MATHEM@TICS

ν_0: From the Desk of the Chair

The Northern Lights have been brightening our skies at night with reds, pinks, and greens; on the ground, maple leaves are turning bright red and the oaks are yellowing. With all of these colorful changes around us, our minds are turning towards ... data science.

The math department is studying what a data science major would look like at Ithaca College, and we'd like your help. What are your thoughts on what students should be learning to prepare them for careers in this or adjacent fields? Please email me at mathchair@ithaca.edu with your insights.

It's also time to consider a summer internship or summer research experience (REU). Alumni, if your company has internships available for math students, please let me know, and I will forward these on to our students. Students, I realize that summer feels far away, but it is the absolute right time to start looking for internships and research experiences, because this process takes time.

Here are a few resources to get you started:

- IC Center for Career Exploration and Development
- Society for Industrial and Applied Mathematics (SIAM)
- More opportunities through the IC Math department

Yes, Fall is in full color. So students, it's time to select your Spring schedule. You'll find descriptions of our Spring course offerings inside this newsletter. The list of all courses to be offered this Spring will be on HomerConnect on Monday, October 21. Be on the lookout for an email from your advisor to schedule an advising meeting where you should have an updated conversation about your future.

Ted Galanthay, chair

ν_1: Upcoming Events

Monday, October 28	Interdisciplinary Speaker Series: "Symmetries in the Embroidery Art of Sashiko," Megan Martinez
Wednesday, October 30	Math Club meeting (featuring a variety mathematical puzzles)
Monday, November 11	Math Department Fall Awards

ν_2: Spring Courses

Registration for Spring 2025 courses is here! Below is a list of courses the Mathematics Department is offering this spring that you may be interested in along with a description provided by the professor teaching the course. You can find program requirements and "flight plans" (suggested sequencing for courses) for all of the math department majors and minors at **this link**.
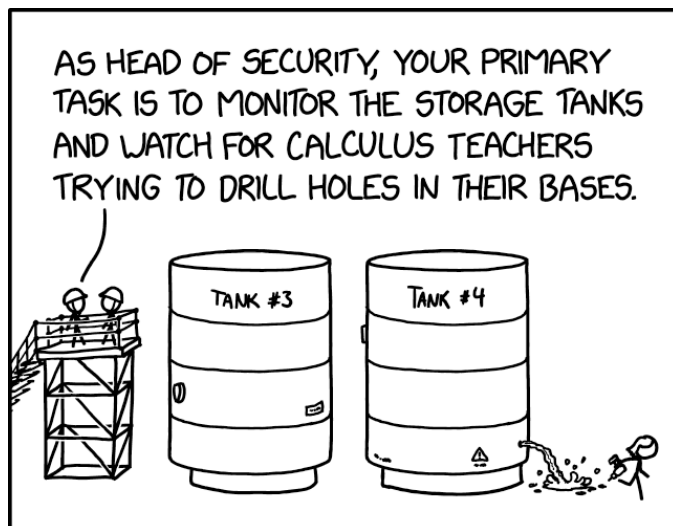
-XKCD 2974

11200 Calculus II **Prof. Yürekli**
Continuation of calculus of functions of one variable. Topics include differential equations, including slope fields, numerical solutions, and separation of variables; evaluation of integrals and antiderivatives; applications of integration; improper integrals; series, with an emphasis placed on power series.
4 cr; MWF 1-1:50, T 1:10-2.

14400 Statistics for Business, Economics and Management **Prof. Mast, Maceli**
A first course in statistics covering descriptive statistical techniques; introduction to probability; statistical inference including problems of estimation and hypothesis testing; correlation and regression analysis; and multiple regression. Data sets and exercises will be chosen from the fields of business, economics, and management. Technology used in this course may include graphing calculators and statistical software.
4 credits

MWF 9-9:50, R 9:50-10:40	Mast
MWF 10-10:50, R 10:50-11:40	Mast
MWF 2-2:50, R 1:10-2:00	Maceli
MWF 3-3:50, R 2:35-3:25	Maceli

14500 Statistics for the Health, Life, and Social Sciences **Prof. Pfaff**
A first course in statistics covering descriptive statistical techniques; introduction to probability; statistical inference including problems of estimation and hypothesis testing; one-way ANOVA; and design of experiments. Most of the data sets and exercises will be chosen from the fields of biology, health, and life sciences, as well as from everyday life. Technology used in this course may include graphing calculators and statistical software.
4 credits

MWF 10-10:50, T 9:50-10:40;
MWF 11-11:50, T 10:50-11:40

16100 Math and Society **Prof. Yürekli**
Multicultural Mathematics explores intersections of culture, historical traditions, sociocultural roots, and mathematics. The course investigates mathematical ideas arising from world cultures, recognizes contributions of non-Western societies to the history of mathematics and explores mathematical thinking outside of traditional Western mathematics. This course aims to introduce and implement a multicultural, interdisciplinary perspective into the mathematics curriculum and how underrepresented groups can develop self-confidence and interest in mathematics through a study of cultural heritage.
3 cr; MWF 2-2:50.

MAA Fall 2024 Seaway Conference

Student attendees from the conference, including IC students Thomas Stark '27 and Earth Sonrod '25. They attended with Professor Galanthay, and Earth presented his work "Parametric Integral Transforms and their Applications," research published last year with Professor Yürekli.

16500 Quantifying Sustainability Prof. Galanthay

How do we meet our present needs without compromising the needs of future generations? This is the fundamental question of sustainability. It requires the study of systems, policies, and individuals' choices. Quantitative information is a key component of the problems and solutions available to us. In this class, we'll create and use simple mathematical tools to help us better understand the issues and make more informed personal choices. Class time will be focused on lectures, small group work, and class discussion. The class draws students from across campus, so this is a great opportunity to engage with other disciplinary perspectives. In a final project, students will have an opportunity to dive deep on a sustainability project of particular interest to them.

3 cr; TR 2:35-3:50.

19100 World of Math Prof. Moore

In this 1-credit pass-fail only course, we delve into mathematical problem-solving, mathematical language and the basic structures of mathematical proof. We'll explore what we think makes something mathematical and how mathematicians approach problems. You will also get to know some of the department faculty.

1 cr; T 10:50-12:05.

21400 Differential Equations Prof. Yürekli

Calculus has been used to study how things change. Calculus provides a framework for modeling systems in which there is change, and a way to predict the future. Change is measured by the derivative which is the key idea of calculus. Differential Equations use the derivative to describe how a quantity changes. Turning the real life situation of a quantity into a differential equation is called modeling. In this course our goal is to learn how to design mathematical models and use the differential equations to predict the future value of the quantity being modeled.

3 cr; MWF 10-10:50.

22000 Math for Childhood Education Prof. Weinberg

Most of us know how to do things like multiply fractions. If you wanted to multiply $2/3 \times 5/7$, you would multiply the tops and bottoms: 2×5 and 3×7. But why does this give us a correct answer? Why does this make sense? Although most people are familiar with how to subtract whole numbers or multiply fractions, many of us don't really understand why they work. In this class, we use Martian number systems, Schwarzenegger fractions, and method you and your classmates come up with to explore our number system and ideas of arithmetic.

3 cr; MWF 11-11:50.

Highlights from the Math Club picnic in September
Grill-master Ted, trivia and other games, Sierpinski triangle cookies, good company.

23100 Linear Algebra   **Prof. Weinberg**
Linear algebra is about many things. It's the study of systems of linear equations—things like $2x + y = 3$. It involves thinking about systems of linear equations in terms of vectors and matrices, so it's about abstraction. It focuses on looking for patterns in relationships between vectors and matrices and explaining why the patterns exist, so it's about making conjectures and explaining your reasoning. Most importantly, it has hundreds of interesting and creative applications: Have you ever searched for something on Google? Watched a computer-animated movie? Thought about how to move traffic through a city? Wondered how to make sense of sectors of the economy? Linear algebra can help you solve all sorts of problems! This course is open to—and encouraged for—students of all majors.
3 cr; MWF 9-9:50.

24000 Statistics with R   **Prof. Geteregechi**
This course is an introduction to doing statistics in the R scientific language and will build upon introductory statistical knowledge. Creating reproducible reports and analyses using real-world datasets will be emphasized.
1 cr; M 10-10:50.

24600 Intermediate Statistics   **Prof. Maceli**
With every passing day, the world around us is getting increasingly complex. People are discovering relationships among variables that were previously thought to be unrelated. What this means is that society needs people with the right knowledge and skills for understanding the complexities of the world that we live in today. This course will introduce you to various multivariate analysis techniques that will boost your statistical knowledge. You will also learn about methods that do not rely on specific distributions like the normal distribution as well as other useful techniques like bootstrapping. All these will be done with the use of the popular environment known as R.
3 cr; MWF 12-12:50.

31100 Complex Analysis   **Prof. Yürekli**
What's the difference between real and complex numbers? There's more than meets the "i"... In this class, we study the complex numbers and functions of complex numbers; the results feel more like a distinct branch of mathematics than just an extension of the real numbers. For example, Newton's method gives a way to find roots of functions of real numbers; here[1] is what the method does when extended to complex numbers. This course will expand your ideas of how to visualize mathematics and will introduce you to the glorious complex plane.
3 cr; MWF 11-11:50.

31600 Probability   **Prof. Pfaff**
Probability theory is a mathematical framework that lets us reason effectively when we are confronted with uncertainty. In this class, you'll use ideas from many different areas of mathematics, such as Calculus and combinatorics. You'll apply and improve your skills in logic and problem-solving too.
3 cr; MWF 1-1:50.

39810 Research Experience in Math   **Prof. Galanthay**
This class is the "choose your own adventure" of math classes! Students will (with the guidance of your professors) find a mathematical topic to explore. You will ask questions, make conjectures, solve problems, and learn what you want to learn. Research students present their work at the Whalen Symposium and even have the option of presenting at regional conferences.
3 cr; TR 1:10-2:25

49800 Math Capstone   **Prof. Weinberg**
This course is the culmination of your math program!, with the option to continue work on a capstone project in Capstone II next fall. In Capstone I, we reflect back on the math major and on your ICC experience. You also work on developing a project proposal for Capstone II (if you plan to continue on in that course) or doing a complete, but smaller scale project in Capstone I. If you are debating whether to take Capstone I in your Junior or Senior year, stop by and we can talk over your options.
1 cr; M 3-3:50.

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[1] https://www.3blue1brown.com/lessons/newtons-fractal

ν_3: **Math in the News**

A few recent articles about math in the news.

Scientific American: High-Dimensional Sudoku Puzzle Proves Mathematicians Wrong about Long-Standing Geometry Problem

Politico: Opinion | Using Math to Analyze the Supreme Court Reveals an Intriguing Pattern

Numberphile: Pokémon and Geometric Distributions

Math Club Origami Night
Check out the finished piece–*Triakis-Petakis Dodecohedron*–by the 402 math department offices.

ν_4: **What's the Problem... with Professor Brown**

Is there an injective and surjective function $f : (0, \infty) \to (0, \infty)$ with derivative equal to its inverse; that is, $f' = f^{-1}$? If not, explain why. If so, provide an example.

Send complete answers to Professor Brown at `dabrown@ithaca.edu`. Those submitting correct answers will have their names printed in the following newsletter. People who correctly solve all problems from Volume 5 of the newsletter will receive a special prize at the end of the year.

Solution to Prof. Brown's previous problem:

Compute the exact area enclosed by the curve given by $|x - y| + |x^2 + y| = 6$.

Working through the various cases for the absolute values, the area in question (see picture) is bounded by the curves $\mathcal{C}_1 : y = -\frac{1}{2}x^2 + \frac{1}{2}x + 3$ and $\mathcal{C}_2 : y = -\frac{1}{2}x^2 + \frac{1}{2}x - 3$, form $x = -3$ to $x = 2$. Note that $\mathcal{C}_1 - \mathcal{C}_2 = 6$ for all x. So, the area enclosed is $5 \times 6 = 30$.
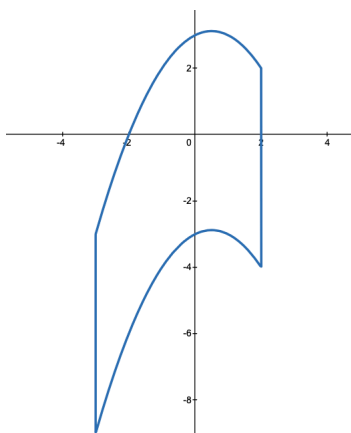
Honor role (solvers from Issue 1): Earth Sonrod (student)

Connect with us online!