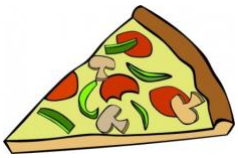
Department of Mathematics

January 19, 2026

UNDERGRADUATE MATH SEMINAR

Professor Bill Zwicker (left), Abe (right)

The next seminar of the winter term will be

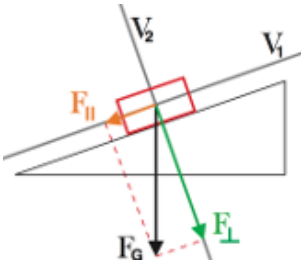


DATE: **THURSDAY, January 22**

Time & **Location:** **12:30 –** Refreshments in **Bailey 204**
12:50 – 1:45 Seminar in **Bailey 207**

In this seminar, Union's **Professor William S. Zwicker**, the **William D. Williams Professor of Mathematics Emeritus** will present the following talk.

Title: Orthogonal Decomposition and the Theory of Voting



Abstract: Remember physics? Given a block on an inclined plane, we can break the vector force F_G of gravity on the block into two parts:

$$F_G = F_\perp + F_{||}$$

with $F_\perp$ perpendicular to the plane and $F_{||}$ parallel to the plane. This *orthogonal decomposition* has great explanatory power – predicting whether the block will slide, for example.

The record of all votes cast in an election is also a vector. Orthogonal decomposition can explain why two different voting rules choose different winners for certain elections, yet agree on others. We will use this method to show that two famous voting rules – which first appear to be completely different – actually aggregate votes in the same way, differing only because they pay attention to different *subspaces of information*.

Professor Johnson Reports Back on Research Supported by Union

Professor Johnson reporting on her research

Recently, **Professor Brenda Johnson**, an algebraic topologist in the math department, was awarded a competitive course release by Union to allow her to focus more time and energy on her mathematical research. On January 8, she gave a wonderful talk, "Functor Calculus and Localization," at a forum for Union College faculty to describe the work she did during this release. As a leader in the Women in Topology network, she mentioned how part of the work was done leading a group of junior mathematicians in the field. Congratulations, Professor Johnson!

Keep on Clubbing!

Activate the social side of your math life and join a club!

- **Actuarial Society Club**. Contact Talha Khan (khant) or Wendy Pham (phama2).
- **Association for Women in Mathematics**. Contact Professor Ellen Gasparovic (gasparoe) or a student club leader (https://www.union.edu/mathematics/awm-chapter-union).
- **Math Club**. Meetings on Friday afternoon in Bailey 204. Contact Henry Howe (howeh2) or Talha Khan (khant).
- **Problem Solvers**. Meetings on Thursdays at 4:00 in Bailey 102. Contact Professor Grant Moles (molesg).

Math Club's first meeting of the winter. From left: Talha Khan, Jack Harmon, Prof. Rylan Gajek-Leonard, Glauk Hizmo, Henry Howe

Summer Research Experiences for Undergraduates (REUs) in Math

Are you interested in learning new mathematics and trying your hand at mathematical research, and getting paid for it? Then consider applying for one of the many National Science Foundation (NSF) sponsored Research Experiences for Undergraduates (REUs). These are small summer programs that last 6-8 weeks, hosted by several universities and colleges around the United States. This summer, some will be held remotely, and others might be held at the host university. The range of research fields covered by different REUs is wide, including algebra, computational mathematics, differential geometry, data science, discrete math, knot theory, mathematical biology, and more. There is something for everyone!

Who should apply? Math majors, typically in their junior or sophomore year, though some programs accept applications from current seniors, and even first-year students. Most applicants to REUs are considering going to graduate school in math and would like to see what math research is about. Most REUs require participants to be US citizens or permanent residents. In terms of coursework, most programs require participants to have at least had multivariable calculus through Math 117, a course similar to Math 199, and/or a course beyond Math 199 that requires proof-writing.

What are the options and how does one apply? The primary site listing REUs, their descriptions, the application requirements, etc., is hosted by the American Mathematical Society (AMS).

http://www.ams.org/programs/students/emp-reu

The AMS website and the corresponding NSF site can be a little difficult to navigate. So here is another site that has links to many REUs.

https://sites.google.com/view/mathreu/

The advice offered at this website is excellent, and includes

- *Apply to several different REU sites*.
- *Do not limit yourself to only certain topics or certain geographical areas*.
- *Follow the directions*.
- *Carefully read all your application materials and have someone else read them as well*.
- *Tailor each application to specifically address the REU for which you are applying.*
- *Don't sell yourself short*.
- *Think carefully about your letter writers, and make sure that they know you well.*
- *If possible, get more senior people to write letters*.
- *Give your letter writers sufficient time* (about one month) *and give them additional information*.
- *Start your application process early*.
- *Have a backup plan*.

Act soon! Most of the application deadlines to REUs are in February or early March.

What now? Browse through the REU programs, get excited by the opportunities, and start the application process, including securing letters of recommendations. In addition, feel free to contact the math department's REU advisors, **Professors Jeff Hatley** (hatleyj@union.edu) and **Rylan Gajek-Leonard** (gajekler@union.edu), to discuss the different programs and your options.

Free Peer Tutoring in Calculus Courses

CALCULUS HELP CENTER!

Sunday - Thursday: 7:30 – 10:00pm in the Sorum House Seminar Room