

There are also a couple of statistics courses being offered!

Statistics 164 (Strategies of Experimentation: Statistical Design and Analysis of Experiments) Students will learn different experimental design options when experimenting with multiple variables as well as analytic methods. Prerequisites: one of STA 104, STA/MTH 128, MTH 228, STA 264, MER 301, ECO 243, PSY 200 or permission from the chair. MWF 9:15-10:20.

Statistics 364 (Big Data Analytics). Learn many techniques on how to analyze large data sets using statistical programming languages. This is a great course for students considering graduate study or careers in the areas of statistics, data science, machine learning, computer science, econometrics, or related disciplines. Prerequisites: STA 264 or ECO 243 or permission from the chair. MWF 11:45-12:50.

Math, Hearts, and Valentine’s Day:
Check out this [NY Times link](#)

