# **Department of Mathematics**

May 19, 2025

## UNDERGRADUATE MATH SEMINAR

Math folk at Union unite for the next math seminar!

#### DATE: THURSDAY, May 22

Time & 12:30 – Refreshments in Bailey 204

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

In this seminar, the Union College Math Department's **Professor Brenda Johnson** will present the following talk:

#### Title: Fixed Points and Fermat

Abstract: If you pick an integer a and a prime number p, the difference  $a^{p}$ -a will be divisible by p. This fact is known as Fermat's Little Theorem and is a standard result in number theory courses. There are many ways to prove this theorem, often involving ideas from number theory and abstract algebra. A less standard approach uses functions one might see in a first-year calculus course together with basic results from the field of dynamical systems. In this talk, we will see how to prove Fermat's Little Theorem and some related results in number theory from this dynamical systems perspective.

## Math Department Prizes Announced

Please join the Math department in congratulating this year's recipients of its prizes.

The <u>Martin Terry Resch Prize</u> is awarded to "the senior who shows the greatest promise for advanced study in pure or applied mathematics." This year, the math department gave this award to **Audrey Benson** and **Jacob Schuckman**. The **Eugene W. Hellmich Memorial Prize** is awarded to "the senior who demonstrates excellence in mathematics and is planning to teach math." This year, the math department gave this award to **Grace Newcombe.** 

### Pieces from Thesis, by Grace Newcombe

Grace wrote her senior thesis this winter under the guidance of **Professor Rylan Gajek-Leonard**.

In the fall and winter terms of this year, I worked with Professor Rylan Gajek-Leonard to develop my thesis: *An Audio Analysis of Elliptic Curves*. My project involved looking at the solutions to the Weierstrass forms of elliptic curves (equations that can be expressed in the form y<sup>2</sup>=x<sup>3</sup>+ax+b, where a,b are certain rational constants). These solutions can be used to define a specific Fourier series (particular sums of periodic sine and cosine functions). I then used Google Colab to help me generate several Fourier coefficients of different elliptic curves and audialized them using techniques such as additive synthesis (superimposing multiple sine/cosine curves on top of each other) in order to hear how they behave.

Some interesting things I found was that the more non-zero coefficients in a series implied a grittier sound, because there were more curves superimposed on each other. The more zeroes in the series implied that there were less curves superimposed, and we got a smoother sound. Another cool phenomenon I came across was the idea of quadratic twists, which are elliptic curves whose y-term is multiplied by a square free integer. When examining the coefficients of these twists, I noticed that if their second term was the same, and the rest of the terms only varied by a negative (CONTINUED!)

Turn the page, there's more, including information on how to apply to become a CHC tutor



Professor Brenda Johnson

sign (if at all), then they sounded the same. It was something that I stumbled across, and had no intention of fully studying, but this idea was so cool, I was able to explore it in great depth in my thesis.

That's the cool thing about math theses. A lot of the work is not set in stone and involves a lot of trial and error and exploring. A lot of meetings involved Rylan and I playing with different codes and listening to a lot of different sounds. It was a really cool experience, as I felt like I could really tailor the thesis to be something I was really passionate about. While at points it can become stressful, it ultimately allows for a thesis that really speaks to your interests, and can cover things really fascinating to you as an individual.

#### Fall Term Calculus Help Center Tutoring Positions Available – Apply Now!

The Math Department is now accepting applications for vacant **Calculus Help Center (CHC) tutoring positions**. Tutors in the fall work in the CHC one fixed night per week, Sunday through Thursday, from 7:30-10:00pm.

Qualifications: Calculus through Math 115 with grades of no less than A-. Preference will be given to students who

- have also completed Math 117 (with a grade  $\geq$  A-),
- are declared math majors,
- are considering becoming a math teacher or pursuing graduate work in mathematics, and
  - work in mathematics, and **Tueso**
- Tuesday, June 3 at NOON

CHC Tutoring

**Application Deadline**:

have other tutoring experience (not necessary, though).

To apply for a position, send an email to Professor Paul Friedman (<u>friedmap@union.edu</u>) expressing your interest, listing your mathematical background, including coursework (term, professor, and grade) and tutoring experience (if any), and discussing why you think you would be a good tutor.

#### Scenes from ReUnion 2025

This past Friday, May 16, the Math Department hosted a reception for math alumni who were returning to Union for ReUnion weekend. Members from the classes of 1970 to the present mingled with current and emeriti professors in the department sharing stories from then and now. Good food, good conversation, math and memories. It was a fantastic event!

