Department of Mathematics

April 15, 2024

UNDERGRADUATE MATH SEMINAR

Amalia Jerison

The next math seminar on the term will be

DATE: **THURSDAY, April 18**

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

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

In this seminar, **Amalia Jerison** will present the following talk.

Title: An Introduction to the Period Conjecture

Abstract: Periods are complex numbers whose real and imaginary parts can be expressed as integrals of rational functions with rational coefficients, over domains defined by polynomial inequalities with rational coefficients. Kontsevich (1999) and Kontsevich and Zagier (2001) conjectured that all linear algebraic relations among periods can be derived from the basic operations on integrals - linearity, change of variables and Stokes' theorem. In this talk I will introduce the conjecture in its simplest form and in an equivalent form in terms of cohomology groups.

My HRUMC Experience – by Talha Khan '26

On Saturday April 6, nine Union students left campus at 6:00am to attend the 30th annual Hudson River Undergraduate Mathematics Conference, hosted by Keene State College this year. Talha Khan wrote about his experience.

Pictured from left to right: Greg Malen (Skidmore, formerly at Union), Tremaine Richardson, Abby Wilder, Livi Gwinnett, Grace Newcombe, Uri Tomer, Talha Khan, Tim Belin. Union HRUMC attendees not shown: Shreya Majumdar, Antonia Soto.

This past Saturday, I got to attend the Hudson River Undergraduate Math Conference (HRUMC), which allowed me to dive deeper into my passions through a mathematical lens. The keynote speaker, Professor Peter Winkler of Dartmouth College, left an indelible mark, using tricky math problems as a platform to urge us to transcend surface solutions and delve deeper into understanding the mathematical logic. Highlights of the conference included captivating talks such as a statistical research presentation exploring innovative methods for ranking DIII Women's Soccer Teams—an intersection of my two greatest passions, soccer and mathematics. One of my favorites was a talk on Transformers and Neural Networks, which went into the mathematical details behind Large Language Models, LLMs.

While the whole conference was enthralling, and I was glad to get exposure to all these different topics in Math, my biggest takeaway from the whole conference was that I do not need to be some kind of super genius to do research in math, but rather I can do it by myself.

Spring Term Calculus Help Center

Sunday, Tuesday, and Thursday nights, 7:30-10:00pm, Sorum House Seminar Room

TURN THE PAGE – THE NEWSLETTER CONTINUES! Read the latest "Pieces from Thesis"!

Pieces from Thesis – by Uri Tomer

Uri *wrote his senior thesis this past fall and winter terms, supervised by* ***Professor Rylan Gajek-Leonard***

For my thesis I spent two terms working with **Professor Rylan Gajek-Leonard** to learn about p-adic numbers and Newton polygons. p-adic numbers are a relatively young branch of mathematics in which we consider the distance between two numbers not to be the Euclidean distance that we are familiar with, but instead it is the difference between the number of times a certain prime p divides either number. This notion of distance changes how we perceive numbers and allows for well-defined notions of infinite and infinitesimal quantities. Newton polygons are a tool that help us study polynomials with p-adic coefficients.

In the thesis we came up with an original geometric proof for a result about the composition of Newton polygons. Furthermore, we laid the groundwork for a yet unproven generalization of the result. Initially, these concepts were very intimidating to me. Furthermore, the method by which I was learning was new and unfamiliar, I had never been expected to learn primarily through my own endeavors. That is, I had never read a textbook without accompanying lectures, or thoroughly explored the mathematics discussion that is constantly happening on the internet. As time moved on, it became an increasingly enriching experience. Everything I learned I had to understand completely - there were no shortcuts. I couldn't study to the point of "good enough", because there was no exam to be good enough for. The only barometer was my own curiosity.

Rylan's support and instruction along the way was beyond valuable. There are certain cultural and technical details in the world of mathematics which are at best extremely difficult to pick up on and at worst completely obscured by tradition (or pretension depending on how cynical you are). Rylan helped me navigate these things and often when I was feeling lost, pointed me in the right direction. At one point I asked Rylan if we would be better off scrapping the research aspect of the thesis and focusing solely on exposition. Rylan urged me to keep going and dig deeper. That was definitely the right decision as I ended up enjoying the research process immensely. In the end, I learned throughout these two semesters almost as much as I had in the previous three years.

Pi Mu Epsilon – Math Honors Society Accepting Applications

Pi Mu Epsilon (PME) is a national undergraduate math honors society. To be considered for membership into Union's chapter of PME, a student must have

- taken at least two math courses at the 200-level or above;
- a minimum campus-wide GPA of 3.0 and a minimum GPA of 3.0 in all math courses that can be used to fulfill a math major;
- a demonstrated engagement and involvement in the promotion of mathematics at Union College and/or broader community, (examples include, active involvement in the Union College Math Club, in the Association of Women in Mathematics, in the Hudson River Undergraduate Mathematics Conference, in the Calculus Help Center, in math tutoring through the Kenney Center, in math problem solving training sessions and/or competitions, regular attendance at the Union College Math Department Seminar);
- an interest in joining PME, demonstrated by writing a few paragraphs/mini-essay in an email to **Professor Paul Friedman** (friedmap@union.edu) explaining your interest, your qualifications, and how you have supported and will continue to support the purpose and goals of PME. This email must be received by **noon on Friday, April 21.**

The national initiation fee for PME is $30. This covers the cost of membership and also a one-year (two issue) subscription to the MPE Journal. Members of MPE can also purchase other PME items such as tassels for graduation, t-shirts, etc. For more information, go to the website **pme-math.org.**