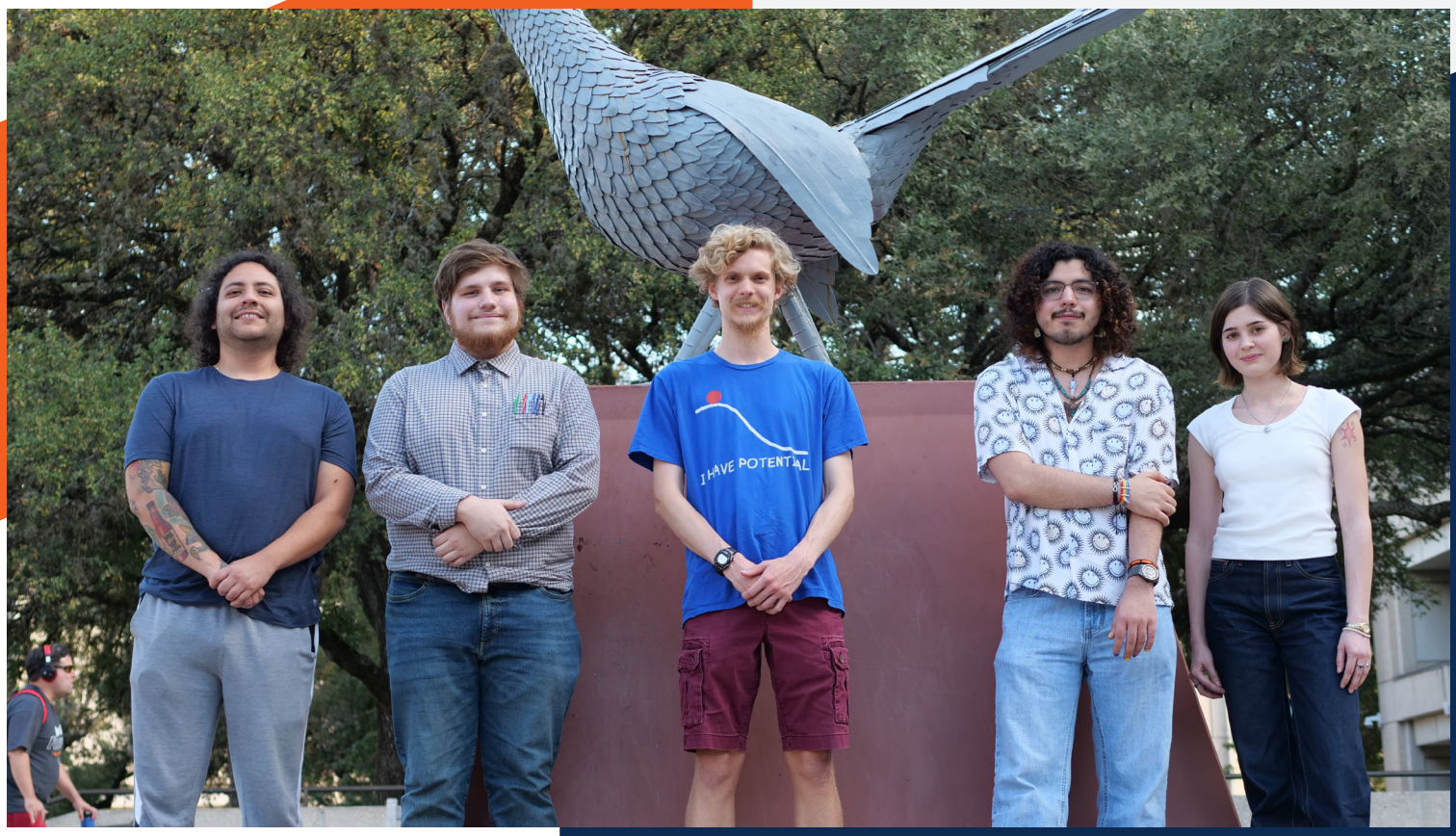
THE IRRATIONAL ROADRUNNER

AN APERIODIC NEWSLETTER OF THE DEPARTMENT OF MATHEMATICS AT UT SAN ANTONIO



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On the cover: UT San Antonio Math students who will be presenting at the 2025 Texas Undergraduate Mathematics Research Conference. From left to right: Ken Soto, Josh Hamilton, Nick Stipanovic, Luca Iovino, Olivia Aubone (Nick, in the center, is from Trinity, but he is doing his honor thesis research at UT San Antonio)

Chair's Welcome

Welcome (back!) to the Fall 2025 semester. Whether you are in your first semester or your last year, we are excited to have you as math students at UT San Antonio! I encourage you to keep this newsletter handy if you feel it contains relevant information. Feel free to share it with your friends too and use it as a tool to recruit them to be new math majors! I am in my first year as Chair, my third year at UT San Antonio, and my 25th year in academia. There are different hoops at each university but the core of what develops you into the next generation of mathematicians remains relatively constant. As a math major or grad student, if you do not become a teacher or professor, you will not likely end up in a job where you are taking derivatives or proving theorems. Besides those skills, what you learn as a math major and as a math grad student is how to think critically, how to abstract, and how to solve problems that you haven't seen before. These are the skills that you will need in a fast-paced, ever-changing world.

A huge thrust that you see daily or that will affect you behind the scenes is all things AI. You see it in your google searches with "AI Overview" written at the top or in the suggestions for what comes next in the email or document you are typing. At the root of this explosion and intertwined throughout is mathematics. This includes topics from areas as seemingly diverse as linear algebra, probability, and scientific programming, all of which we offer here in our Math Department. You can find articles stating that coding will be made obsolete by AI. This may be true for entry level coding; however, abstraction to how to code AI and with caveats such as wanting to create as much as possible an unbiased system is at heart a mathematical problem.

A second thrust that is behind the scenes even more but is arguably more revolutionary deals with quantum information. When I was in school, quantum computing felt like a distant dream—but today it is rapidly becoming a reality. The two biggest challenges to building quantum computers are cryptography and error correction. Cryptography, rooted in deep mathematics, secures our communication and keeps sensitive data safe from hackers. Banks, governments, and tech companies rely on it every day. But did you know that a powerful quantum algorithm, called Shor's algorithm, could one day break the encryption we depend on—if we had a large enough quantum computer? How large? Researchers estimate around one million qubits. The main issue is that quantum computers are fragile and prone to errors, which means they need sophisticated error-correcting codes to keep their computations stable. Linear algebra over finite fields underlies the approach to solving this. In both cryptography and error correction, mathematics lies at the heart of the challenge—and it will be essential in shaping the future of secure and reliable quantum technologies.

A third thrust that has been in the forefront in recent years is mathematical biology. Whether it is looking at the transmission of diseases, examining how physiological systems work, or analyzing any number of other biological systems, mathematics can provide a vehicle for analytically and computationally modeling and analyzing such systems through the field of mathematical biology.

Finally, if you're reading this far, you very likely love math. Undoubtedly, you know people that have had a less-than-ideal experience. If you have an interest in creating opportunities for students to experience deep conceptual understanding and joyful creativity in math, math education is the perfect opportunity for you. You will dabble in many of the above areas but will home in on how to best help others learn.

We have degrees that will stretch you and prepare you to make an impact in this world! We have faculty that will help you learn the material and fellow students that will climb the proverbial mountain with you! Give us a chance and bring a friend!!

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Students, students, students!!!

It's never too early to start thinking about careers and what you want to do in life. It's also rarely too late to change your mind! Whether you are an **undergraduate student** or a **graduate student**, asking questions from those who have been through or are going through the process is the best way to learn! Things that you may consider, whatever your level:

- Do you know what areas of math you like?
- Do you prefer more theory or application?
- Do you think you may like research in math?
- Do you like to help others learn?
- Are you just good at math but really want a job to go make money?

There's nothing wrong with the last question!! But knowing the answers to the first ones can inform that. **There will be information in the ensuing pages that applies to each group.**

Math Gym in FLN 3.02.08

Students in lower division math courses

A lot of math you have taken up to this point may have traditionally been computational in nature but you have been exposed to a deeper way of thinking about math in MAT 1313 Algebra and Number Systems, and then in MAT 2313 Combinatorics and Probability. Even if you love the computational aspect, knowing the theory will make you stronger in the computations! Enjoy the aspects you love but don't shy away from the theory. Regardless of whether your major is Math, Math for Teaching, or MDC, there is a core set of math courses you will take. Talk with your fellow classmates and the professors teaching the courses you are taking about your plans or lack of them! Sometimes a particular course can change your trajectory. Be open to that and ask! If you haven't been to the **Math Gym in Flawn 3.02.08**, consider going. Not that you necessarily need the help but it's staffed by upper division students and graduate students and you can work with your fellow students on upper division class work too. For the latest hours, please visit: https://sciences.utsa.edu/mathematics/students/math-gym.html.


Students working in the Math Gym.

The Student Success Center (SSC) COS also provides lots of info for students including mentoring, scholarships, programs, etc. Check it out: https://sciences.utsa.edu/student/

A message from the UGAR

Hello math majors! As you register for classes in the Spring and when planning for next year, keep in mind that we have three courses that have a sequel: Differential Equations, Linear Algebra, and Real Analysis. All math majors (that is, for a B.S. in Mathematics, in Mathematics for Teaching, or in Mathematics of Data and Computing) are required to take one or more of the initial courses, depending on concentration, but the sequel is not usually required. For example, DE II is not required of any major. Often, at least in my opinion, the sequel is where things get really interesting and you can apply what you learned in the first course. Other upper division elective courses offer a variety of topics, but these three sequels will help you build a more robust background in those key areas. Please reach out to me at zachery.sharon@utsa.edu with any questions you may have.

Students in upper division math courses

Keep engaging in your classes as well as with your classmates and professors as we work to transform you to be ready for the next level! If you are a junior or sophomore taking junior-level math courses, this is the perfect time to start thinking about **paid math research during the summer**. The National Science foundation (NSF) funds many sites where undergraduate students are paid to learn and conduct research in math through **Research Experiences for Undergraduates (REUs)**. Different locations have different requirements so don't just assume it's not for you. Please explore the links below and ask your math faculty for advice if you are unsure. These can be competitive so if you are considering, don't just apply to one. At the same time, you have to have an interest in the area so it's probably not wise to apply to 20 either.

Some links for REU sites and other student opportunities:

From the AMS (American Mathematical Society): https://www.ams.org/learning-careers/students/emp-reu
From the NSF https://www.nsf.gov/funding/initiatives/reu/search?f%5b0%5d=reu_research_area:25741
Independent compilation: https://sites.google.com/view/mathreu
From SIAM: https://www.siam.org/programs-initiatives/education-resources/resources-for-undergraduates/
From NSA: **https://apply.intelligencecareers.gov/student-tiles** (see link for Director's Summer Program (DSP))

UT San Antonio math students working on research.

Research at UT San Antonio

If you can't apply or don't get in (or even if you do!!), consider asking one of your professors if they have research projects that you could work on. Not all do, and it would be an indpendent time commitment, but the opportunity is life-changing! Ask, and if the answer is no, ask someone else. Check out our department website for some of the research areas that our faculty work in.

Present your research at conferences

Once your research, whether from an REU or a professor here, gets to a certain place, you should consider presenting the work in a conference. There are many conferences that allow students to present and there is often funding available for students to attend. Even if it a local conference, it can be worth the day trip or weekend excursion to go. This applies to both undergraduate students and graduate students. Organizations that are particularly student friendly in terms of opportunities include AMS, MMA (Mathematical Association of America), SIAM (Society for Industrial and Applied Mathematics), SACNAS (Society for the Advancement of Chicanos and Native Americans in Science – although anyone is welcome to join and participate!). Some of our undergraduate students, featured here and on the front cover, will represent UT San Antonio at the Texas Undergraduate Mathematics Conference, October 17-18. They will present their cutting-edge research on model theory, noncommutative algebra, and quantum theory. Please congratulate the team and root for them! Getting involved in research as an undergraduate will be the best avenue for you to start attending and even presenting in conferences.

Graduate students!

The combination of the GAR, your classmates, your professors, and your grit will get you through. Three of those require interaction so please reach out - we are here to help. Here are some notes from your GAR:

1. Please contact the math GAR, Jose Iovino, for guidance on course selection for Spring 2026.
2. The graduate degree program flowchart has been updated. The updated version provides details about the thesis option and the qualifying exam tracks. We will start to date the document to avoid confusion: https://sciences.utsa.edu/_documents/mathematics/grad-degree-flowcharts.pdf
3. The two-year course rotation has been updated as well. Note that Algebra I is listed among the core courses, and that it will be offered every year. https://sciences.utsa.edu/_documents/mathematics/grad-course-plan.pdf
4. If your picture and profile do not appear in the graduate student gallery, or if you need to update your photo or profile, please contact Jose Iovino. The link for the gallery is given below.

Attention seniors and first-year graduate students!

The National Science Foundation offers 3-year fellowships to study in a doctoral or research-based master's program. If you are **graduating senior** and interested in graduate school, you don't need to know yet where you are going – the award follows you wherever you enroll! The information that you are thinking of using for your graduate school applications can serve as a springboard for this application. If you are a **current graduate student**, identifying a thesis or advisor will help you focus your ideas. The process is highly competitive but we have some stellar students and you won't get it if you don't apply! The application deadline is November 14, 2025. Please visit https://www.nsf.gov/funding/opportunities/grfp-nsf-graduate-research-fellowship-program/nsf25-547/solicitation for additional and complete information.

Present your research at conferences

Graduate students, the same blurb for undergraduates about presenting research at seminars and conferences applies to you! For all students, it is important to keep in mind that progress on research depends on many factors, time of which is only one of them. Your advisor will have the best idea of when you work is at a place in which you can present. Being in regular contact with your research advisor goes a long way toward avoiding miscommunication. Whether you are thinking about a doctoral program or industry, having your presentation skills honed during presentations will be a great asset! Whether you know what you want to do after your time at UT San Antonio or you have no idea, search through some of the math societies to see if resources they have catch your eye:

AMS: https://www.ams.org/learning-careers/students
MAA: https://maa.org/audience/students/
SIAM: https://www.siam.org/programs-initiatives/programs/

Graduate student photo gallery

We have a great **gallery of our current graduate students**, so please check that out if you haven't already done so: https://sciences.utsa.edu/mathematics/students/grad-students.html

Seminars and colloquia

We will often have colloquia or seminars, usually on Fridays 4-5pm when they happen. Please look for flyers on the bulletin board outside the department or check on the math webpage on the right tab under Seminars & Events. All students, undergrad or grad, as well as faculty or others are welcome to attend. Cookies are served!

UTeachSA STEM Teacher Preparation at UT San Antonio

Have you ever thought about becoming a mathematics teacher? The UTeachSA Teaching Program is designed for mathematics and science majors interested in trying out teaching as a possible career option. UTeachSA makes it possible for you to get both your math degree as well as a secondary teaching certification. The best part for you is that we reimburse the tuition for you to take two introductory courses to decide if teaching is a good fit for you. There are no required textbooks and no finals. The classes require you to complete fieldwork with a mentor at a local public school (elementary, middle and high school) campuses. There is no commitment. There are additional support and scholarships you can apply for if you decide to continue with the program. And if you decide to teach, teachers in San Antonio make as much as $60,000 their first year… and that is with summers off! Not bad… and STEM teachers are ALWAYS in demand!

UTeachSA
The University of Texas at San Antonio
One degree • Two careers • A lifetime of opportunities

UTeachSA has new cohorts starting each semester. You are not able to register for these classes on your own; however, if you are interested you can contact the UTeachSA advisor, Allison Gutierrez at allison.gutierrez@utsa.edu so she can explain how your degree plan can accommodate all your required coursework. You can also contact Carey Walls at carey.walls@utsa.edu for more information or stop by her office FLN 4.01.06. Additional information can be found at https://sciences.utsa.edu/student-programs/uteachsa/.

Additional Opportunities

The following resources were provided by the Army Research Office.

* The Research Teaming Opportunities page provides a comprehensive listing of opportunities for anyone interested in working with the Army's S&T Enterprise: https://hbcumiresearch.army.mil/research-teaming-opportunities/

* Army SPARK Internships website: The Army HBCU-MI SPARK (Student Partnership for Applied Research and Knowledge) program offers a 10-week summer research internship at Army research facilities across the United States and provides accepted interns stipends, housing, and some travel funds: https://armyspark.com/

Some final thoughts...

Please get involved and find your community with us! If you haven't checked out our webpage recently, please do so at https://sciences.utsa.edu/mathematics/ or scan the QR code on the top of the 3rd page!
We have information on upcoming seminars, research done by our faculty, opportunities for students, programs we offer, and more! We try to keep it updated so please check back periodically!

Annual Derivative Bee

Think fast, calculate faster! Join us for the 2025 Derivative Bee, a fun, competitive event where Calculus students test their differentiation skills and compete for awesome prizes. The event will take place in the MH Building on **Wednesday, November 5th from 5:30pm-8:00pm**.

The competition features three categories: Business & Biology Calculus, Calculus I, and Calculus II and Beyond, so there's a challenge for everyone. Whether you're competing or cheering on your classmates, it's sure to be an exciting event. **Keep an eye out for flyers soon**, because the limit doesn't exist, but the deadline does on Halloween to sign up! This is one function you want to attend! Be there or be undefined!

And a spotlight on two of our students!!!

We finish by highlighting two of our students, one undergraduate and one graduate student. Each is featured in the last two pages of the newsletter. Congratulations Olivia and Eloy! Keep up the great work!!!

Student Spotlight

Olivia Aubone

Major: B.S. in Mathematics
Hometown: San Antonio
Favorite color: Pink
Favorite artist: Gustavo Cerati
Favorite movie: Alice in Wonderland
Fun fact about you: I enjoy bouldering in my free time

What has been your favorite class so far (and why)?
My favorite class so far has been the directed research course I am taking with Dr. Iovino because we are learning model theory which I find very fascinating. I also really like the way the course is structured. Rather than just attend a lecture, each of us is assigned a paper to read, write notes on, and then present to the rest of the group.

What are your career goals?
I would like to obtain a PhD in Mathematics, work in academia, and do research.

If you could have one superpower, what would it be?
Super speed

What advice would you give the incoming freshman?
get involved in activities on campus related to their interests so you meet students with like-minded interests.

Student Spotlight

Eloy D. Santos

Major: M.S. Applied Industrial Mathematics
Hometown: Laredo
Favorite color: Red
Favorite artist: Chappell Roan
Favorite movie: the super mario bros
Fun fact about you: I am taking a road trip around Utah and the western States to visit national Parks.

What has been your favorite class so far (and why)?
My favorite class is math/physics because I love many formulas and am interested in physics. I also enjoy the hands-on activities in the lab. It's great to see how math is applied to real-world applications.

What are your career goals?
My career goal is to become a STEM tutor on a YouTube Channel, focusing on data analytics and optimization of engineering problems.

What advice would you give the incoming freshman?
Advice to graduate students is that you need much more motivation and learn how to manage your work and balance your life. It is essential. Also make building connector with peer and mentor. To focus on learning and being flexible. To prioritize your health and balance at your own. Again, if you need help to be successful, always get help, and they will support your goal.