NC State Undergraduate Mathematics

Spring 2021

Newsletter

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SUM Club

College Life In Person

Attention: All students can pre-register for a vaccine from NC State at: https://ncsuvam.service-now.com/vam

In-person events remain few and far between this semester, but starting in the fall, NC State has announced a return to (mostly) regular order. Freshman and sophomore math students may not have experienced some of the particular joys and challenges associated with fully in-person college life. In this newsletter, we aim to offer some relief from current stresses, along with some helpful advice for the coming year.

Get your steps in! 15 minutes is a long time between Zooms, but not so much to walk from SAS to Jordan Hall. Plan your schedule and leg day accordingly.

Find some food. The only main campus dining locations relatively near to classes are Talley Student Union and the Atrium; make sure to schedule enough time to order, travel, and eat.

Hillsborough and company. A great next year on Hillsborough street and in nearby shopping centers like Mission Valley and Cameron Village.

Map it out. Campus is pretty large; if you're not familiar, spend some time walking around to your classes to learn where buildings are.

Find a productive location. A major challenge with quarantine is having work, sleep, and play in the same location. Try switching it up to help your productivity.

Go to some events! Making friends is an exciting part of college, and attending campus or club events is a great way to meet new people and get free food.

Don't stress over grades. The end of the pandemic may mean the end to enhanced S/U grading. Keep in mind that a bad test does not guarantee a bad grade in a class. Talk with your professors on how you can improve for next time. Challenging yourself and gaining valuable skills are often more important than getting straight A's, so try to focus on learning from your classes, rather

Taking a Break

Our semesters in quarantine remain unusually challenging. Here, math majors and faculty offer their adaptations to life indoors, along with their best stress-relieving pastimes.

Favorite Stress-Relievers:

Tennis, running, and walking
—Eli Hunter, Junior

Rock Climbing, Organizing (and re-organizing my room), Hiking and Painting
—Beth Rodgers, Junior

Play guitar, playing disc golf, watching TV
—Daniel Katowitz, Junior

Running, skateboarding, watching Schitt's Creek, playing Codenames
—Tye Lidman, Assistant Professor

Group fitness workouts "with" my family up north via Zoom
—Elisabeth Brown, Teaching Assistant Professor

Watching TV shows/movies, hanging out with friends, playing sports
— Jamie Loring, Sophomore

Reading, Personal Art Projects, Hiking, and Playing with Pet
— Amanda Baright, Freshman

Walk the dog, play piano
— Linda Balazich, Administrative Assistant

Hiking, reading to my children
—Nathan Reading, Professor

Playing Chess
—Bryant Cox, Senior

Watch movies
— Xuchen Liu

How have you adapted to time spent indoors?

I enjoy the time spent indoors, and this is what I'd like to do before the pandemic — Li Tang, Freshman

I make sure to go outside at least once a day!
—Ashly Dzaahabiyyah, Senior

Taking time to do the things I enjoy has been critical. It's easy to feel like, since you don't have many places to go, you should be working 24/7 — Annamarie Leske, Sophomore

I spend a lot of time with my 2-year old, Ella. On rainy days, we've been doing little science experiments together.
— Stepan Paul, Teaching Assistant Professor

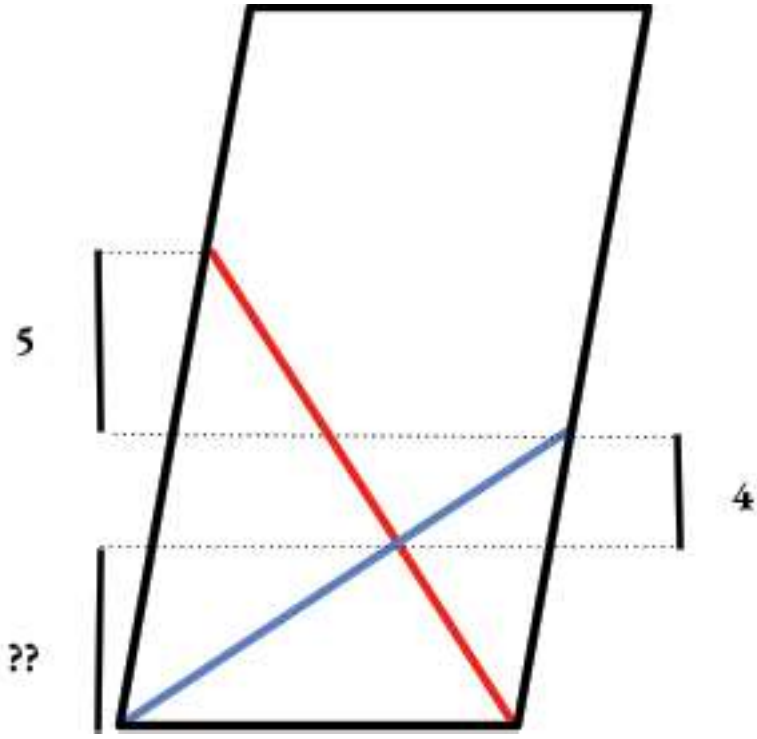
I haven't
— Devon Troester, Junior

Gotten lots of plants that bring the outdoors into my home!
—Leah Rolf, Senior

Math Puzzle Page

Two Crossed Ladders in an Alley

Two ladders are placed crosswise in an alley to form a lopsided X-shape. The walls of the alley are not quite vertical, but are parallel to each other. The ground is flat and horizontal. The bottom of each ladder is placed against the opposite wall. The top of the longer ladder touches the alley wall 5 feet vertically higher than the top of the shorter ladder touches the opposite wall, which in turn is 4 feet vertically higher than the intersection of the two ladders. How high vertically above the ground is that intersection? (image is not to scale)



The Ant and the Box

A 12 by 25 by 36 cm cereal box is lying on the floor on one of its 25 by 36 cm faces. An ant, located at one of the bottom corners of the box, must crawl along the outside of the box to reach the opposite bottom corner. What is the length of the shortest such path?

Note: The ant can walk on any of the five faces of the box, except for the bottom face, which is flush in contact with the floor. It can crawl along any of the edges. It cannot crawl under the box.

Three Children

On the first day of a new job, a colleague invites you around for a barbecue. As the two of you arrive at his home, a young boy throws open the door to welcome his father. "My other two kids will be home soon!" remarks your colleague.

Waiting in the kitchen while your colleague gets some drinks from the basement, you notice a letter from the principal of the local school tacked to the noticeboard. "Dear Parents," it begins, "This is the time of year when I write to all parents, such as yourselves, who have a girl or girls in the school, asking you to volunteer your time to help the girls' soccer team." "Hmmm," you think to yourself, "clearly they have at least one of each!"

This, of course, leaves two possibilities: two boys and a girl, or

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 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!

Math Honors Program

For Spring of 2021, new students who joined the Math Honors Program will be updated in March. Currently we have 41 students active in the Math Honors Program. Lately about 14% of math graduates complete the Math Honors Program and nearly 92% 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/

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

BMA 771, Biomathematics I
Instructor: Dr. Flores

This course provides an introduction to modeling biological systems. We focus on models that employ ordinary differential equations (ODEs). The aim is to develop an appreciation for the formulation, analysis, interpretation and criticism of mathematical models in biology. The course will develop the theory of ordinary differential equations, worrying less about the more esoteric mathematical aspects of the theory than would be the case in an applied math course on ODEs, and instead focusing on biological motivation and interpretation. By the end of the course you should be able to construct, analyze, interpret and criticize ordinary differential equation models of biological systems. You should be able to use appropriate analytic, geometric and numerical techniques to study a particular model. You should also have an appreciation of the broad range of behaviors that these models can exhibit and how model behavior can change (for instance as a parameter is varied). This course is suitable for advanced undergraduate and graduate students. Even though this is a 700 level class, enrollment is open to undergraduates. You are expected to have passed multivariate calculus and linear algebra, and you should remember the material well enough to build on it. Note, a course in differential equations is not required. Some basic knowledge of dynamics of biological systems is preferable, but not necessary.

Advanced Mathematics Courses

MA 430: Mathematical Models in the Physical Sciences

Instructor: Dr. Fulp

There will be a short introduction to linear geometry and how it is utilized in Newtonian mechanics, special relativity, and Hamiltonian mechanics (symplectic geometry). There will be an introduction to differential forms on subsets of n- dimensional vector space with emphasis on n=2,3,4. Stokes theorem, the divergence theorem, Greens theorem, from vector calculus all become a single theorem in this formalism. There will be an extensive, but elementary, treatment of Maxwell's electrodynamic equations, as vector calculus equations, as equations involving integrals, and finally as equations involving differential forms. His equations reduce to two very simple equations using differential forms and these easily generalize to modern gauge theory.

This course does qualify as a modelling course required of undergraduate math majors.

Finally, the prerequisites for the course are: the third course in calculus (MA 242), some matrix theory (either from linear algebra or from what you learned in a differential equations course), and either a very good course in high school physics or a single course in physics at the university level. Physical concepts will be explained as needed.

MA 591 002, Foundation of Quantum Computation

Instructor: Dr. Jing

Quantum computation and quantum information has been an active and far-reaching interdisciplinary research area recently. The possibility and promise of new computational protocol has attracted many researchers from engineering, physics, computer science and mathematics. In 1994, Peter Shor shocked the scientific world with a quantum algorithm of factorizing integers that could potentially break the NP barrier in the usual computer science. In theory quantum computer is based on quantum mechanical principles to process information and computation. Though quantum computers have not be realized in reality, many experts agree that we are probably at the dawn of new era of quantum computers.

The course intends to introduce students to basic mathematical foundation of quantum computation. The materials will prepare students with the mathematical knowledge and tools needed for further research in the area. After covering basic algebraic materials used in quantum mechanics, we will discuss basic concepts and problems on quantum states, density matrices, separability, local unitary equivalence, decoherence, quantum resource and quantum processing etc. in simple mathematical language. A few quantum algorithms (Shor's factorization, quantum queuing etc) will also be studied in the course.

I will keep the course's prerequisites at minimum. Familiarity with linear algebra and quantum mechanics is helpful, but not required, as I will review the needed materials in the class. The class should be accessible

Math for Social Justice

Instructor: Dr. Lindman

In this class, we will study how mathematics can be applied to social justice issues. Potential topics, depending on the interests of the class, may include analyzing political districting (gerrymandering), modeling social change, and studying human trafficking. In the process, we will learn and develop significant mathematical theory in the areas relevant to the issues, such as metric geometry and graph theory.

Prerequisites: MA225 and a willingness to engage in discussions around social issues.