

## UNDERGRADUATE MATH SEMINAR

This week's seminar will be back in its usual location

**DATE:** **Thursday, May 16**

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

**Location:** **1:00** – Seminar in **Bailey 207**

In this seminar, **Professor Ravi Ramakrishna** from the math department at **Cornell University** will present the following talk.

**Title: The History of Fermat's Last Theorem**



Professor Ravi Ramakrishna

**Abstract:** In 1994, Wiles, assisted by Taylor, finally settled the 340 year old question of Fermat's Last Theorem. In this talk I will give some of the history of this problem, with particular focus on events of 1847 and the 1980-90s. I'll then talk a little about developments off the last 25 years in the subject. This talk is NOT aimed at faculty in number theory. It is intended for undergraduates who like math but have not taken many upper level courses.

## Math Club and AWM – Dinner with the Speaker, by Kallan Piconi

Come join the Math Department, Math Club, and the Association for Women in Mathematics for a dinner with Professor Ramakrishna from Cornell this **Wednesday, May 15, at 6 pm in the Green House great room!** Professor Ramakrishna is a world-class number theorist with a lot of knowledge to share. Stop by for some fun conversation along with dinner from Perreccas!

Also on **Wednesday, May 15**, the Math Club will be having its next meeting at **common lunch** in the **math common room, Bailey 204**.

## ReUnion! Math Majors Social Gathering

To help kick-off ReUnion weekend, the Math Department is hosting an informal social gathering with light refreshments for math faculty, alumni, and current math students on **Friday, May 17** from **3:00-5:00** in **Bailey 204, the Math Common Room**. Come on by to relive old memories and to create some new ones!

## Pieces from Theses, by Allegra Dawes

*Allegra's thesis was supervised by Professor Jeff Hatley*

Going into Spring term of my junior year, I didn't have any sense of what a math thesis would entail or how I should go about selecting a topic. The Math Department sent out a list of professors who were interested in taking thesis students along with potential topics, but I still wasn't sure how to choose. I started asking for advice from professors in the department who I was familiar with and who had some sense of the type of math I was interested in. I ended up being paired with Professor Hatley with a potential topic in Bezout's theorem...which I didn't really know anything about. I met Professor Hatley for the first time that term and I was immediately blown away by his willingness to work with me on developing a topic that I was passionate about. I told him number theory wasn't my thing (sorry Professor) and we soon settled on a completely new topic—geometric group theory—and we were off.

Geometric group theory seeks to understand groups not as algebraic objects, but as geometric objects. Broadly, then, it is concerned with how groups act on spaces and how they can be understood as geometric spaces themselves. A crucial part of this is the Cayley graph of a group. We can present a group as two sets—one of generators and one of relators—that encode what group elements are equivalent to the identity element in that group. We can then construct a Cayley graph for a group by letting the vertices of the graph

(Continued on next page.)

be the group elements and moving along an edge by right multiplication with a generating element. Equipping this graph with a metric allows us to see the group as not only acting on a space, but in fact being a space itself.

My thesis focused on hyperbolic groups that had Cayley graphs with geometries that could be understood as negatively curved. This particularly pertained to delta-hyperbolicity as we classified a group as hyperbolic if it satisfied certain metric requirements depending on a nonnegative number delta. I also looked at a combinatorial problem in groups, specifically the word problem. This problem concerns our ability to determine whether a group element represents the identity of that group or not. The solution takes the form of an algorithm that allows us to reduce a word down and thus determine if it is the identity. The word problem is always solvable in hyperbolic groups as their geometry ensures the existence of a special type of presentation—the Dehn presentation.

My advice to underclass students is to explore during your time at Union. Don't be afraid to take classes in fields that are completely new to you; look for classes that expand your spheres of interest and try to find the connections between them. I think I felt a lot of pressure to know my major immediately (which I didn't), and to have a set plan for my four years here (which I never made), but I've realized that wandering in different fields and trying new things has enriched my time here and me life immensely. In terms of thesis, I would recommend talking to your professors outside of class as much as possible. Try to develop your relationships and connections with your professors as early as possible. Tell them what excites you and pursue the topics and opportunities that make you feel alive.

Finally, I'd like to thank my advisor, Jeff Hatley, for all his guidance and support during this process. I really enjoyed developing the project and learning about an entirely new area of math. Professor Hatley encouraged me to follow my interests and made sure that this thesis turned into exactly what I wanted it to be.

## Seen at Steinmetz



Some Math majors presenting at the annual Steinmetz Symposium, Friday, May 10: from left to right, Vanessa Raskin, Ryan Baldwin, and Allegra Dawes.

## Problem of the Newsletter – May 13, 2019

**Last week's problem:** Congratulations to **Tom Harrison '20** for solving last week's problem. A solution has been posted at the newsletter sites in Bailey Hall.

**This week's problem:** The following is from the 2017 Green Chicken Mountain Competition between Middlebury and Williams College, as relayed in the Pi Mu Epsilon journal.

If the length of the side of a triangle is less than the average lengths of the other two sides, show that the opposite angle is less than the average of the other two angles.

**Professor Friedman** ([friedmap@union.edu](mailto:friedmap@union.edu)) will accept solutions until midnight Friday, May 17.