



Mathematics Graduate Program at OU

Our graduate students and the graduate program are the heartbeat of the Mathematics Department here at Oklahoma. Students come from across the globe, enriching the experience of undergraduates at the University of Oklahoma, feeding a rich intellectual and academic atmosphere that makes the department an exciting place to work and be.

A Century in the Making

With the first master's degree in 1927, and first doctorate in 1947, the program has grown over the past century to around 60 graduate students in the program at any given moment. On average, we now graduate about five master's and five PhD students per year. Our students go on to successful careers in industry and academia.

In addition to our faculty-run research seminars, the graduate students organize their own student-led Graduate Student Seminar, the Graduate Student Colloquium, a variety of topics seminars, host an end-of-year workshop called OU Graduate Student Math Fest, and organize the semiannual departmental picnics.

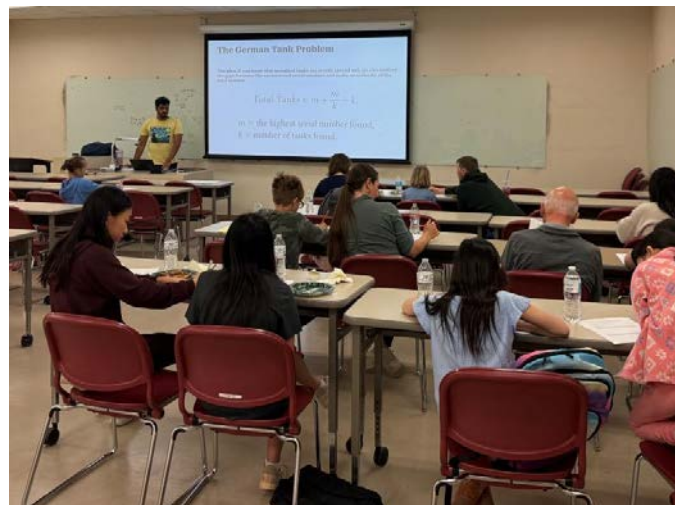
Outreach and Impact

The OU math graduate students engage in the major outreach events that our department offers. For example, this year our graduate student began participating in the Norman Math Circles, one of our signature outreach programs to the broader Norman community. This program introduces K-12 students to interesting mathematics beyond the classroom.

The Directed Reading Program was founded by the graduate students nearly 10 years ago. This program pairs graduate students with undergraduate math majors. Together, they pick a topic to explore and choose a book to work through together.



Steven Lin and Sajal Halder
2025 Oklahoma Math Fest



Ojas Bhagavath leading a group of elementary
and middle school students
Norman Math Circles, March 2026

Life of a Mathematics Graduate Student

The graduate school experience is one of teaching, learning, personal discovery, and comradery. For many students, it is a lifestyle change of doing mathematics for long stretches of the day and traveling to conferences, workshops, and summer schools. Their experience culminates in a dissertation, making a new and substantial intellectual contribution to the mathematical community.

Former graduate students, supporters of the program, and potential students all wonder what life is like in the program now. Mathematics graduate students must learn to balance dual roles as scholars and educators.

The Student-scholar

The first two years in the program are a whirlwind of introductory classes and qualifying exams. Students who move on to the PhD track will quickly start working with an advisor on a research project that will become their dissertation work.

The Mathematics Graduate Student Association (MGSA) provides a resource to help new students study for “The Quals”. MGSA officer, Jimmy Ramsey, says that “structured *study hall* or *problem jam* events in which students meet, have snacks, and work on exam problems are very popular.” As students mature, they support each other through giving seminars and providing friendly, constructive feedback.

The Student-educator

The other side of the academic coin is giving back to the next generation of students. The Department Chair, First Year Mathematics Team, and Graduate Director have developed a 2-week onboarding/training scheme for new graduate students.

Initially, graduate teaching assistants are placed into highly structured classes, where the syllabus, exams, and most of the day-to-day lesson plans and activities are prepared in advance by course coordinators. Over time, our GTAs are given assignments with increasing levels of responsibility and instructor autonomy. By the end of their time at OU, they are ready to assume the role of a new faculty instructor.

Maintaining Balance

Our students recognize the importance of down time and exercise. In the past, popular ways to decompress included lawn croquet, bowling nights, and soccer leagues. Nowadays, Saturday basketball games in the Sarkeys fitness center and trivia nights are all the rage.

Support

Our program does not exist in a vacuum and has enjoyed substantial support in recent years. With support from Graduate Dean Randy Hewes, the graduate student stipend has increased by 50% over the last 8 years.



In addition to the base stipend, the Mathematics Department uses endowed fellowships to support several recruitment and summer research fellowships each year. Named in honor Richard V. Andree, John Clark Brixey, Nancy Scofield Hester, Harold Huneke, T.K. Pan, C. Eugene Springer, Thomas Hill, and Gerard Walschap, these awards are supported by friends and benefactors of the department. Very recently, two new awards have been generously gifted by Conrad and Ellen Masterson and David and Judi Proctor.

The Impact of Support

The generous support our department has received cannot be overstated. Recent Graduate Director Max Forester said it well, “These funds help us compete for some of the best domestic and international students. There has been a notable increase in both the quantity and quality of international applicants over the past 6 or so years.”

Of note, fellowships support student research projects over the summer. Freed from summer teaching duties, graduate students are then able to move through the program more quickly, publish their work before graduation, and enjoy more invitations to speak at conferences while in graduate school. These activities substantially raise the profile of the Mathematics Department at Oklahoma.

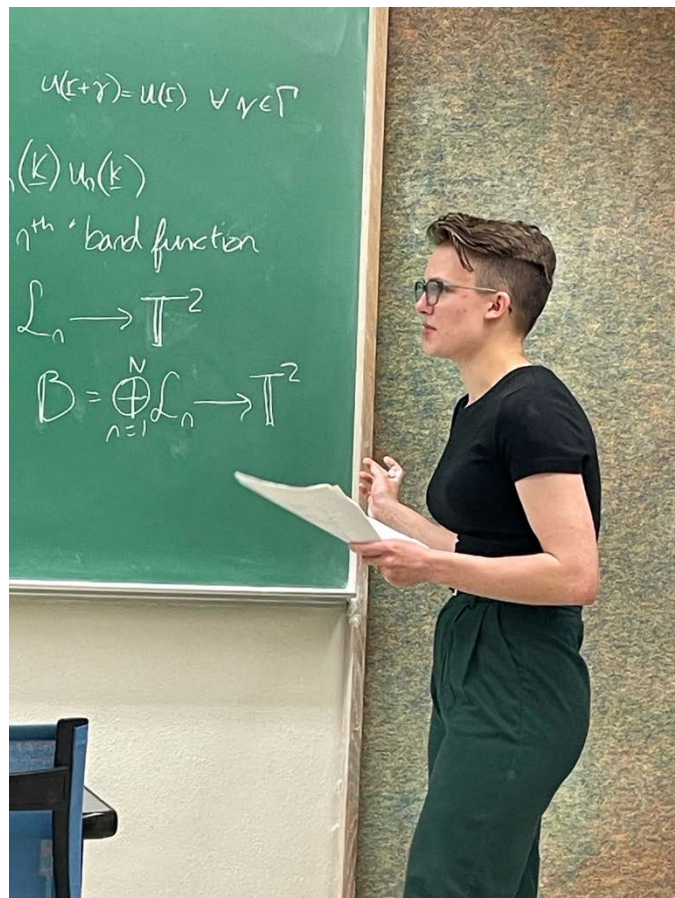
News From the Undergraduate Program

The Math Department is expanding its footprint in Arezzo! Recently, the College of Engineering asked whether we would be willing to teach two courses during the program.

Dr. Noel Brady was the first Math faculty member to teach the two-course load in Arezzo, in Fall 2025, and he enjoyed his time very much. Teaching two courses in a compressed eight-week format keeps the instructor quite busy during the work week. According to Dr. Brady, “The compressed format means that one gets to know the students quite well. The OU Arezzo team encourage this community building in a variety of ways. Faculty are encouraged to dine with students one day a week. In addition, there are many social activities, excursions and hikes that faculty and students can participate in together.”

The department is also adding a new undergraduate course, **Mathematics of Data**, to the curriculum. The course is designed to give students a mathematical foundation for working with modern data and is expected to appeal both to math majors and to students from across the sciences.

In 2025, the OU math department graduated 25 math majors with Bachelor of Arts, Bachelor of Science, and Accelerated BioStats B.S. degrees.



Undergraduate Lydia England presenting during the Student Topology Seminar, April 2025.

Faculty Awards and Recognitions

Miro Kramar was granted tenure and was promoted to Associate Professor.

Ricardo Mendes was awarded an NSF grant for the project *Singular Foliations and Invariant Theory*.

Deborah Moore-Russo was awarded an NSF-IUSE (Improving Undergraduate STEM Education) research grant for the project *Institutional Mentored Partnerships Advancing Multivariable and Vector Calculus Teaching with CalcPlot3D*, with co-PIs Stepan Paul (NC State), Shelby Stanhope (US Air Force Academy), Paul Seeburger (Monroe Community College).

Ying Wang received a 1-year seed grant from the OU Data Institute for Societal Challenges for the project *Data-enabled Self-Supervised Algorithm for Enhanced 3D Medical Image Segmentation*.

Weinan Wang was awarded a Simons Foundation grant for the project *Topics in Kinetic Theory* and a travel grant from the Southeastern Conference (SEC).

Michael Jablonski and **Ying Wang** received grants from the OU Libraries for developing textbooks and online materials for classes in Ordinary Differential Equations and for Advanced Numerical Analysis, resp.

Alejandro Chávez-Domínguez, Verónica Dimant (Universidad de San Andrés, Argentina), and Daniel Galicer (Universidad Torcuato Di Tella, Argentina) published the monograph *Operator Space Tensor Norms* in the series *Lecture Notes in Mathematics*, volume 2379, Springer, 2025.

Milòs Savíc has been named as Dean of the OU College of Professional and Continuing Studies (PACS).

Graduate Degrees Awarded in 2025

Chary Addanki received a Ph.D. from the math department in summer 2025. His advisor is **Ameya Pitale**. Chary is now a Visiting Assistant Professor at Sam Houston State University.

James Beyer received a Ph.D. from the math department in spring 2025. His advisor is **Greg Muller**. James is now a Postdoctoral Fellow at the Institute of Mathematics, National Autonomous University of Mexico (UNAM), Mexico City.

Martin Carlson received a Ph.D. from the math department in summer 2025. His advisors are **Nikola Petrov** and **Pengfei Zhang**. Martin is now a Physics teacher at the Oklahoma School of Science and Mathematics.

Chih-Kuang Lee received a Ph.D. from the math department in summer 2025. His advisor is **Roi Docampo**. Chih-Kuang is now working as a Seismic Imaging Analyst with Viridien.

Keng-Hung Steven Lin received a Ph.D. from the math department in summer 2025. His advisor is **Roi Docampo**. Steven is now Postdoctoral Fellow at the Graduate Institute of Communication Engineering, National Taiwan University, Taipei.

Maya Verma received a Ph.D. from the math department in summer 2025. Her advisor is **Max Forester**. Maya is now a Postdoctoral Fellow at the Tata Institute of Fundamental Research, Mumbai.

Kazi Sabrina Islam received an M.A. degree from the math department in spring 2025.

Mathematics Department Events

2025 Math Day

On Nov. 7, 2025, the OU Math Department hosted our biggest outreach event of the year – Math Day – a day of math competitions for high-school kids from Oklahoma and North Texas. Started in 2001, with a two-year hiatus for Covid, this was the 23rd such event.

Students competed in written tests and participated in the “Sooner Math Bowl” – an exciting, Jeopardy-type real-time team competition.

Professor **Frank Wang** presented an entertaining and engaging lecture demonstrating the beauty of mathematics and the unexpected ways in which it can arise in everyday situations. The winners of the competitions got trophies and prizes!

This year, we welcomed over 300 students and 40 teachers and chaperones, some coming from as far as Tulsa and North Texas.

Andras Lorincz chaired the Math Day Organizing Committee.



Professor Frank Wang from the Oklahoma School of Science and Math presenting at Math Day, November 2025.

2026 TORA Conference

This year the mathematics department hosted the TORA XII on April. 17-19. Texas-Oklahoma Representations and Automorphic forms (TORA) is a conference series, which is hosted in rotation by Oklahoma State University, the University of Oklahoma, and the University of North Texas. These are weekend conferences with talks on Saturdays and Sundays. The first TORA conference took place in 2011 at the University of North Texas. Our colleagues Professors **Finn McGlade** and **Ameya Pitale** were the local organizers in 2026.

2026 Redbud Conference

The 2026 Redbud Topology Conference was held April 12-14 at Oklahoma State University. This regional conference series, supported by the National Science Foundation, brings together topologists and geometers from OU, OSU, the University of Arkansas, and beyond. The 2026 organizing committee included our colleagues Professors **Max Forester**, **Justin Malestein**, **Peter Patzt** and **Jing Tao**.

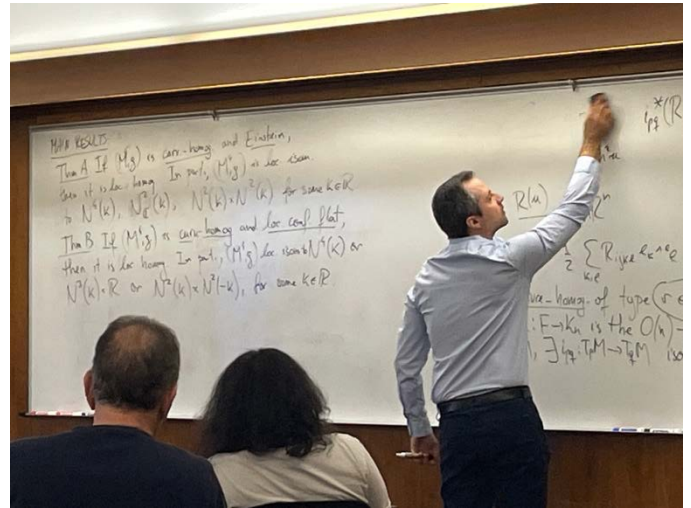
Norman Math Circle

The Norman Math Circle offers regular meetings for middle and high school students. Students meet with mathematical scholars and professionals, including graduate students and professors at OU. The main goal of each meeting is to present an interesting problem in mathematics which is not typically taught in the classroom. We strive to create an encouraging learning environment to get students excited about mathematics.

2026 Soul and Shape Conference

In memory of our former colleague Gerard Walschap who passed away last year, the conference Soul and Shape: Metric Structures and Geometric Analysis was held on April 8-10, 2026. The workshop was supported by the National Science Foundation, the OU David and Judi Proctor Department of Mathematics, and the OU Dodge Family College of Arts and Sciences.

Over three days, we hosted approximately 40 visitors from across the United States, Spain, and Mexico. Professors **Ricardo Mendes** and **Michael Jablonski** comprised the local organizing committee.



Renato Bettiol (City University of New York)
presenting on curvature-homogeneous manifolds.

AWM Events

The Association for Women in Mathematics (AWM) chapter at the University of Oklahoma was founded in 2022 and is dedicated to building an inclusive and supportive community for students interested in mathematics. Every year, the chapter organizes a variety of events, including research talks, panel discussions, social gatherings, and outreach activities, with the goal of promoting the participation and advancement of women in mathematics at all levels. Through these initiatives, AWM provides opportunities for mentorship, networking, and professional development, while creating a welcoming environment for all students who share an interest in mathematics.

During the 2025–2026 academic year, our local AWM chapter organized a welcome event, followed by a Halloween-themed “STEM and Sweets” event in collaboration with Concrete Canoe and Steel Bridge where students engaged in fun math activities, made goodie bags, and enjoyed free food while wearing costumes.

Throughout the year, AWM organized study nights to support students academically in a collaborative environment. In the spring semester, the chapter held a Valentine’s Day social event and hosted a research talk by Dr. **Elizabeth M. Keley** (postdoctoral researcher at OU), providing students with the opportunity to engage with current research.



Graduate Director Greg Muller with several OU graduate students.

New Faces Around the Department



Karen Baker (renewable term faculty) earned a BA in mathematics from Southwestern College (Winfield, KS) in 2002, a master's degree in psychology and mathematics from McNeese State University (Lake Charles, LA) in 2004, and an MS in movement science from Barry University (Miami Shores, FL) in 2006. She has taught mathematics, psychology, health, nutrition, and sports science at the high school and college levels. Karen likes to travel with her husband Wes, their adult children James and Jade, and their 9-year-old German shepherd mix.



Dr. Jordan Barrett (renewable term faculty) earned a BS in mathematics and a BA in physics in 2018 and an MS in mathematics in 2019, all from Syracuse University, and a doctorate from the University of Nebraska, Lincoln, in 2025, on algebraic geometry. Jordan has two cats, Mars and Dr. Bones.



Dr. Nathan Dalaklis (postdoctoral associate) holds a BS in mathematics from Carleton College, Northfield, MN (2018) and a PhD from the University of North Texas (2025). His research is on multifractal analysis, fractal geometry, symbolic and topological dynamics, ergodic theory, and thermodynamic formalism. When Nathan is not doing math, you can usually find him experimenting with new recipes or practicing capoeira. He plays a few trading card games around OKC too when he has the time. Mary He will be his mentor.



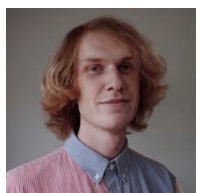
Dr. Meenakshy Jyothis (postdoctoral associate) holds an MS in mathematics from the Indian Institute of Science Education and Research at Thiruvananthapuram, India (2016) and a doctorate in mathematics from Binghamton University (2025). She is an expert on low-dimensional topology, Teichmüller theory, mapping class groups, and geometric group theory. Her mentor will be Jing Tao.



Dr. Juan Manuel Lorenzo Naveiro (postdoctoral associate) holds undergraduate (2020), master's (2021), and doctoral (2025) degrees in mathematics from the Universidade de Santiago de Compostela (Spain). His area of expertise is differential Geometry, in particular: Lie groups, actions on homogeneous and symmetric spaces, foliations, and submanifold geometry on manifolds with symmetry. His mentor will be Mike Jablonski.



Dr. John-Oliver MacLellan (renewable term faculty) earned a BS in mathematics from Cape Breton University (Sydney, NS, Canada) in 2014, and a PhD in mathematics from the University of Alabama in 2025, on harmonic analysis and its applications to partial differential equations.



Dr. Finn McGlade (postdoctoral associate) earned a BS in mathematics from the University of Melbourne, Australia in 2018, and a doctorate in mathematics from UC San Diego in 2025. He works on number theory and algebra, especially in relation to automorphic forms and theta correspondences. He will be mentored by Ameya Pitale.



Dr. Alexander Mramor (assistant professor) holds a BS in mathematics from the University of Missouri-Columbia, and a doctorate from the University of California, Irvine; his advisor was Richard Schoen. Alex was a J.J. Sylvester Assistant Professor at Johns Hopkins University (2019–2022) and a postdoc at the Copenhagen Centre for Geometry and Topology, University of Copenhagen, Denmark (2022–2025). His area of research is geometric analysis, with an emphasis on mean curvature flow and minimal surfaces.



Dr. Joshua Pankau (renewable term faculty) earned a BA in mathematics from California State University, Northridge (2011), an MA (2014) and a PhD in mathematics from UC Santa Barbara in 2018. He held a visiting assistant professor position at the University of Iowa (2018-2021), a postdoctoral position at OU (2021–24), and worked as a lecturer at OU last academic year.



Dr. Miguel Alonso Peinado Portillo (renewable term faculty) earned a BS in mathematics from Universidad Autonoma de Ciudad Juarez (Mexico) in 2016, as well as MS (2020) and PhD (2025) degrees from New Mexico State University (Las Cruces, NM). His area of expertise is logic.



Dr. April Richardson (renewable term faculty) holds a BS in mathematics from OU (2018) and a PhD from Oklahoma State University (2025). Her research is on mathematics education.



Jenice Roberts (renewable term faculty) holds a BS in education with concentration in middle level math from OSU (1997), and in 2005–2006 pursued graduate studies at Kansas State University. She has worked as an adjunct instructor in our department since 2022. Before coming to OU, Jenice taught in K-12 education for over 20 years. She now primarily teaches courses for elementary education majors. In her spare time, she loves to teach Sunday school and work along her husband on the family farm where they raise cattle and sheep. She has recently become a grandmother and realizes that this was the promotion she was born for.



Dr. Xiang Xu (postdoctoral associate) holds BS (2018), MS (2020), and PhD (2025) degrees in mathematics from the University of Kansas. His research is on partial differential equations, focusing on nonlinear wave equation, hyperbolic conservation laws, and mathematical models of liquid crystals. He will be mentored by Weinan Wang

Recent Retirements and Departures

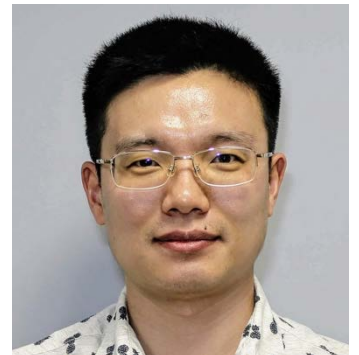
Dr. Kaan Akin retired in 2025 after 40 years of service at OU. He earned his PhD in 1980 from Brandeis University, and he held positions at MIT and Purdue University before coming to OU in 1985. Kaan's research area is commutative algebra. He was known as an original thinker and published in prestigious journals; his research was supported by the NSF. Kaan also taught numerous students in undergraduate and graduate classes over the course of his long career.



Dr. Kimball Martin has accepted an offer from Osaka Metropolitan University, Japan. He left our department in 2025 after 18 years of service. Kimball earned his PhD in 2004 from Caltech, was an NSF postdoc at Columbia University, and he joined OU in 2007. He was one of the most active researchers at the department, with expertise in number theory and automorphic forms and a large number of publications in this area, but also on other, perhaps more pressing questions such as "How often should you clean your room?" (2015, joint with former OU professor Ravi Shankar). His research was supported by the NSF and the Simons Foundation. Kimball also taught a large number of students, advised several PhD students and mentored postdocs.



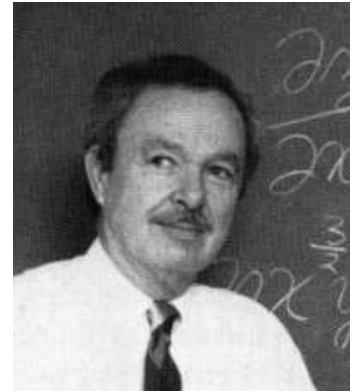
Dr. Pengfei Zhang left the department in 2025 after 8 years of service. He earned his PhD in 2011 from the University of Science and Technology of China and held positions at the Universities of Houston, Mississippi, and Massachusetts at Amherst as well as Peking University before coming to OU in 2017. He was an active researcher, working mainly on dynamical systems. Pengfei taught a large number of courses at OU, and he advised PhD students and mentored postdocs.



In Memoriam

Dr. Thomas Hill passed away in Norman on April 9 at the age of 98 years.

Thomas earned a doctorate in 1967 from Columbia University, joined our department as a faculty member the same year and retired in 1993. He received numerous awards and honors at OU, culminating in a David Ross Boyd professorship in 1981, one of the University's highest honors. Thomas was also instrumental in creating our RUME (Research in Undergraduate Mathematics Education) program.



Thomas was a nationally recognized and popular mathematics educator. He wrote nine mathematics texts for the secondary and college levels, several articles and yearbooks for the National Council of Teachers of Mathematics, and he was the editor of The Mathematics Student Journal, a quarterly publication for secondary math students. He also served as a National Executive Director of Mu Alpha Theta, the national honorary organization for high school and junior college mathematics students, and as a President and a member of the Board of Directors of the Oklahoma Council of Teachers of Mathematics.

Before attending graduate school, Thomas worked as a high school teacher in Oklahoma. One of those students in whom he instilled lifelong love for mathematics was Conrad Masterson. In recognition of his teacher, Conrad and his wife Ellen established the Thomas Hill Scholarship in 2024, which is now awarded annually to outstanding mathematics graduate students.

Professor Donald Patten passed away in Houston, TX, on September 16, 2025 at the age of 96 years.

Don earned a Bachelor's degree from Oklahoma City University and a Master's degree from OU in 1952. He pursued a PhD, but his dissertation advisor moved to another university out of state. He was appointed as an instructor of mathematics, then as an assistant professor, and eventually was promoted to associate professor. Don taught mathematics and some astronomy at OU from 1952 until his retirement in 1995. He received an NSF grant to spend the 1965-66 academic year at Harvard to study the use of computers in college, after which he organized several workshops in Oklahoma to educate students and teachers on computer basics.



Although Don retired in 1995, he still had an office at the department until he moved to Houston in 2012, regularly attended seminars, and often came to the department lounge to chat with faculty and students. Thanks to his indefatigable good humor and open personality, he was liked by everyone. Retirement certainly didn't slow him down: in 2004, he earned the ITN 100 Nations Award for having been to 100 countries. Closer to home, he had also visited each post office in Oklahoma, and then sent to himself a postcard with the stamp from this post office.

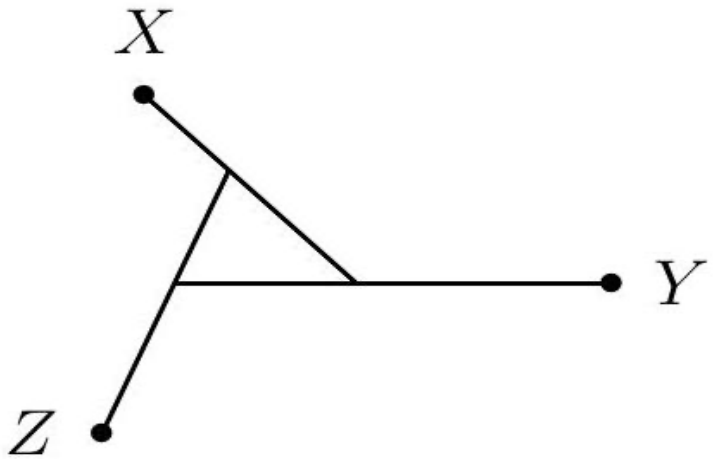
Don's obituary, written by his nieces and nephews, points out that Don, never one to let a teachable moment pass, died on Pythagorean Triple Square Day, 9/16/25.

From the Emeritus Corner

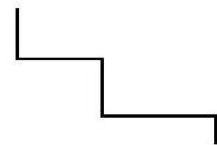
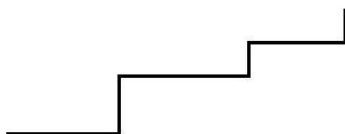
A fun article from our former colleagues **Paul Goodey** and **Marilyn Breen**.

Bonjour Marilyn, I see that, in a recent email, Nikola posed us a question "who is more fun than the two of you"? I have long thought that our entertainment credentials have been overlooked and am delighted to observe this belated recognition. I received his message whilst reading an account of the recent happenings in the Louvre Museum. As you know, I have close contact with the upper echelons of the current French administration. I mentioned to them that a colleague of mine is well placed to oversee the revamping of security at said location. I wondered if you could remind me of your work on Krasnosel'skii-type results, since I would like to include it in my nomination of you as their next head of security.

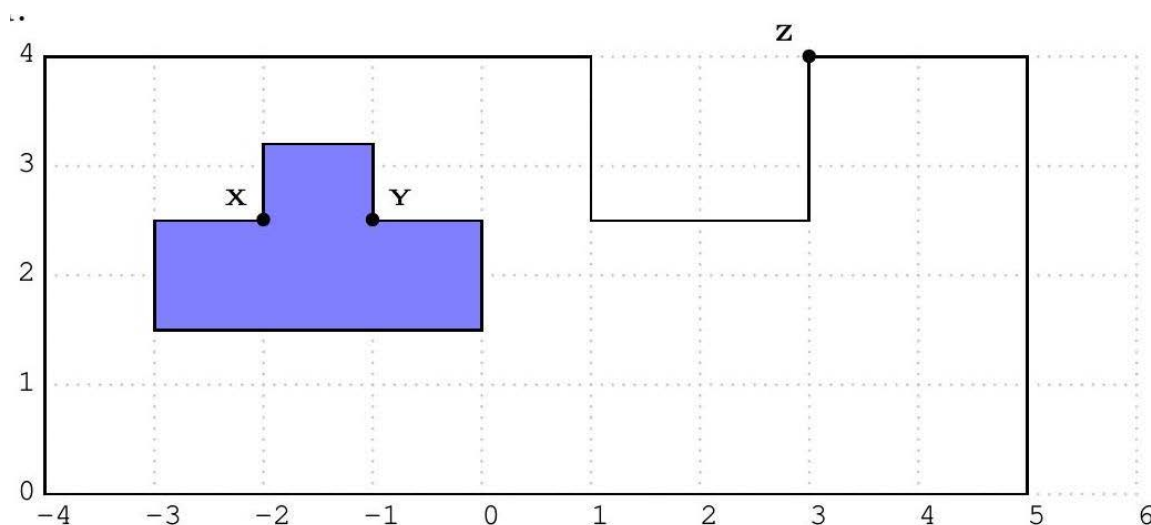
Hi Paul, thanks for your message. I look forward to a couple of years in Paris! As you know, some favorite results of mine are Helly-type theorems, named for mathematician Eduard Helly. These theorems give information about a whole set from information on small subsets of a certain size. The format usually looks like this: For a counting number k , if every k -point subset together behaves a certain way, then all points together behave this way. Art gallery theorems are in this category, and since O.U. has a wonderful art museum next to the Physical Science Center, the Fred Jones, Jr., Museum of Art, containing an impressive array that includes the Weitzenhoffer Collection of French Impressionism, I've selected art gallery theorems as a topic. Given the floor plan of an art gallery (a compact set in the plane), if every three points (every three paintings) can be seen (guarded) from a common point, then by a theorem of Krasnosel'skii, there is some point from which all the paintings can be seen (guarded). That is, mathematically speaking, the museum is starshaped. Here I'd better introduce the definition of starshaped: A set S in Euclidean space is starshaped if and only if there is some point p in S such that p sees every point x of S via a straight line segment $[p, x]$ in S . Therefore, if the museum is starshaped, then there is a point from which a guard can see all the paintings. It's interesting to note that the number three above is best. The result fails for two. Consider the example to the right. Every two points see a common point but not every three. Look at points X, Y, Z . They see no common point via segments in the set, so the set is not starshaped.



The art gallery theorem above works when our paths are straight line segments. However, certain surveillance techniques might allow a museum guard to see along a different type of path. One alternate type of path is the staircase path (used in robotics). Thus, we need another definition: A polygonal path in the plane is a staircase path if and only if every edge is either horizontal or vertical and the associated edges alternate in direction. Here are examples.

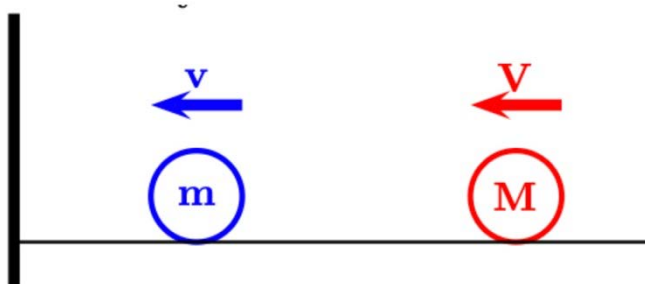


This time, we'll consider sets that are finite unions of boxes in the plane. And we'll adapt our earlier definition this way: For a finite union of boxes S in the plane, set S is staircase starshaped if and only if there is some point p in S such that p sees every point x of S via a staircase path from p to x in S . Now we have an analogue of the earlier result: Let S be a finite union of boxes in the plane and assume that S has no holes. If every two points of S are visible via staircase paths in S from a common point, then set S is staircase starshaped. Notice that the earlier number three is reduced to two here, and two is best, of course. Unfortunately, the result fails when set S has holes. In the example below, the shaded area represents a hole. Every two points of the set see a common point via staircase paths, but no point can see X , Y , and Z via staircase paths. Thus, there is no point from which a guard can see every painting via staircase paths, and the set is not staircase starshaped.



That's a brief summary of some art gallery theorems. Other theorems involve the number of guards required to protect the paintings. I'm sure that the Louvre will be interested in the results, and we should remember this the next time we visit O.U.'s art museum. The museum definitely is not starshaped, so there will be several guards!

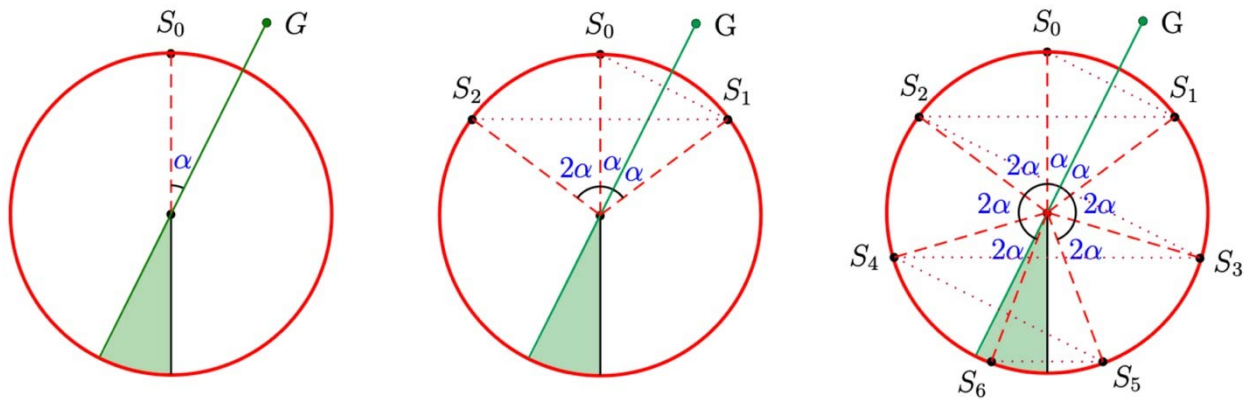
Thanks Marilyn, that's exactly what I needed. In the meantime, I have been playing a lot of pool. Our colleague, K. B. Lee was, of course, the ultimate master but is now back in Seoul. In any case this reminded me of a result Ravi Shankar mentioned to me some years ago. I think Ravi knew of my obsession with π . Ravi told me of an amazing result discovered in 2003 by G. Galperin. You have two balls and a wall as pictured below. The blue one is initially stationary, and the red is set in motion towards it. After the first collision the blue ball will be in motion and soon hit the wall and bounce back causing another collision with the red ball and so on. Galperin's observation was that the number of collisions can be used to calculate π .



The number of collisions tells you the decimal expansion of π if the ratio M/m is a power of 100. For example, if $M = m$, there are 3 collisions and π starts with a 3. If $M = 100m$, there are 31 collisions and π starts 3.1. If $M = 10,000m$,

there are 314 collisions, and so on. Seems hard to believe but read on, if you're interested. If you're not, calculate the integral $\int_0^1 x^4(1-x)^4/(1+x^2)dx$; did I mention my obsession with π ?

For those still reading, we note that the velocities of the balls are constant in between the various collisions between balls and between the inner ball and the wall. So, we imagine the point S in the plane with coordinates $(v\sqrt{m}, V\sqrt{M})$, and note that this point only moves at collisions. Because of the conservation of energy throughout this process, this point must always lie on a certain circle, centered at the origin.



The point G in the diagram lies on the line through the origin with slope $\sqrt{M/m}$. We call this green line the momentum line since the momentum of the balls at any time is the component of S on this line (it's just a matter of looking at the dot product of S and G). Initially our point S_0 is at the top of the circle, because its first coordinate is zero (the inner ball is stationary, and we're measuring velocities to the left as positive). At the first collision (between the balls) momentum is preserved, which means the point S_0 must be reflected across the green line. Of course, it remains on the circle and so it moves to position S_1 . The next collision is the inner ball hitting the wall, this just reverses the velocity of the inner ball and so reflects our point across the vertical (red dashed) line through the origin. We then quickly see that as time goes by our point is alternately reflected across the green and the vertical red dashed lines. As we teach in Linear Algebra and occasionally in Modern Geometry the product of these two reflections is a rotation about the origin through angle 2α . So, our point gradually makes its way around the circle advancing through angle 2α . It will eventually end up in the green sector, but this forces us to have $V < v < 0$ which means both balls are moving to the right and the outer one is faster, so there will be no more collisions. The number of collisions will therefore be the largest n strictly less than π/α . So, if, for example, $M = 10,000m$, then $\tan \alpha = \sqrt{m/M} = 10^{-2}$. As we teach in calculus, for small α , $\tan \alpha$ is basically equal to α . So, we want the largest n with $n < 10^2\pi$, that is the largest $n < 314.159 \dots$. Clearly this is 314 and this is the number of collisions. Our diagrams above are the case that $M = 4m$ and we see that this results in exactly 6 collisions. Of course it's 6. As we all know $\pi = 11.001001000011 \dots$, to base 2 and Galperin's result shows that since $4 = 2^2$ there should be 110 collisions (to base 2); but this is 6 (to base 10). Just goes to show π really is ubiquitous.

In conclusion, I feel that we have clearly answered the question posed by Nikola, sad to say the number of funnier pairings is likely to be $\binom{n}{2} - 1$, where n is the number of faculty in the department.

Department Chair: Nikola Petrov

Newsletter Editor: Michael Jablonski

Newsletter Contributors: Noel Brady, Miroslav Kramer, Christian Remling, Sepideh Stewart, Weinan Wang

Math Department picnic, Sept. 28, 2025

