MATH MOMENTS

Faculty and Students Use Mathematics to Study COVID-19

Faculty and students in the UTC Department of Mathematics have been hard at work using their backgrounds in Mathematics to research and study Covid-19. The research is varied and has studied several aspects of the virus and its transmission.

Dr. Lani Gao worked with graduate student Gage Plott and undergraduate students Chris Tompkins, Andrew Calkin and Jenni Smithson to develop statistical methods to investigate the association between comorbidities and morbidity and mortality of COVID-19 patients with heart failures and hospitalized in Erlanger hospital from March 2020 to February 2021. The results indicate that older patients with Venous thromboembolism, PAD, asthma and stroke had significant longer hospital length of stay. And older patients with DVT/PE and Drug use history have significantly higher risk of in-hospital mortality. They presented this work at UTC Research Dialogues in April 2021. This research project is supported by BRIC Gao and NSF HDR DSC #1924278.

Gao (with Dr. Greg Heath, etc.) submitted a paper titled "Maintaining Quality Acute Stroke Care during the COVID-19 Pandemic". They conducted analysis data from Acute stroke consultations seen by Telespecialists, LLC physicians in 171 hospitals (19 states) from December 1, 2019 to June 27, 2020. And they compared pre-COVID (December 1, 2019 to March 14, 2020) and COVID groups (March 15, 2020 to June 27, 2020). The result shows the quality of acute stroke patients is significantly dropped during COVID pandemic.

Maame Akua Korsah, a graduate student in the Department of Mathematics, defended her M.S. thesis in March 2021. For her research project, Aqua constructed a mathematical model to study the transmission and spread of COVID-19. She used data from both China and the United States to validate her model. Her findings indicate that the implementation of health education and disease awareness programs, in addition to other non-pharmaceutical intervention methods such as social distancing and mask wearing, is an effective approach to slow down the spread of the coronavirus disease.

Dr. Eleni Panagiotou has been working with Tuskegee University student Quenisha Baldwin and have submitted two papers for publication. The research is on how the novel coronavirus SARS-CoV-2 infects human cells using a mechanism that involves binding and structural rearrangement of its spike protein. Understanding protein rearrangement and identifying specific residues where mutations affect protein rearrangement has attracted a lot of attention for drug development. They use a mathematical method to associate a local topological/geometrical free energy along the SARS-CoV-2 spike protein backbone. These results show that the total local topological free energy of the SARS-CoV-2 spike protein monotonically decreases from pre-to post-fusion and that its distribution along the protein domains is related to their activity in protein rearrangement. By using density functional theory (DFT) calculations with inclusion of solvent effects, the research shows that high local topological free energy conformations are unstable compared to those of low topological free energy.

Panagiotou also is working on a project with the Oak Ridge National Laboratory and has submitted one paper based on this research. In the paper, she and colleagues use the quantum chemical density-functional tight-binding (DFTB) method to perform geometry optimizations for 8840 binders from the SWEETLEAD database and perform a topological analysis for their binding interactions with the SARS-CoV-2 Spike protein using Vina scores determined through a combination of classical molecular dynamics and docking simulations in a recent paper. The results show a decrease of the Vina score with increasing Average Crossing Number of the ligands. They also find a decrease of the Vina score with the maximum linking between segments of the ligands and a decrease of the Vina score with the maximum local torsion in a ligand. These results suggest that ligands with inflection points and local turns are stronger binders than other binders. These results suggest that topological analysis provides a potentially efficient screening tool for strong binders.

Note From the Department Head

Dr. Chris Cox | Department Head

From the Department Head:

I've read that "you're on mute" was one of the most popular phrases of 2020. If I had to name the most popular acronym, it might be "WFH." Working from home during the pandemic was easier for some of us than others. I know that it has been especially difficult for parents whose children couldn't go to daycare or school. If you compare occupations of those who had to "retool" in order to work from home, I believe teachers who had no previous online teaching experience faced some of the biggest challenges. That's why it was gratifying for me, as I read faculty year-end self-evaluations, to learn of steps my colleagues took to prepare course materials and develop communication strategies aimed at keeping students engaged and connected while learning in a virtual environment. These extra efforts included time spent in preparing slides and recorded lectures and extra help sessions by Zoom. I had not heard of the gaming app called Discord until this year when two colleagues mentioned that it is useful in facilitating communication with students.

While coping with the difficulty of maintaining regular operations during the pandemic, the Math Department managed to move to Lupton Hall in late Summer 2020. This Spring we completed a self-study for our degree programs as part of a five year review (actually covering the past six years). I'm confident that the feedback we receive from Dr. Robert Mignone, the external reviewer, will provide valuable insights for our bachelor's and master's degree programs.

Two department members were honored at this year's College of Arts and Sciences Spring Convocation. Dean Riggs-Gelasco made awards to the six members of what she called "the Dean's List," and Lecturer Thandi Klingbeil was a member of that group. Thandi's nomination was based on efforts that include re-organization, Quality Matters certification, and ongoing course coordination of MATH 2100, along with diligent committee service at department and

university levels. Heather Heinlein was named CAS Administrative Specialist of the Year. Heather facilitated the department move (after a massive clean-out and packing effort), and thanks to Heather, the Department now has a much-improved web and social media presence.

Speaking of our upgraded webpage, when you go to the Department website, https://utc.edu/mathematics, right under the social media links in the upper right corner there is a button labeled "Give to UTC Math." Clicking on that button takes you to a page where you can donate to the UCF (University of Chattanooga Foundation) Fund for Math. The primary use for this fund is the monetary awards for winners of the annual Math Poster Competition for area middle and high school students.

I will soon complete two years as a professor and department head at UTC. I would never have guessed when I started, on July 1, 2019, that "You're on mute" and "WFH" would have the familiarity that they have today. Our mission to provide impactful instruction, research and service has not changed. I'm proud of my colleagues who never lost sight of that mission during stressful times. Because of the unusual circumstances involved in teaching during the pandemic, faculty were not required to share their student evaluations from Spring and Fall 2020 for evaluations by department heads this Spring. I enjoyed receiving one set of teaching evaluations, voluntarily, from a colleague in which a student said,

"[The professor is] literally an angle [sic] sent from above to teach. [The professor is] super patient and wants to be here teaching."

With apologies to Abraham Lincoln, may we continue to strive to be better angles.

-Chris

FACULTY & STAFF

Professor Marks Career Milestones

Dr. John Graef celebrates two career milestones during the pandemic
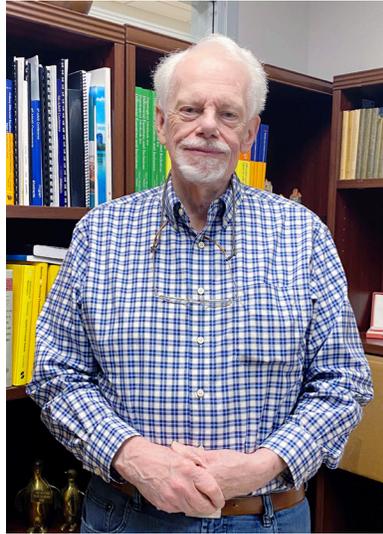
Dr. John Graef, Professor of Mathematics for the Department of Mathematics marked two major career milestones during the pandemic. The year 2020 marked the 50th anniversary of receiving his Ph.D. He has also published his 500th research paper in Mathematics in 2021.

Graef is a brilliant mathematician and has had a love for the subject since he was in the fourth grade. By the eighth grade, he was sure that math was a subject that he wanted to study. Throughout secondary school, he had several fantastic math teachers which made his transition to college much easier.

Graef attended Loyola University in Chicago, IL where he graduated with his bachelor of science degree in mathematics with a minor in philosophy in 1964. He did not know what he wanted to do after his undergraduate studies, though. His mom began a job at a local high school and her bosses had mentioned to him that St. Mary's University had a fantastic master's program in mathematics. In 1964, Graef moved to San Antonio, TX to begin his graduate work in statistics. He graduated with his degree in 1965. Following graduation, Graef taught for the San Antonio Independent School District as a junior high school math teacher from 1965 to 1966.

After teaching for a year, Graef realized he wanted something a bit different so he had applied and was accepted into the Ph.D. program at Southern Illinois University in Carbondale, IL in 1966. He was planning to complete his concentration in statistics until he learned that the statistician in the department was on leave. So, he opted for differential equations instead. Graef completed his Ph.D. program in 1970 with his dissertation titled, "Relaxation and Forced Oscillations in a Second-Order Nonlinear Differential Equation."

Once completing his Ph.D. program, Graef found that the job market was difficult. He eventually was offered a job at Mississippi State University in 1970 as an Assistant Professor. He was hired along with another person, Paul Spikes, who also had a concentration in differential equations. Graef and Spikes published about 80 papers together during this time.

In 1999, Graef was hired to lead the Deparment of mathematics as department head at the University of Tennessee at Chattanooga. He has been a member of the department ever since, currently holding the position of professor of mathematics. He has continued to be a prolific researcher in the field of differential equations during his tenure at UTC.

Graef published his 500th research paper in 2021. He does not have an all-time favorite paper, though he finds a lot of his earlier published papers to be a bit more special to him. His 500th publication is titled, "Altered Oscillation Criteria for Second-Order Nonlinear Neutral Delay Difference Equations of Non-Canonical Type" with G. Ayyappan, T. Kumar, and E. Thandapani. This will appear in the PanAmerican Mathematical Journal later this year. This paper was dedicated to the 90th birthday of his former colleague, Paul Spikes.

FACULTY & STAFF

Mathematics Department Faculty and Staff Earn College Awards

Professor Thandi Klingbeil and Administrative Specialist Heather Heinlein honored at College of Arts and Sciences Award Ceremony

Two members of the UTC Department of Mathematics faculty and staff have earned awards from the College of Arts and Sciences. These awards were given to honor the achievements and contributions made to the college during the 2020-21 academic year.

Professor Thandi Klingbeil received the Dean's List Award. This award is a new category that recognizes noteworthy faculty efforts that may fall outside traditional categories but are nonetheless important contributions to the college. She was given this award for leadership in shepherding the Statistics program in Math through a curricular transformation. She obtained the Quality Matters certification for the department's Math 2100 Introductory Statistics course. She also conducted research that looked into whether adding a prerequisite to Math 2100 could potentially improve student outcomes. Data was collected from spring 2018 through fall 2020 from 3,959 students and found that students who had a Math ACT score of 21+ or those who have had a previous math course at the college level had better outcomes than students who did not achieve either of these.

Klingbeil holds an MS Mathematics: Applied Statistics degree from UTC and Bachelor of Science in Mathematics from Stellenbosch University, South Africa. She was an adjunct professor at UTC the summer of 2017 and joined the faculty full-time in Fall 2017 as a lecturer.

Heather Heinlein was awarded the Administrative Specialist of the Year award for her contributions to the department during the 2020-21 academic year. She coordinated the department move to Lupton Hall even though most of the faculty were not on campus due to the pandemic. She also worked this year to update the website, relaunch the department social media and blog, and set up the department's email marketing lists to better reach faculty, staff, students and the outside community.

Heinlein holds a Master of Business Administration from UTC and a Bachelor of Arts degree in Communications with a concentration in Public Relations from Berry College. She has worked at UTC since 2004 and has served as the Administrative Specialist in the Department of Mathematics since 2009.

Graduate Student Completes Internship Program at Unum

Alexis Jackson, graduate student in the University of Tennessee at Chattanooga Department of Mathematics, recently completed the Unum Scholars Internship Program at Unum in Chattanooga, TN.

Jackson began her internship on June 22, 2020. It will run through July 2021, but she is hoping to find a full-time position prior to that end date. During the internship, she worked with the voluntary benefits (VB) pricing and experience analysis actuarial team in the finance organization. The team analyzes data to develop studies and tools to support the VB business area. Her responsibilities included ensuring the log of requests that the pricing team received from underwriters was up-to-date and accurate, creating and updating QlikView tools used by finance and underwriting, completing annual rate certifications required on a state-by-state basis, and various other ad hoc projects.

The Unum Scholars internship was very flexible with Jackson's schedule. She was able to set her own hours and be a successful graduate student throughout her internship. She also enjoyed having known some former Unum Scholar Interns who are UTC graduates. She was able to get to know about her friends better as well as get a better understanding about what they currently do at Unum and about what she could potentially do one day at Unum. Some difficulties that she ran into was beginning her internship remotely due to COVID-19. Adjusting to a new role, where she could not just go ask someone on her team a question made it difficult to start.

This internship was especially beneficial to Jackson as she is planning on applying to Unum's Actuarial Development Program (ADP) once she graduates. The internship provided her with the opportunity to work with actuarial assistants in the ADP and regularly connect with and job shadow members of the ADP to gain a better insight into the day-to-day work expectations. The projects that she worked on allowed her the opportunity to sharpen her critical thinking and communication skills while learning how to think like an actuary.

Jackson completed her Bachelor of Science degree in Applied Mathematics with a concentration in Actuarial Science here at UTC in Spring 2019. She continued her graduate work in Mathematics at UTC and will complete Master of Science degree in Mathematics with a concentration in Applied Mathematics in spring 2021.

Graduate Students Recognized for Achievements in Mathematics

The UTC Graduate School Honors five students in the Department of Mathematics Graduate Program

Five graduate students in the Department of Mathematics have been recognized for their academic achievements in the Mathematics Graduate Programs by the University of Tennessee at Chattanooga Graduate School.

Michael Corley received the Outstanding Graduate Student Award for Ph.D. in Computational Science: Computational and Applied Mathematics Concentration.

Alexis Jackson received the Outstanding Graduate Student Award for Master's in Mathematics: Applied Mathematics Concentration.

Maame Korsah received the Outstanding Graduate Student Award for Master's in Mathematics: Pre-Professional Concentration.

Mark Mcfeaters received the Outstanding Graduate Student Award for Master's in Mathematics: Applied Statistics Concentration.

Joshua Nowlin received the Outstanding Graduate Student Award for Master's in Mathematics: Mathematics Education Concentration.

Seven Department of Mathematics Students Inducted into Pi Mu Epsilon

The Department of Mathematics inducted seven new members into the Tennessee Beta Chapter of Pi Mu Epsilon at UTC. Pi Mu Epsilon is a national mathematics honor society. It was founded at Syracuse University and incorporated at Albany, New York on May 25, 1914. The purpose of Pi Mu Epsilon is the promotion and recognition of mathematical scholarship among students in postsecondary institutions. It aims to do this by electing members on an honorary basis according to their proficiency in mathematics and by engaging in activities designed to promote the mathematical and scholarly development of its members. The Tennessee Beta Chapter was established at the University of Tennessee at Chattanooga in 1971.

New Pi Mu Epsilon Inductees

Dahlen Elstran is a freshman majoring in Mathematics: General Mathematics. She also is the current awardee of the UTC Dorothy Dean Shelton Mathematics Scholarship.

Hannah Holland is a senior majoring in Mathematics: Actuarial Science. She is graduating in the spring 2021 semester and plans to enter the workforce and continue to take the actuarial exams to obtain her FSA designation.

Maame Akua Korsah is a second-year Master's of Science in Mathematics: Pre-Professional Mathematics student . She recently graduated in spring 2021 and plans to pursue her Ph.D. in Computational Science: Computational and Applied Mathematics at UTC beginning in fall 2021.

Danielle Layne is a second-year Master's of Science in Mathematics: Pre-Professional Mathematics student . She recently graduated in spring 2021 and plans to teach mathematics at the college level.

Mark McFeaters is a first-year Master's of Science in Mathematics: Applied Statistics student.

Gage Plott is a first-year Master's of Science in Mathematics: Applied Mathematics student.
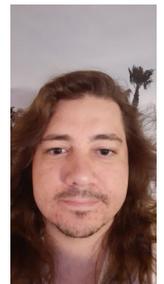
Philip Smith is a senior majoring in Mathematics: Actuarial Science.

Department of Mathematics Recognizes Students for Outstanding Academic Achievement

The Department of Mathematics recently awarded outstanding mathematics students for out academic achievement in mathematics courses. The 2021 honorees are:

Ruth Clark Perry Memorial Mathematics Award
The Ruth Clark Perry Memorial Mathematics Award was established in 1969 to be given to an outstanding upper-class woman majoring in Mathematics. This year's awardee is Margaret (Maggie) Harrison. Maggie is from Milton, TN and is currently majoring in Mathematics: STEM Education. She was inspired to major in mathematics thanks to her 8th grade algebra teacher and plans to graduate in December 2022 and continue on to graduate school to obtain a graduate degree in Mathematics Education before going into the teaching field. Her favorite math class so far has been Differential Equations.

John W. Jayne Memorial Mathematics Award
The John W. Jayne Memorial Mathematics Award was created in 1994 to be given to an outstanding mathematics student. Benjamin Van Breugel, Civil Engineering major, was given this award for 2021. He was influenced throughout high school with his interest in mathematics because he wanted to apply principles in math and physics to benefit society. He plans to graduate in 2022 and enter the workforce at that time. His favorite math course so far is Differential Equations.

James G. Ware Mathematics Education Award
The James G. Ware Mathematics Education Award was established in 1994 to be given to an outstanding mathematics student planning to teach mathematics at the high school level. This award has been given to Emily Miller in 2021. She is from Kingsport, TN and majoring in Mathematics: STEM Education. She was influenced by her high school calculus teacher to pursue mathematics and realized her freshman year that she wanted to teach mathematics. After graduation she wants to pursue teaching math at the high school level with the possibility of also pursuing a graduate degree as well. Her favorite course she has taken has been Basic Concepts of Geometry.

Winston L. Massey Memorial Mathematics Award
The Winston L. Massey Memorial Mathematics Award was established in 1973 to be given to an outstanding upper-class man majoring in mathematics. The 2021 award has been given to Daniel Wittry. He is from Oswego, IL and is majoring in Mathematics: General Mathematics. He has always enjoyed and excelled in math so he decided to major in the subject in hopes that he could apply that knowledge to a career. He plans on gaining experience through an internship to lead to a career after graduation. His favorite class so far has been Differential Equations.

Department of Mathematics Recognizes Students for Outstanding Academic Achievement (cont.)

Karel and Harriet Hujer Scholarship
The Karel and Harriet Hujer Scholarship is given each year to an outstanding student in mathematics. This award is given to James Cummins in 2021. James is a native of Chattanooga, TN and is a graduate of the UTC Math Department Undergraduate program. He is currently pursuing a graduate degree in Applied Mathematics here at UTC. After graduation, he would like to pursue a Ph.D. in Mathematics to inspire the next generation of mathematicians. His favorite course has been Complex Analysis and he is looking forward to Calculus of Variations this fall.

Outstanding Graduate Student Award
The Outstanding Graduate student Award is given each year to an outstanding student in the graduate studies program in Mathematics as UTC. This year's awardee is Maame Akua (AK) Korsah. Maame is from Takoradi, Ghana and will be graduating with her Masters Degree in Mathematics: Pre-Professional Mathematics in spring 2021. She plans on pursuing her Ph.D. in Computational Science: Computational and Applied Mathematics here at UTC beginning in the fall 2021 semester.

She has enjoyed all the math courses she has taken here at UTC, but as part of her current project, she has applied Differential Equations and Numerical Analysis and has appreciated some real-life applications of these courses.

Marjorie Watson Mathematics Scholarship
The Marjorie Watson Scholarship is a renewable scholarship awarded to an incoming freshman student majoring in mathematics. The scholarship is $2000 for the freshman year and $1000 for the sophomore, junior and senior year.

Freshman awardee: Areli Pantaleon

Renewals: Margaret Harrison

        Andrew Mathis

Dorothy Dean Shelton Mathematics Scholarship
The Dorothy Dean Shelton Mathematics Scholarship is given to an incoming freshman majoring in mathematics and pays all tuition, fees room and board and books. This year, the scholarship will be renewed for Dahlen Elstran.

Mathematics Department Celebrates Our Fall 2020 and Spring 2021 Graduates

The Department of Mathematics is so excited to recognize our Fall 2020 and Spring 2021 graduates!

BS Math: Actuarial Science

Hannah Holland is from Dunlap, TN and is graduated in spring 2021. She has worked as a Scholars Program Intern at Unum from Sept. 2018-May 2020 and has been employed as an Actuarial Intern there since June of 2020. She hopes to pursue a career as an actuary in an Actuarial Development Program in Chattanooga. Her favorite memory at UTC was taking Calculus 2 and Calculus 3 with Dr. Boris Belinskiy.

Bethany Taylor is from Medina, TN and graduated in December of 2020. She is looking to begin her career as an Underwriter and wants to be an expert in this field so she can be the person other people go to for help and questions. One of her favorite memories was taking Calculus 2 with Dr. Ossama Saleh. She also enjoyed group study session with other math majors.

BS Math: General Mathematics

Nathan Sheppard is from Morgan Hill, CA and graduated in spring 2021. He hopes he can find a position where he can try to make a difference in his community and provide for his family. His favorite memory has been how the mathematics faculty has helped him succeed in school despite everything else going on in his life.

BS Math: STEM Education

Victoria Arthur is from Ocoee, TN and graduated in spring 2021. She is currently planning to enter the education field as a certified math teacher for grades 7-12. She hopes to obtain a master's degree in mathematics after teaching a couple of years. Her favorite memories have been those studying with other math majors. It became a time for everyone to relate to each other and grow friendships.

Alyse Rietveld is from Syracuse, Indiana and graduated in spring 2021. She will be pursuing her master's degree in mathematics education in the fall here at UTC. Her favorite memory was her time as an orientation leader. It was her responsibility to show new math majors the department and help prepare them for the next four years.

Bailey Sudduth is from Shelbyville, TN and graduated in spring 2021. She will be attending graduate school in the fall at Middle Tennessee State University to pursue her Master's degree in Mathematics.

STUDENTS

Mathematics Department Celebrates Our Fall 2020 and Spring 2021 Graduates (cont.)

MS Math: Applied Mathematics

Alexis Jackson is from Hixson, TN and graudated in spring 2021. She is a graduate of the UTC Undergraduate program here at UTC and has been a Unum Scholar Intern on the Voluntary Benefits Pricing and Experience Analysis actuarial team since June 2020. She hopes to work full-time at Unum in the Finance or Underwriting department. Her favorite memories involve the Math Club events such as Mathsgiving and Pi Day.

MS Math: Pre-Professional

Maame Korsah is from Takoradi, Ghana and graduated in spring 2021. She plans to continue her education here at UTC in the fall as she enters the Ph.D. Computational Science: Computational and Applied Mathematics program. She aspires to be a math professor in the future.

Danielle Layne is from Arlington, TX and graduated in spring 2021. She plans to teach at the community college level or at a university. Her favorite memories included the Pie in the Face Pi Day celebration sponsored by the Math Club where she got to pie two of her professors in the face and assisting the math department to move to their new location.

Ph.D. Computational Engineering: Computational and Applied Mathematics

Michael Corley is from here in Chattanooga, TN and graduated in spring 2021. He is a graduate of the UTC Mathematics Master's in Mathematics program and is seeking to obtain a position at a university to teach and continue his research. He has always enjoyed spending time talking, joking and bouncing ideas off the other graduate students.

Also graduating in Spring 2021
Jonathan Barnes – BS Mathematics: STEM Education
Mary Cate Scango: BS Mathematics: General Mathematics
Chad Tawfik: BS Mathematics: Actuarial Science
Megan McCoy: MS Mathematics: Applied Mathematics

Also graduating in December 2020:
James Cox – BS Mathematics: Actuarial Science
Garret Flores – BS Mathematics: STEM Education
Thomas Lusk – BS Mathematics: General Mathematics
Rosalinda Powell – BS Mathematics: General Mathematics
Gavin Reiniche – BS Mathematics: STEM Education

UTC Mathematics Poster Contest Goes Virtual

The pandemic has forced departments to get creative when offering programs and activities this year. The UTC Mathematics Poster Contest is one such activity. The 2021 UTC Mathematics Poster Contest was held on April 12, 2021 via Zoom.

The poster contest is held annually for local middle and high school students. Each year there is a theme related to mathematics that students must follow to submit posters for consideration of the judges of the contest. Judges are various members of the UTC academic community. The contest typically has over 200 students from 10 area middle and high schools take part in the competition.

The theme for 2021 was "The Math Behind a Pandemic." Students were divided into three categories by grade level and first, second and third place winners were chosen in each category. The winners for the 2021 were:

Category 1 (6th, 7th and 8th grade)

First Place: Weston Jeno, Berean Academy
Second Place: Spencer Gore, Berean Academy
Third Place: Elizabeth Delcamp, Berean Academy

Category 2 (9th and 10th grade)

First Place: Landon Powell, Berean Academy
Second Place: Hope Milligan, Berean Academy
Third Place: Lauren Grant, Berean Academy

Category 3 (11th and 12th grade)

First Place: Akhilsai Ujjina, Homeschool
Second Place: Tanishqa Kuchi, Chattanooga School for the Arts and Sciences
Third Place: Josiah Tillet, Red Bank High School

Visit the UTC Mathematics Poster Contest page for videos of the poster entries and winners.

Math Department Relaunches Digital Presence

After a difficult 2020, the Math department has started 2021 with some updates to the department's digital presence. The website has been revamped and refreshed in recent months. There are new ways to connect digitally and remotely to the department, updated information on the department programs and events and additional information on student resources such as placement, overrides and advisement.

The department also relaunched its blog and social media accounts. You can now connect with us on Facebook, Instagram and LinkedIn. Be sure to check often and keep in touch with the department.