# NC State Undergraduate Mathematics

**Fall 2020**

# Newsletter

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### SUM Club

# Staying Strong During COVID-19
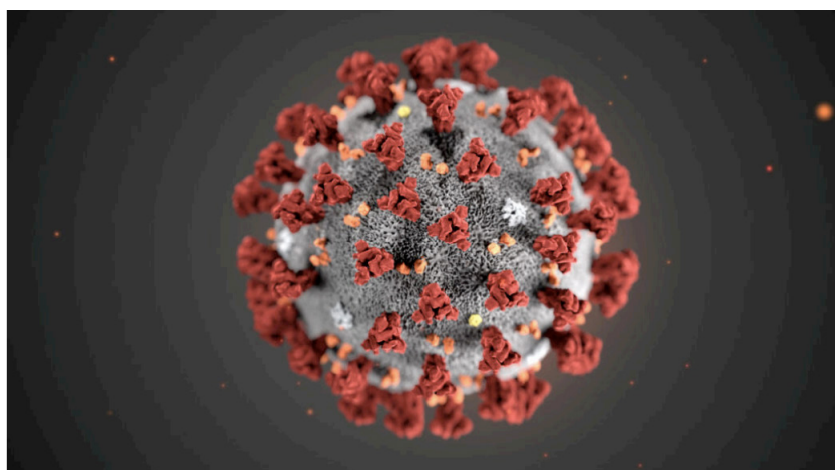


A semester of online learning is never easy, but here in the math department we want to support you in any way possible. In this newsletter, we hope you find some respite from the stress of classes, jobs, or anything else which may be troubling you.

### Career Advice

For many students, particularly graduating seniors, the current situation has made applying and searching for jobs and internships difficult, but don't worry! The Career Development Center is offering Zoom-based career counseling appointments with career counselors at the center. Appointments can be scheduled through ePack or by emailing the appropriate career counselor—Wes Wade, for students in the College of Sciences. More career resources can be found at careers.dasa.ncsu.edu/coronavirus/.

### Mental Health

For personal assistance, note that the Counseling Center remains available by phone and offers appointments through secure teleconferencing. The Counseling Center specifically maintains an information page at counseling.dasa.ncsu.edu/coronavirus/. For broader information, the university maintains its primary Coronavirus Response Page at go.ncsu.edu/coronavirus.

### Math Social Events

We enjoyed seeing everyone at the Zoom meetup on Oct. 1, and we are planning to do more of these through the rest of the semester. Dr. Duca will send out emails ahead of these, so check your inbox! For a less structured environment, consider joining the Math Lounge Discord Server at https://discord.gg/ewKdm8. Get help with homework, discuss sandwiches, or play Among Us with other math majors.

### Class Registration

The class schedule for Spring 2021 opens on October 8th, and enrollment dates open from October 16th through November 6th. You will need to meet with your advisors ahead of time to have your hold lifted and discuss what classes you need to satisfy your degree requirements. Check out your Degree Audit and Pack Planner on MyPack to help chart out your courses.
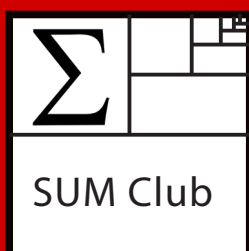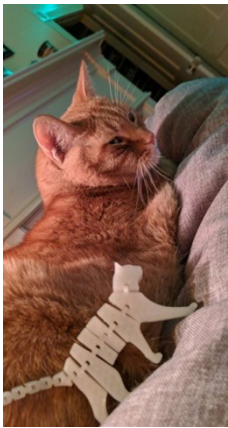
# Adventures in Zoom

*Zoom classes are a decidedly distinct experience in many ways. Here we highlight some of the zany moments math majors have experienced over the past months! (And some of the adorable pets sharing their screens.)*

**What's your favorite zoom background?**
The fire nation school classroom from Avatar the Last Airbender.
—Daniel Ferriter

**What new skills have you acquired from teaching virtually?**
I've definitely learned how to be more compassionate.  It's easy to forget all the expected and unexpected difficulties that can go along with being a student but teaching virtually brings those things to the surface so much more prominently.
—Tye Lidman

**Weirdest thing you've seen on zoom?**
A most spectacular cupboard filled floor-to-ceiling with potato chips.  —Elisabeth Brown

$$\Delta x = \frac{3-0}{3} = 1$$

$$f(x) = 9 - x^2$$

$$\text{Area estimate} = \sum_{i=1}^{3} f(x_i) \Delta x \quad \text{right endpoint}$$

$$= f(1)(1) + f(2)(1) + f(3)(1)$$

$$= (9-1^2) + (9-2^2) + (9-3^2)$$

$$= 8 + 5 + 0$$

$$= 13 \quad \text{underestimate!}$$

**What's the cutest pet you've seen?**
The National Zoo has a six week old panda cub.
— Peter McGrath

**I hope everyone is doing well. Remember to take time for yourself and to prioritize your mental health. We are literally living through a pandemic y'all, take care of yourself.**

— Minoucha Previlon

**What's the weirdest zoom call location you've seen?**
Bathroom!
— Annamarie Leske

# Putnam Math Competition



The William Lowell Putnam Competition is a preeminent mathematics competition for undergraduate college students in the United States and Canada. The next Putnam will be offered on February 21, 2021. Contact ncsusumclub@ncsu.edu to learn more about participating.

The 2019 NCSU team came in very strong, ranking 61 out of 488 competing teams from the US and Canada, that is, ranking in the 87th percentile. NCSU has increased its ranking in this competition in each of the past 3 years. Among the NCSU contestants, the top three places go to math majors Bryant Cox, Everett Meekins, and Grant Barkley. Congratulations to all!

# Math Puzzle Section
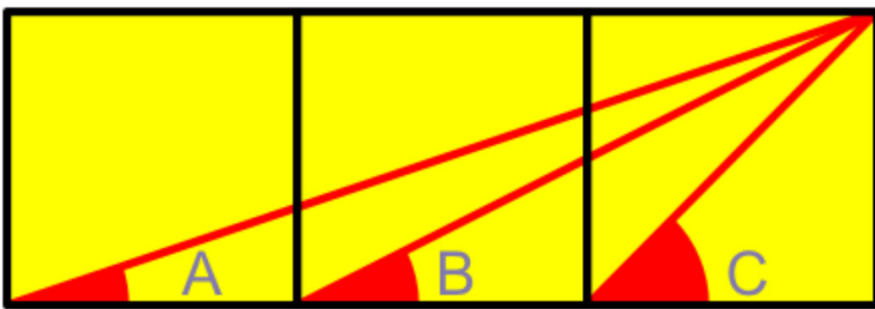


## Trying with Triangles

Show with basic geometry (no trig) that A+B=C

## Operation Madness

Using the numbers 100, 50, 10, 6, 3, and 2 and the operations (+,−,x,÷) in any order, create the number 422.

# SUM Club



The Society for Undergraduate Mathematics (SUM Club) is a student organization for students with a passion for 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 the first and third Thursday of every month 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.

# MIC Club

The Mathematical Insights Club (MIC) aims to foster an environment where undergraduate students can delve deeper into the field of mathematics. We will discuss undergraduate research, interesting papers, and math history. MIC is a platform for students to share their math interests. Each month two students give a short informal presentation on something they have found interesting, whether it is their own research, a published article, a fun problem, or math history. Come to MIC and advance your ability to discuss mathematics and give your CV a boost! We hope to see you there! mathematicalinsightsclub@ncsu.edu

# Sports Analytics Club

The Sports Analytics Club at NC State is a student-run, student-driven club which brings together undergraduates, grad students, and faculty who are interested in the quantitative analysis of sports. We enable members to work on individual and group research projects under the guidance of grad students and our faculty advisors. In addition, we play fantasy sports and prediction contests together. Email sportsanalytics@ncsu. edu if you would like to join 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 really 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 next meeting will be October 31st where we will have a Halloween social. Come stop by for some tricks and treats and great times with new and old friends. If you have any questions or want to be added to the mailing list please email Jordan Lewis at jslewis9@ncsu.edu. We hope to see you all soon!

# Graeciā Mathēmaticī - A Historically Mathematical Poem

I.
Father Time remembers him well,
Of Alexandria, he did dwell.
Geometry legend, he may be,
It's Elementary my dear, can't you see!

Our hero's writings still do us good,
Main proof techniques learn we should.
Man owes him much for his great knowledge -
Euclid and his postulates, we pay homage.


II.
We will hear of another learned scholar
(All his ideas were worth at least a dollar).
Love for mathemathematics, this man did show,
The soldier who killed him, just didn't know!

Oh, for new horizons, this Great had such affinity,
Gee, what's the deal with this strange idea infinity?!
Himself known as mathematician and inventor,
Archimedes was the greatest Greek experimenter!


III.
Here this math-man, who is also quite cool,
Is also an alumnus of the Alexandrian school.
The genius himself, the algebraic father,
Legend says, complicated equations, him did not bother.

The writings of he are quite worth a look,
Great Fermat even wrote a tiny note inside this man's book.
Algebraist and creator of symbols new,
Diophantus - his epitaph is Puzzle No. 142.

# Math Honors Program

Currently we have 40 students active in the Math Honors Program. Lately about 12% of math graduates complete the Math Honors Program and nearly 90% of those students go on to excellent graduate schools or find great jobs. In the past, schools they have attended include Berkeley, Princeton, Stanford, MIT, Cornell, NYU, UCLA, Cambridge and many other top universities. Math honors students have received 25 NSF Fellowships AND 3 DoD Fellowships for graduate school as well as 9 Goldwater Scholarships, 1 Churchill Scholarship and 3 Gates Fellowships. Besides taking a number of challenging advanced Mathematics courses, Math Honors students also do research in Mathematics either at NC State or at a summer REU Program (Research Experience for Undergraduates) nationwide. More than 36 students have participated in a study abroad program focusing on Mathematics via the BSM Program (Budapest Semesters in Mathematics) or the MiM Program (Math in Moscow Program).

Participation in REUs, BSM, MiM and doing undergraduate research in mathematics has helped greatly the success of honors students getting accepted into numerous excellent graduate schools. Dr. Min Kang is happy to talk to any student interested in undergraduate research opportunity in Mathematics. Feel free to email her at mkang2@ncsu.edu for further information or a zoom meeting. More information about the program can be found on the Math Honors website at https://math.sciences.ncsu.edu/undergraduate/undergraduate-programs/math-honors-program/

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### Welcome to the Math Honors Program!

Zack Bonds
Simon Campos Greenblatt
Hang Nguyen
Johnathan Rhyne
Tanvi Thummar
Noah Wolfe

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For those who have interest in working as a researcher after graduating, participating in undergraduate research is a great asset. However, many students don't know how to locate or search for undergraduate research opportunities. An unofficial list of some undergraduate research opportunities and relevant internships can be found at www.go.ncsu.edu/sum_club_research

# Advanced Mathematics Courses

### Section 050 Courses

Are you looking for a course with a tight knit community of math majors? If so you should consider enrolling in section 050 courses for the Spring of 2020. These sections of certain math courses are restricted to any mathematics major and honors student. In addition the professors teaching these courses specifically want to teach math majors.

### MA719: Optimization by Vector Space Methods
Instructor: Patrick Combettes

The goal of modern optimization is the analysis and the construction of equilibria such as minimizers of functionals, saddle points, solutions to variational inequalities and monotone inclusions, solutions to minimax problems and games. This course provides an account of the essential tools of modern optimization in the setting of Banach spaces. The theoretical foundations will be developed from first principles and in tight interactions with application domains such as control theory, signal processing, game theory, partial differential equations, statistics, mechanics, inverse problems, machine learning, finance, and optimal transportation.

# Advanced Mathematics Courses

## MA755: Riemannian Geometry
Instructor: Peter McGrath

Riemann Geometry is an exciting branch of mathematics which extends notions of length, area, and curvature to non-Euclidean spaces. Riemannian Geometry is the mathematical language in which Einstein's theory of General Relativity is expressed and has important applications to other areas of the mathematical sciences, including in robotics and in data science. Topics include Riemannian metrics, connections, covariant derivatives, parallel translation, Riemannian [or Levi-Civita] connection, geodesics and distance, curvature tensor, Bianchi identities, Ricci and scalar curvatures, isometric embeddings, Riemannian submanifolds, hypersurfaces, Gauss Bonnet Theorem; applications and connections to other fields.

## BMA 815: Special Topics - Writing science effectively: Principles and practice
Instructor: Kevin Gross

Are you eager to develop your skills as a writer in a light-hearted, small group setting? If so, consider this workshop-style course that will study how to write effective scholarly prose. The backbone of the course will be a group study of Joseph M. Williams's classic writing handbook Style: Lessons in Clarity and Grace, soon to be in its 13th edition and co-authored by Joseph Bizup. This text offers practical, lucid guidance to help writers communicate complex ideas clearly. We will also study George Gopen's Reader Expectation Approach and intersperse occasional readings from other sources.

Each week, students will study a chapter or two of the text or a related reading. We will then spend our time together practicing the ideas encountered with hands-on, small-group exercises. We will emphasize revision and practice and will learn from each other along the way.

This is not a class in how to write a scientific paper. I expect students to know the basic format and mechanics of writing such a paper. Instead, this is a class about writing better sentences, better paragraphs, and better sections within the larger context of a scientific paper, or any other scholarly form. We will not take any one author's advice as inviolate, but instead will critically examine what makes writing effective. We will welcome diverse points of view.

## MA587: Finite elements methods for differential equations
Prerequisites: A reasonable background in linear algebra, numerical analysis, and differential equations
Instructor: Zhilin Li

The Finite Element Method is a MUST for applied mathematicians, engineers, or anyone who uses computers to solve problems that involve ordinary/partial differential equations. In this course, we use one-dimensional problems to introduce the finite element method, including algorithm implementations, theoretical backgrounds, and applications. Then we will carry over the essential tools to two dimensions. We will discuss some commonly used finite element spaces, error analysis, and other related topics. Efforts will also be made on issues of implementation and related software packages. Using the data from \Matlab mesh generator, the students will be able to implement the finite element method using their favorite computer languages for complicated geometries in two dimensions.

# Puzzle Solutions

For puzzle solutions, contact ncsusumclub@ncsu.edu.