UNDERGRADUATE MATH SEMINAR – Save the Date!

The next math seminar is scheduled for **Thursday, May 6**, during the common lunch hour, 1:20 – 2:15. It will be held via Zoom. More details will be announced in upcoming newsletters, via email, and they will also be posted on the Math Department's website under the Activities tab. Stay tuned!

Math Honors Society, Pi Mu Epsilon, Accepting Applications: **see page 2**

Senior Writing and Pieces from Thesis

Woody Wu *wrote his senior thesis this past winter term under the direction of Professor Jeffrey Jauregui.*

This past winter term, I finished my one-term thesis on Calculus of Variations advised by Professor Jeffery Jauregui. I still remember the description of the thesis topic posted by Professor Jauregui was something similar to this: "What is the shortest curve that connects two points? What is the fastest path that a particle can travel from A to B by the force of gravity? Given two fixed points, A and B above the x-axis, which curve between the two points can generate the minimal surface area by rotating it about the x-axis?" Now, I know that those problems belong to the field of Calculus of Variations because they share the same goal: to discover the curve that can produce an extreme result.

As suggested by its name, Calculus of Variations is strongly based on the fundamental calculus. We may recall from calculus that to find the point of extreme values, we set the function's derivative to zero and solve for answers. The calculus of variations applies similar ideas to find the function (the curve) that produces an extreme value. Functionals can be understood as a function of functions. Similar to a function $f(x)$, a functional, denoted $J[y]$, takes a function $y = f(x)$ (a curve if we visualize it) as an input and produces a number as an output. For each Calculus of Variations problem, we can derive a functional associated with the answer it is looking for. For example, to find the shortest curve between two fixed points A and B, we have to apply the arc length functional that takes the curve and calculates its arc length between A and B. After determining the functional associated with the problem, we have to look for the functions that produce the extreme values of the functional. The Euler-Lagrange Equation, developed by Leonhard Euler and Joseph-Louis Lagrange in the 1750s, becomes a useful tool for finding the extreme values of a functional. The equation is based on the idea that if a curve is the local maximum or minimum of a functional, then the first variation of the functional on this curve should be 0. By plugging in the functional to the Euler-Lagrange Equation and solving the differential equation, we can get the function that yields the extreme value of the functional. Taking the arc-length functional as an example, a linear function produces the minimum value of the arc length functional, which agrees with our knowledge that the shortest path between two points is a line. We can apply the same procedure to compute the answers for any Calculus of Variations problems.

In general, the entire math thesis experience was pleasant and rewarding. Even though Prof. Jauregui and I could not meet in person for the entire term, we had many insightful discussions via our weekly zoom meetings. However, regardless of the meeting styles or the number of terms the thesis is, I am glad that I picked a topic that I am interested in. My curiosity about the material kept

motivating me to put consistent effort into the thesis and let me enjoy this self-studying process. Hence, my first piece of advice for anyone who will pursue a math major would be to know your area of interest. If you don't know your favorite topic, then spend some time familiarizing the thesis topics provided by the department. Further, when you are pursuing a thesis, it is important to outline the goals for the term in the first week and accomplish the goals by making weekly plans. Doing so can help you avoid leaving a lot of things to the last day. Wish all of you good luck with the study and have a wonderful thesis experience!

Pi Mu Epsilon – Math Honors Society Accepting Applications

Pi Mu Epsilon (PME) is a national undergraduate math honors society. In Spring 2013, a chapter of PME was established at Union College. Now we are looking to induct new members who have demonstrated an ability and interest in mathematics consistent with PME's purpose and goals.

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, while at Union College, in the promotion of mathematics at Union College and/or broader community, (examples include, but are not limited to, 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; 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 23rd.**
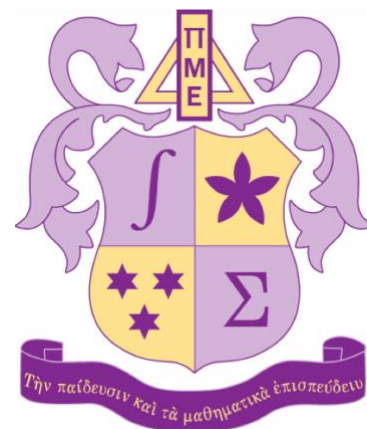
Math Club: Trivia Night!

The Math Club will be continuing its fun filled term with another Trivia Night. Come test your math skills and perhaps win some prizes! The event will be **Thursday, April 22 at 5:30 pm**, run through Kahoot, over Zoom: **https://union.zoom.us/j/7365779779**

If you are unable to attend this event but want to get involved with Math Club, then email club President **Lily Dong** (dongl@union.edu) to get on the club's mailing list and stay in the loop.

Calculus Help Center

The Calculus Help Center (CHC) offers free tutoring in calculus courses through Math 117. The CHC is held over Zoom: the link is **https://union.zoom.us/j/99516768139**. This link is also findable on the Math Department's website under the "For Students" tab.

Hey! That's not funny!