MATHEM@TICS

"All the ν's fit to print"

Department of Mathematics | Ithaca College
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ν_0: From the Desk of the Chair

It is time to register for spring courses and it hasn't even snowed yet. As a student I always found registering for the next semester course fun and distracting as I would start to look forward to new course. So, take a moment and indulge yourself in thinking about new courses to take. At the risk of playing favorite: if you haven't taken Math Experimentation, Math 18500, you should consider it. I'll also plug the two 1 credit R courses: Math 24000 Stats with R—it never hurts to do more stats and learn more R—and Math 29000 Interactive Graphics—making cool graphs with R can't be beat.

In other news, we are getting our Instagram account going and so take a moment and check it out—ic_math—and let me know what you'd like to see posted (tpfaff@ithaca.edu). Also, don't forget to solve the newsletter problem.

Tom Pfaff, chair

ν_1: Spring Courses

Registration for Spring 2023 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.

11200 Calculus II **Prof. Yürekli**
Calculus of functions of one variable. Topics include limits, continuity, derivatives, applications of derivatives (problems of motion, graphing, and optimization), antiderivatives, and an introduction to the definite integral. Functions covered include polynomial, rational, exponential, logarithmic, trigonometric, and piecewise-defined functions.
4 cr; MWF 1-1:50, T 1:10-2.

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 10-10:50.

16500 Quantifying Sustainability **Prof. Weinberg**
How do we meet the needs of the present without compromising the needs of the future generations to meet their own needs? This is the fundamental question of sustainability. Quantitative information is a key component of the problems and solutions available to us. In this class, we'll use simple mathematical tools to help us better understand the issues, make more informed personal choices, and weigh in on society-wide

policy. Most of class time will be focused on 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; MWF 9-9:50.

18500 Math Experimentation **Prof. Visscher**
Scientists discover physical properties of the world through the lab. Mathematicians discover new mathematical phenomena... well, also through experimentation! This course explores how to create and collect examples, find patterns, and make conjectures—the beginning of the process of creating mathematics. We will study what makes a good question, how to skillfully play with examples in order to gain insight, and how to express the results accurately and concisely. Experimentation will be done both by hand and with technology.
3 cr; MWF 2-2:50.

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 12-12:50.

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.

23100 Linear Algebra **Prof. Conklin**
It's pretty easy to argue that Linear Algebra contains some of the most important tools in mathematics. Applications that are linear algebra based are everywhere, including a huge list that includes data science, computer graphics, economics, engineering and pretty much all the sciences. Within mathematics itself, linear algebra ideas show up in calculus, abstract algebra, statistics, probability, differential equations, dynamical systems, network and graph theory, numerical analysis, and game theory just for a start! Starting with ideas of solving a relatively simple set of equations and the idea of a matrix (just a rectangle of numbers), it's amazing how useful and interesting the ideas become. This course is open and encouraged for students of all majors. Please see me if you have any questions about the course (WILL 402-D).
3 cr; MWF 9-9:50.

24000 Statistics with R **Prof. Weinberg**
Real statistical analysis requires technology. This course is an introduction to doing statistics in the R scientific language and will build upon introductory statistical knowledge.
1 cr; M 12-12:50.

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 analyses 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.

29000 Interactive Graphics **Prof. Maceli**

Interactive and animated graphics are the future of displaying data on the internet and the future is here. We use the scientific programing language R and explore ways to create interactive and animated graphics. Experience with R or strong programming skills are expected.
1 cr; W 3-3:50.

30500 Introduction to Analysis **Prof. Visscher**

Real analysis studies the behavior of real numbers, sequences and series, and real-valued functions. We will work with topics such as convergence, limits, continuity, smoothness, differentiability, and integrability; investigating both the questions of "what actually is a real number?" and then "how does that lead to the fundamental results that we learned in calculus?" In the process, we will study how to harness and use the notion of infinity through the quantifiers "there exists" and "for all"—two phrases that have the remarkable ability to make complicated ideas precise. Ideas from topology and dynamical systems will also make an appearance.
4 cr; MWF 11-11:50, T 10:50-11:40.

31100 Complex Analysis **Prof. Visscher**

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 10-10:50.

31600 Probability **Prof. Conklin**

Probability theory is a mathematical framework that lets us reason effectively when we can't be certain. Since we live in a "Chancy" world, knowing how to quantify and reason in the face of uncertainty is an increasingly important skill. Probability uses ideas from many different areas of mathematics. Some parts of probability make a lot of use of Calculus; other areas use logic and problem solving with no specific background knowledge needed. Please see me if you have any questions about the course (WILL 402-D).
3 cr; MWF 1-1:50.

39810 Research Experience in Math **Profs. Galanthay & Wiesner**

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 (We have some flexibility in this meeting time. If a class conflict is keeping you from enrolling in the class, let's talk!)

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

49800 Math Capstone **Prof. Wiesner**

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; T 2:35-3:30.

ν_2: What's the Problem... with Professor Brown

Five identical basketballs, each with 24cm diameter, are stacked on a gymnasium floor as follows. Four of the basketballs are on the floor so that the four points of contact (one for each of the four) with the floor forms a square and each basketball just touches each of its two neighbors. The fifth basketball is carefully stacked on top of the four basketballs on the floor, just touching each of the four basketballs. An ant climbs to the top of the fifth basketball (the one balanced in the middle). Assuming each basketball is a perfect sphere, how high is the ant above the gymnasium floor? Exact answers only.

> 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 4 of the newsletter will receive a special prize at the end of the year.

Solution to Prof. Brown's previous problem:

$$\begin{aligned} 5^{1/5} \cdot 25^{1/25} \cdot 125^{1/125} \cdot 625^{1/625} \cdots &= 5^{1/5} \cdot 5^{2/25} \cdot 5^{3/125} \cdot 5^{4/625} \cdots \\ &= 5^{(1/5+2/5^2+3/5^3+4/5^4+\cdots)} = 5^S, \text{ where} \end{aligned}$$

$S = \displaystyle\sum_{n=1}^{\infty} \frac{n}{5^n} = \frac{5}{16}$ because

$$\begin{aligned} 4S = 5S - S &= 5 \cdot (1/5 + 2/5^2 + 3/5^3 + 4/5^4 + \cdots) - (1/5 + 2/5^2 + 3/5^3 + 4/5^4 + \cdots) \\ &= (1 + 2/5 + 3/5^2 + 4/5^3 + \cdots) - (1/5 + 2/5^2 + 3/5^3 + 4/5^4 + \cdots) \\ &= 1 + 1/5 + 1/5^2 + 1/5^3 + \cdots = \frac{5}{4} \Longrightarrow S = \frac{5}{16} \end{aligned}$$

Honor role (solvers from Issue 1): Earth Sonrod (current student), Michael Avanessian (current student), Jon Bancone ('86)

Connect with us online!

Ithaca College Mathematics Alumni and Friends

ic_math

Editor: Daniel Visscher