Department of Mathematics

September 22, 2025

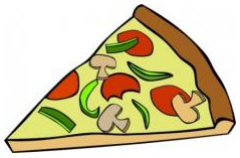
UNDERGRADUATE MATH SEMINAR

The next math seminar on the term will be

DATE: **THURSDAY, September 25**

Time & **12:30 –** Refreshments in **Bailey 204**

Location: **12:50 – 1:45** Seminar in **Bailey 207**



Professor Grant Moles

In this seminar, **Professor Grant Moles**, and algebraist in the Union College Math Department, will present the following talk.

Title: Numbers!

Abstract: For most of us, the first mathematical concept we encountered was the idea of a "number" – likely as a young child. In these early days, we used numbers to count, to put things in order, and eventually to add and subtract. As we aged and encountered more advanced mathematics, however, we may have come to realize that this early concept of a number is a bit simplistic. This begs the question: just what is a number?

In this talk, we will explore the wide world of numbers, from the "natural" and "rational" to the "complex" or even "surreal". Throughout, we will explore how these numbers are constructed and how, by making difference choices, we might construct "numbers" we may not be entirely familiar with. Ultimately, we will ask the question: how might we define the term "number" mathematically, and would establishing such a definition even make sense?

Our Summer REU Experience(s), by Ricky Farina '27 and Izzy Petersen, '27

Intro: Over the summer we attended the Marist University SMART REU! This was an amazing opportunity, and while no two REUs are the same, we hope that by sharing our experiences, from the application process to the program itself, it helps give an idea of how similar research programs operate.

Application: The process of applying to an REU can be a lengthy one, so exploring multiple programs that suit your academic interests and qualifications is often your best bet. These particular programs generally require not only a transcript and resume, but also recommendation letters and specific personal statements. We recommend looking at programs as early as possible to see which ones align with your interests and any prerequisites they might have. It is also best to give any professor at least a couple weeks of notice to write your recommendation letter. A great place to start looking is https://sites.google.com/view/mathreu (note: it doesn't have a lot of programs listed currently, but it will populate as more schools open applications for their programs). If you decide to apply, be sure to reach out to **Professors Jeff Hatley** and **Rylan Gajek-Leonard** for support during this process, as they are our REU contacts in the math department!

Experience: Over the 8-week program, we were fully immersed as research students at Marist University in Poughkeepsie, New York, complete with a dorm assignment and invitations to school-sponsored summer events. We represented 2 of 3 small research groups which focused on completely independent projects. Our day to day schedules varied slightly, but we were expected to work for 35-40 hours per week, almost always in our groups. We both had 2 other collaborators working on the research with us and teamwork was heavily emphasized throughout the process. By the end of the summer, both of our groups began the publication process for our findings.

Outside of our regular work hours, our cohort of 9 total research students made an effort to spend lots of time together. Some highlights of the summer included a hike at Minnewaska State Park, group spikeball and tennis, card games, and a big "family dinner." Additionally, we had the opportunity **(turn!)**

to attend a research conference at Jane Street in New York City near the end of the program to present the results of our projects in a professional setting. We also got to meet other undergraduate math students and learn about their research!

Izzy Research Overview: My project fell under the umbrella of Real Analysis, but was more specifically focused on metric spaces. Broadly, metric spaces are a set of points for which we can define a function used to measure distance. This function, called the metric, must satisfy a series of conditions including non-negativity, symmetry, identity, and a property called the Triangle Inequality. You may be familiar with common metric spaces, like the Euclidean Metric, which can be thought of as distance as the crow flies. Our project looked at a familiar calculus optimization problem through a unique lens of metric spaces. My team, including myself and two other rising juniors from around the country, spent our summer working through math journals, deriving new formulas, Adobe Illustrating, and ultimately writing a paper (in LaTeX, of course).

Ricky Research Overview: This project had an emphasis on statistics, computer science, and machine learning/artificial intelligence. The project aimed to use Bayesian Networks to create a directed acyclic graph depicting the causes of Excessive Daytime Sleepiness, a condition characterized by drowsiness while completing everyday activities. While it may not seem like math research on the surface, the mechanisms behind developing the graph rely heavily on statistical processes and frameworks and used advanced algorithms to correctly make connections in the dataset.

What Do Math Faculty Do in the Summer? Some More Highlights

- **Professor Brenda Johnson**, a topologist, traveled to Quebec City to speak at the summer meeting of the Canadian Mathematical Society and to Ottawa to speak at a conference on Foundational Methods in Computer Science.
- **Professor Phanuel Mariano**, a probabilist, along with **Fanhui Xu**, organized the Progress in Discrete and Continuous Probability Conference at Union College, with support from a National Science Foundation grant. The meeting brought together leading researchers and early-career mathematicians from across the U.S. and abroad for tutorials, invited talks, and contributed talks. Highlights included tutorials by Yimin Xiao (Michigan State University) and Omer Angel (University of British Columbia), and a banquet in Union's iconic Nott Memorial.

Progress in Discrete and Continuous Probability Conference participants

- **Professor Grant Moles**, an algebraist, traveled to Nebraska for the first part of the summer to spend time with family. While there, he finished and submitted for publication a paper on the associated, ideal-preserving, and locally associated properties of subrings. After returning to Schenectady, he advised a summer research project by **Talha Khan '26**, leading to a paper entitled "Locally Associated Orders in Real Quadratic Number Fields" that has been submitted for publication. He also continued a research project with one of his collaborators, Jared Kettinger, investigating factorization in orders of algebraic number fields. This project is continuing work from a paper entitled "Elasticity of Orders with Prime Conductor" that was published in the *Journal of Number Theory* in August.
- **Professor Kim Plofker**, a math historian, visited New Zealand to give a talk entitled "Latin-Sanskrit conic sections analysis in 18th-century Jaipur" in the 27th International Congress of History of Science and Technology at the University of Otago in Dunedin, and to co- teach the course "Mathematics in Perspective" in the Department of Mathematics and Statistics at the University of Canterbury in Christchurch. She is glad to get back from Southern Hemisphere winter to Schenectady in time to enjoy the remaining scrap of local summer!