NC State Undergraduate Mathematics

Spring 2023
Newsletter

Washington Elementary Math and Science Night

By Miranda Powers

This past semester SUM Club participated in an outreach event at Washington Elementary to promote and encourage interest in math and science. At this event, students and their families were welcomed to come to Washington Elementary to participate in various math and science activities to show kids that math and science can be fun. The students were thrilled with this experience, and many SUM club members had a great time helping out! Below are a few descriptions of what some of our SUM club members were helping with throughout the night and their overall experience with this outreach event.

"I had a great time volunteering at the Washington Elementary Math and Science night. I was assisting at the egg drop station, where students used the provided resources to create a shelter for their egg to protect it during a 15 ft drop. It was so fun to watch the students light up as they watched their egg drop from the balcony. Students observed and learned from others tips on what worked and what didn't to improve their egg drop." - Miranda Powers

"During Washington Elementary's Math and Science night, there were two different math activities I was helping out with. One was the tower of Hanoi, which involved moving a stack of disks from one peg to the other without stacking a larger one on top of a smaller one. The second was showing students how you can't fold a paper very many times because of exponential growth. This night was so much fun, and I look forward to the next SUM Club outreach event!" - Lilah Board

"For the Math and Science Night at Washington Elementary, I had fun assisting students and their families as they made tin-foil boats to test how many pennies could float. Throughout the night, I saw various designs, with some families making boat-like structures and others utilizing the provided straws to create more stability by creating square-like platforms. One student, in particular, created a flat platform that held 130+ pennies, with these platform structures lasting longer than folded boat-like ones. Overall, I loved engaging with the Raleigh community through a STEM Night event, and it reminded me of my childhood dream of being an educator in whatever form that takes." - Amanda Baright

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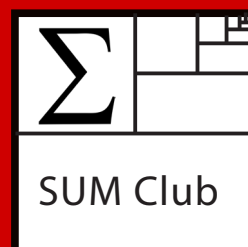
Mathematical Insights Night with SUM Club

The math department has faced ample change through the COVID-19 pandemic. While change often brings growth, the department lost a formal structure to the Mathematical Insights Club (MIC). This former student organization aimed to foster an environment where undergraduates could delve deeper into mathematics and serve as a platform for students to share lectures on their mathematical interests. The organization provided the students an opportunity to advance their presentation skills and increased audience exposure to various math topics. Over the past year, the Society for Undergraduate Mathematics (SUM Club) has worked to bring back MIC through Mathematical Insights Night, held once or twice a semester. To learn more about the topics presented so far and the student's experience with presentations in the past and their most recent endeavor, check out the following blurbs from our past presenters.
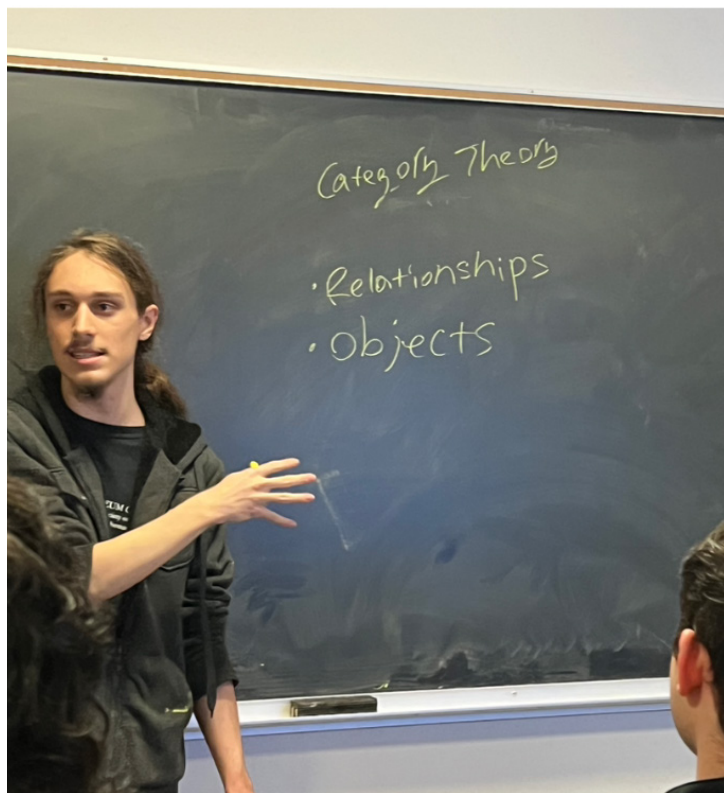

Etienne Phillips - *The Beauty of the Yoneda Lemma*

At the first spring 2023 Mathematical Insights Night, I presented a talk titled The Beauty of the Yoneda Lemma. The Yoneda Lemma is a foundational result from an area of current mathematics, Category Theory, which aims to provide a general framework for all areas of mathematics by describing seemingly very different areas like Groups, Sets, Topological Spaces, etc., all as specific examples of one thing: Categories. Category Theory is a very general framework for understanding mathematics, and results proved about Categories are often interpretable as fundamental truths about mathematics as a whole. The main takeaway of the talk was that the Yoneda Lemma, translated from the specific language of Category Theory into a philosophical statement, says that in mathematics, the relationship between objects is just as important as the definitions of objects themselves. This is the philosophical underpinning for the way a lot of current mathematicians think about their field.

> *Life is good for only two things, discovering mathematics and teaching mathematics.*
> *   - Siméon Poisson*

Mathematical Insights Night with SUM Club
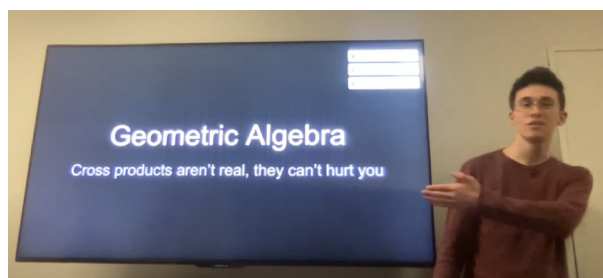
Andrew Farkas - *Geometric Algebra*

I presented on Geometric Algebra and how it makes sense of quaternions and cross products in a way that generalizes to higher dimensions. I decided to present on this topic in the hopes that other students would get a glimpse of the geometric intuition behind quaternions, which are usually very opaque. I haven't given any formal math presentations before this, but I've always been passionate about explaining mathematics and computer science topics to my friends and family, so I've had a lot of practice distilling concepts down to their essence. I had a lot of fun giving this presentation to SUM Club and watching others' presentations.
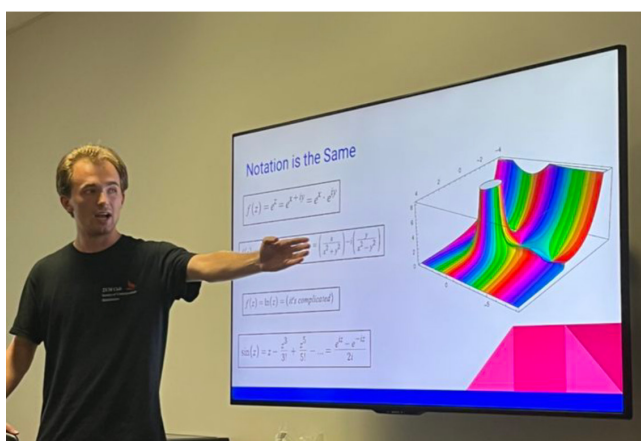
David Sieg - *Imaginary Numbers, Real Math: A Look at Complex Variables*

My Mathematical Insights Night lecture was on complex numbers and an introduction to calculus of functions of a complex variable. The square root of negative one is briefly addressed in high school, but the topic is never aptly delved into until one takes the graduate level MA 513, Introduction to Complex Variables. I'd been fascinated with the idea of bringing calculus to functions of complex variables since high school and knew plenty of undergraduates in the department who simply hadn't been given the necessary exposure to become just as enamored with the topic as I am. After reviewing the basics of complex numbers, I introduced functions of a complex variable and different visualizations of 4-dimensional space. Then, I was able to introduce differentiation and integration relating to such functions along with Cauchy's Residue Theorem, all key to the discipline. Overall, I'm glad I was able to give more undergraduates a brief foray into complex analysis, something beautiful which they might not have seen otherwise.

Are you interested in attending the next Mathematical Insights Night? On April 17th at 6 pm, in the Undergraduate Mathematics Lounge (SAS 2202), David Sieg returns to present on Fourier Series and Amanda Baright on Cardiovascular Models.

Department Happenings

Past, Present . . .

The Mathematics of Card Shuffling - **Dr. Cornelia Van Cott (University of San Francisco)**
October 2022
Abstract: If you're handed an unshuffled deck of cards, you'll likely attempt to do a so-called *perfect shuffle*. A perfect shuffle splits a deck of cards into two equal stacks and then perfectly interlaces the cards from the two stacks. Only experienced gamblers and magicians can perform perfect shuffles reliably, and yet the mathematics behind perfect shuffles has a rich history, including everything from mathematical card tricks to sophisticated research. We'll talk about this together. No card shuffling expertise is required!

Mathematics Alum Career Panel
November 2022
In November 2022, SUM Club hosted a Mathematics Alum Career Panel with panelists coming from various backgrounds. Meet the panelists:

› Dr. Peter McGrath - *an NCSU math professor with areas of expertise in geometric analysis, minimal surfaces, and partial differential equations.*
› Chandra Manivannan (Class of 2020) - *a Technology Development Program Analyst at Accenture with experience in financing, consulting, and analytics*
› Ashley Avis (Class of 2018) - *known as The Ms. Frizzle of Data Science, Ashley has spent her time as a high school math teacher and as a founder of Meet My Future, a youth career education program.*

Hike with Dr. Alina Duca
March 2023
An opportunity for students within and associated with the NC State Math Department to spend time outdoors with our Director of Undergraduate Programs, Dr. Alina Duca, and her dogs. Students recently went to Umstead Park and had fun exploring the rocky terrain by the creek.

Department Happenings

. . . and Future

Second Annual North Carolina State University Integration Bee
February 2023
The North Carolina State University Integration Bee was back for its second year this past February as math enthusiasts competed for the honor of being the Grand Integrator. Hosted by math majors in coordination with SUM Club at NC State, competitors participate in the two-day event consisting of the qualifier round and the Playoffs. This year, Noah Siekierski, a Computer Engineering student, was crowned our Grand Integrator, with Josh Ott (Physics/Math) the runner up, and Megan Vezzetti (Math/Physics) and Arvin Kushwaha (Physics/Math) the semifinalists. In addition, the following students were the additional 2023 Qualifiers: Blan Morrison (Math), Ramkumar Radhakrishnan (Physics), Aashu Parajuli (CSC), Jarod Schneider (Math).

SK Day
Saturday, April 15th, 2023
Sonia Kovalevsky Days (SK Days) have been organized and sponsored by AWM and held at colleges and universities throughout the country for more than 20 years. At NC State, SK Day consists of workshops and lectures for middle and high school girls intended to foster a passion for mathematics and problem-solving. Workshops this year include the mathematics of origami, basic numerical analysis, and an introduction to geometry.

Mathematical Insights Night
Monday, April 17th, 2023, 6 pm @ Undergraduate Mathematics Lounge (SAS 2202)
Come hear talks by and for undergraduates on some interesting mathematical topics outside the regular classroom curriculum. Tentatively, David Sieg will be returning with a presentation on Fourier Series, and Amanda Baright will focus on Cardiovascular Modeling. More details to come.
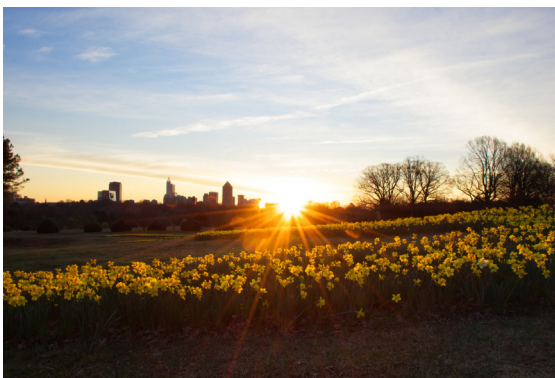
End of Semester Celebration and Hangout
Saturday, April 29th, 2023 - 1 pm to 3 pm
Come to Dorthea Dix to enjoy snacks, friends, and good times on a Saturday afternoon in between exams. We'll have cornhole, and you can bring board games if you have any! You're also more than welcome to bring any food you would like to this event.

Please RSVP by 4/24 via the form in the SUM email update (or email ncsusumclub@ncsu.edu)

SUM Club

The Society for Undergraduate Mathematics (SUM Club) is a student organization for students passionate about mathematics. We connect math undergrads and provide students with academic and professional development, leadership, and service opportunities. This is accomplished through social and outreach activities, presentations at meetings, career events, and other college- and university-wide involvement. Open to any student, math major, or otherwise, we meet on Mondays at 6:00 pm in the Undergraduate Math Lounge (SAS 2202) to get to know one another, do math puzzles, play games, learn together, and perform outreach.

The club hosts undergraduates, graduate students, and professionals to share their experiences and knowledge. SUM Club supports the Raleigh community through participation in programs like Service Raleigh and Washington Elementary Math and Science Night. We hope to continue to create a strong undergraduate mathematics community.

We would love to have more people involved! Email us at ncsusumclub@ncsu.edu with any questions or to be added to our email list.

Stat Club

If you are interested in statistics or related professions or just want to meet and socialize with other statistics lovers, come join Stat Club. The purpose of the club is to expose people to the endless applications of statistics and what a career in statistics looks like by bringing in guest speakers from industry and academia. This is also a great way for members to network with industry professionals, NCSU faculty, and other statistics majors. Our meetings also consist of workshops to hone your marketability when applying for internships and opportunities. If you have any questions or want to be added to the mailing list, please email us at statistics-club@ncsu.edu. We hope to see you all soon!

Sports Analytics Club

The Sports Analytics Club at NC State is a student-run organization committed to the quantitative analysis of sports strategy and management. This club is open to all students and faculty members of NCSU. The club encourages and enables students to share ideas and complete research projects on any topic related to sports statistics. We meet weekly on Monday nights at 6:30 pm in SAS Hall, room 1216. Email sportsanalytics@ncsu.edu if you would like to join our email list.

Association for Women in Mathematics

The purpose of the Association for Women in Mathematics at NC State is to encourage women and girls to study and have active careers in the mathematical sciences and to promote equal opportunity and equal treatment of women and girls in the mathematical sciences. Events held by AWM include Sonia Kovalevsky Day on April 15, 2023, and an annual Math Research Competition.

Putnam Club

2022 NCSU Putnam Winners (From left: Jarod Schneider, Mason McElroy, Etienne Phillips)

The Putnam Competition Club is a weekly problem-solving club based around preparation for the prestigious William Lowell Putnam undergraduate math competition. The Putnam Competition is hosted once annually in December, and the top scorers have included several respected researchers. Achieving a good score is often a resume booster! During the Putnam Competition Club meetings, we are motivated by solving interesting competition problems and developing problem-solving skills and mathematical knowledge. A typical meeting involves everyone working on trying to solve a problem -- either collaboratively or on their own -- and writing up solutions for practice. No prior competition experience or significant mathematical knowledge is necessary to participate and succeed, as the club is built around developing the necessary skills! Email ecphill6@ncsu.edu if you would like to learn more about The Putnam Competition Club.

Special Topics for Fall 2023

MA 493-001 Math Foundations of Data Science
MA 591-002 Algebraic Aspects of Quantum Computing
MA 591-003 Heegaard Floer Homology
MA 601-001 First Year Graduate Seminar
MA 791-001 Stochastic Analysis and Applications
MA 797-001 Data-Driven Methods for Biological Modeling in Industry
MA 798-001 Matrix Methods in Scientific Computing and Data Science

FIM 590-002 Methods and Techniques for Financial Data

Math Honors Program

The Math Honors Program began in the mid-1960s as a means of encouraging excellent undergraduates to pursue a program that would challenge their abilities and better prepare them for their postgraduate career. Since that time, the program has grown from an average of four to five participants, with one to two completing the program each year, to an average now of about 35–40 participants, with 10–14 students completing the program each year. More than half of the participants are double majoring in math and another area such as physics, computer science, math education, chemistry, engineering or a foreign language.

More information can be found by visiting https://math.sciences.ncsu.edu/undergraduate/undergraduate-programs/math-honors-program/

Student Spotlight:

Highlighting Undergraduate Achievement

Etienne Phillips
2023 Barry Goldwater Scholar

On behalf of the NC State Math Department, congratulations to Etienne Phillips (BS Mathematics '24) for his selection as one of two North Carolina State University's 2023 Barry Goldwater Scholars, with Katherine Traynelis (BS Chemical Engineering '24) being the second student selected. His research projects range over various topics with mentors from NC State (Laura Colmenarejo, Lorena Bociu, Hooh Hong) and Michigan State University (Aklilu Zeleke). Etienne is one of 413 college students from across the United States to receive the distinguished honor of being named a Goldwater Scholar. In addition, Goldwater Scholars have gone on to win an impressive array of prestigious post-graduate fellowships, among which are the NSF Graduate Research Fellowship, Rhodes Scholarship, Marshall Scholarship, Churchill Scholarship, Hertz Fellowship, DOE Computation Science Graduate Fellowship, and the National Defense Science and Engineering Graduate Fellowship. Give a big congratulations to Etienne when you see him. We can't wait to see his contributions to mathematics throughout his career!

Undergraduate Updates

Check out what some of our current students have been up to!

Jamie Loring

My name is Jamie Loring, and I am a senior graduating in May from NC State. I am double majoring in applied mathematics and statistics. Upon graduation, I will transition into a full-time role at SAS in Cary, NC. I have been working as an intern at SAS since May 2022, and I am beyond excited to move forward with a full-time position within the company. Beginning in the Fall of 2024, I will begin my Master's of Statistics at NC State in a part-time and completely online format. While I know it'll be a challenge to balance full-time work with a part-time school load, I am looking forward to spending the next year getting acclimated to my full-time position without the added stress of school, and I know I will be up for such a challenge by the time the Fall 2024 semester rolls around. I am very thankful for all the opportunities I've had as an undergraduate student at NC State, and I am so excited to return to this institution for my Master's degree next year. Go Pack!

Lilah Board

I will graduate from NC State this spring with a bachelor's degree in mathematics. My time as an undergraduate student has prepared me well for my future educational and career goals. For the next two years, I will earn my master's degree in mathematics from Wake Forest University. I plan to use these degrees to teach math at the community college level.

Nick Gawron

My name is Nicholas Gawron, and I am a graduate student finishing up my Masters in Statistics this upcoming May from NC State. This past May, I graduated with my major in Mathematics. After I graduate, I will transition into a full-time role in Data Science but am currently considering offers between a few places in the Tech and Energy sectors. I have been working as a Graduate Assistant /Data Analyst for the Poole College of Management, improving academic advising with data. My Masters was definitely a transition between the more theoretical math degree to the applied ideas in the statistics program. That being said, my Math degree prepared me to tackle all the problems I faced with a first principles approach. I appreciate all the opportunities I've had to grow and learn as an undergraduate and graduate student at NC State Math and Statistics!

> *For the things of this world cannot be made known without a knowledge of mathematics.*
> *- Roger Bacon*

Puzzles, Jokes, Etc.

Cartoon found in 1986-87 Math Newsletter
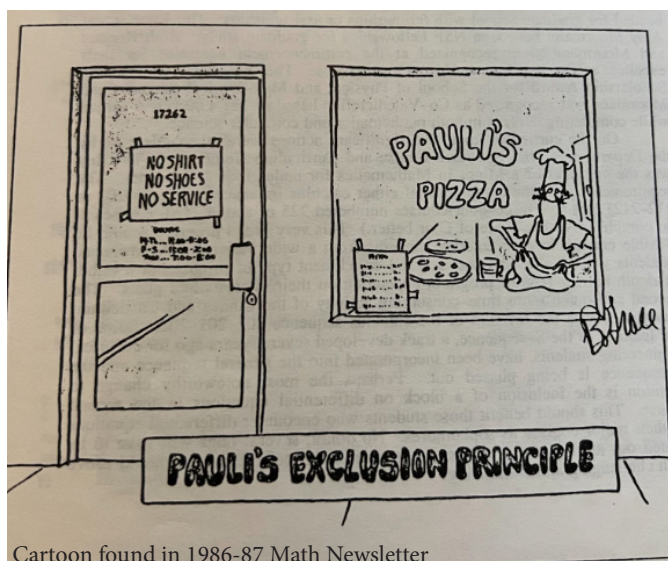
"Physics is much too difficult for physicists."
  - David Hilbert

1.

Q: In a certain community there are 1000 married couples. Two-thirds of the husbands who are taller than their wives are also heavier and three-quarters of the husbands who are heavier than their wives are also taller. If 120 wives are taller and heavier than their husbands, how many husbands are taller and heavier than their wives?

Taken from 1986-87 Math Newsletter

2.

What do you say to a parrot that should go on a diet?

3.

How many ways are there to split the integers 1 through 14 into 7 pairs such that in each pair, the greater number is at least 2 times the lesser number?

108 (B) 120 (C) 126 (D) 132 (E) 144

Taken from the 2022 AMC 10A Problems

"The heart of mathematics is its problems."
  - Paul Halmos

4.

What do you call an insect that isn't feeling well?

1. 480   2. "Poly, no meals"   3. 480   4. A secant