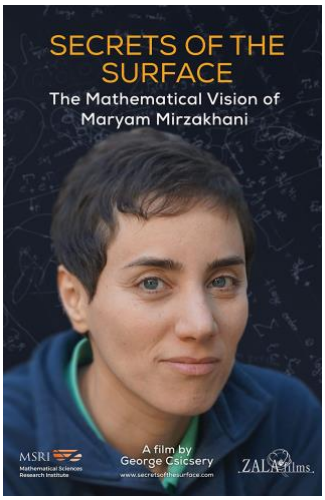
Department of Mathematics

May 30, 2022

UNDERGRADUATE MATH SEMINAR – Movie Time!

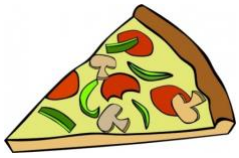


This week's seminar, *the last one of the term*, is a movie. Since its running time is 57 minutes, the seminar will start 10 minutes earlier than usual, that is, at 12:45. Attendees are welcome to take their pizza into the seminar room.

DATE: **THURSDAY, June 2**

Time & **Location:** **12:30 –** Pizza lunch in **Bailey 204**

12:45 – 1:45 Movie in **Bailey 207**



Title: Secrets of the Surface. *(Description below from the movie's website.)*

Secrets of the Surface examines the life and mathematical work of Maryam Mirzakhani, an Iranian immigrant to the United States who became a superstar in her field. In 2014, she was both the first woman and the first Iranian to be honored by mathematics' highest prize, the Fields Medal.

Mirzakhani's contributions are explained in the film by leading mathematicians and illustrated by animated sequences. Her mathematical colleagues from around the world, as well as former teachers, classmates, and students in Iran today, convey the deep impact of her achievements. The path of her education, success on Iran's Math Olympiad team, and her brilliant work, make Mirzakhani an ideal role model for girls looking toward careers in science and mathematics.

Five Students to Be Inducted into Pi Mu Epsilon

On Wednesday, June 1, five students will be inducted to the Union College chapter of a national undergraduate math honors society, Pi Mu Epsilon. The purpose of this organization is the promotion and recognition of scholarly activity in the mathematical sciences among student at the academic institutions that have been chartered as Chapters of the Society. The honorees are **Thomas Knoff, Aidan McAuliffe, Katelynne Righi, Daniel Tyebkhan,** and **Julian Zapata-Hall**. Congratulations!

The 2022 Union College Math Conference

The 2022 Union College Math Conference will be held on Friday, June 3 to Sunday, June 5. In addition to parallel sessions in **Algebraic Topology, Applied Topology and Geometry, Differential Geometry and Geometric Analysis, Rings and Algebras, and Stochastic Analysis and Applications**, the conference will have the following featured speakers:

- Claude LeBrun (Stony Brook University)
- Sergio Lopez-Permouth (Ohio University)
- Tai Melcher (University of Virginia)
- Kate Ponto (University of Kentucky)
- Yusu Wang (University of California, San Diego)

While the conference is primarily aimed at working mathematicians ranging from early stage graduate students to senior researchers, any Union students, faculty, and staff are more than welcome to attend any talk they are interested in.

The website for the conference can be found here: https://bit.ly/UCMC2022

My Senior Writing Experience – by Charles Grob

Charlie *participated in the Senior Writing Seminar with Professor Kim Plofker.*

When I first went into the selection process for my math thesis, I had many questions. I wanted to know what to expect how I could give myself the best opportunity to write a thesis that I would be proud of. After asking around, I decided to choose 487 Math Seminar with Professor Kim Plofker, which meant that I would be alongside other math majors during the process.

In this class, there were five other students with me and we had two major assignments. The first paper was on historical math research such as works done by Euler, Newton, and Leibniz. The focus of the assignment was to show what the research paper was proving, while also providing historical background on the subject, which could be understood by a college-level calculus student. As someone interested in teaching in the future, I saw this as an opportunity in developing my skills as a teacher and I was interested in translating math concepts from confusing to interesting. Professor Plofker helped me out whenever I needed it, whether it was helping me choose my topic, to finding trustworthy sources which I could use. This first paper helped me get interested in the history of mathematics, specifically Euler. The topic I chose was infinite series such as the Taylor Series and infinitesimals with work selected from Euler and Taylor such as Euler's proof of the Basel Problem. I was able to get the skills required and also narrow my subject for the second assignment.

The final paper had the same premise as the first paper but this time, we were granted the freedom to choose whatever topic we wanted, as long as it hasn't been done a lot before. I had been planning my topic early in the course and discussing it with Professor Plofker. I was interested in the Clay Institute Millennium Problems. I ended up choosing the Riemann Hypothesis, since it is a famous problem, it is related to the Basel Problem from earlier, and Professor Plofker had found new research that was not necessarily well known. Thus, it looked like a great paper topic.

I spent many hours researching and finding ways to get my paper to meet my requirements of understandability while also looking into the lesser known research that Professor had recommended. Throughout this process I began to love the topic and I became an expert on explaining what the Riemann Hypothesis is. In the end, I had a paper that I was proud of and my professor seemed to think it was well done.

I am extremely grateful for Professor Plofker making the thesis process valuable, interesting, and also not too hard where I felt I was drowning in work. The result is a paper that I will keep with me for the rest of my life and it will be a reminder of why I find math to be so intriguing.

My recommendation to those still unsure about their math thesis is to talk other math majors and professors to see what interests you the most. If you are interested in your thesis, it will feel more like a game and less like work. My experiences with most math professors have been positive, so I would focus more on whether the topic you choose speaks to you. During this class, I discovered so much about math's history and the underlying rules of numbers that it reminded me why I became a math major in the first place, because I love learning, discovering, and teaching math.

Pieces from Thesis – by Junyi Liu

Junyi *wrote his senior thesis this past winter under the supervision of Professor Leila Khatami.*

This winter, I wrote a one-term thesis with Professor Leila Khatami on the Islamic Medieval Architecture. The reason for choosing the topic was that it seemed related to the common sense of math. Since we see plenty of proofs in our high level math classes, I wanted to try something different

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from those rigorous proofs. Fortunately, this was a chance for me to explore the world of math in an artistic way, studying the patterns of tilings on some Islamic buildings.

When conducting my research, I found the key idea behind these tilings is the quasi-periodic construction. This kind of construction is visually different from periodic ones in terms of rotational symmetry. Since the repetition of a single cell can only form some certain orders of rotational symmetry, there is a rule called *forbidden symmetry*. However, the tiling I tried to investigate involved the group of symmetries without following the usual rules.

In order to explore the mystery of such patterns or the idea of quasi-periodicity, I looked into the Penrose tiling which is the most famous instance of aperiodic tiling. There is a group of tiles containing two shapes, called dart and kite. We can obtain the two shapes from a special rhombus, named Penrose rhombus, by using the Golden Ratio. Then, we can use the two shapes to construct an aperiodic tiling by a method of substitution. Based on this, we can create an infinite tiling by the kites and darts. If we record the numbers of kites and darts using in the construction, we can find that the ratio of kites to darts is closed to the golden ratio which is an irrational number. This implies that there is no single pattern for us to see the whole picture or regular pattern of the tiling. Thus, it is quasi-periodic.

Besides what I learned from the thesis research, the experience of exploring a new topic was more crucial for me since it led me to think and design a project more independently. For instance, how does one structure a thesis? what kind of people will read my paper? We have to find the solutions to these questions by ourselves, and the thesis research is a really good practice to construct the whole work step-by-step.

Spring 2022 Math Final Exam Schedule

Course #	Course Name	Professor	Room	Day	Date	Time
MTH*112*01	Calculus 2: Integral Calc	Malen, G.	KARP 105	Wed	6/8	2:30-4:30 PM
MTH*112*02	Calculus 2: Integral Calc	Malen, G.	KARP 105	Wed	6/8	2:30-4:30 PM
MTH*115*01	Calculus 3: Diff Vector Calc	Catalano, L.	BAIL 106	Wed	6/8	2:30-4:30 PM
MTH*115*02	Calculus 3: Diff Vector Calc	Johnson, B.	OLIN 115	Wed	6/8	2:30-4:30 PM
MTH*115*03	Calculus 3: Diff Vector Calc	Johnson, B.	OLIN 115	Wed	6/8	2:30-4:30 PM
MTH*117*01	Calculus 4: Integral Vector	Plofker, K.	BAIL 207	Wed	6/8	2:30-4:30 PM
MTH*117*02	Calculus 4: Integral Vector	Plofker, K.	BAIL 207	Wed	6/8	2:30-4:30 PM
MTH*117*03	Calculus 4: Integral Vector	Hatley, J.	BAIL 100	Mon	6/6	8:30-10:30 AM
MTH*130*01	Ordinary Differential Equation	Khatami, L.	KARP 005	Wed	6/8	8:30-10:30 AM
MTH*130*02	Ordinary Differential Equation	Mariano, P.	BAIL 102	Mon	6/6	8:30-10:30 AM
MTH*199*01	Intro to Logic & Set Theory	Friedman, P.	BAIL 100	Thu	6/9	11:30-1:30 PM
MTH*199*02	Intro to Logic & Set Theory	Hatley, J.	BAIL 100	Wed	6/8	8:30-10:30 AM
MTH*228*01	Probability Theory	Mariano, P.	BAIL 102	Mon	6/6	11:30-1:30 PM
MTH*332*01	Abstract Algebra	Catalano, L.	BAIL 106	Wed	6/8	8:30-10:30 AM
STA*164*01	Strategies of Experimentation	Hoerl, R.	WLDC 128	Wed	6/8	8:30-10:30 AM
STA*364*01	Big Data Analytics	Hoerl, R.	WLDC 128	Mon	6/6	8:30-10:30 AM
IMP*121*01	Int Math/Physics 2 W/Lab	Jauregui, J.	ISEC 118	Mon	6/6	2:30-5:30 PM