CLASS DESCRIPTIONS—WEEK 4, MATHCAMP 2025

Contents

9:30 Classes

5 Proofs That It Is Impossible To Tile A 10×10 Square By 1×4 Rectangles (🌶, Nikita, $\boxed{\text{TW}\Theta\text{FS}}$)
Can you tile a 10×10 square with 1×4 tiles? You can't, and I know five proofs of it, all using surprisingly different ideas. We will explore one of the following ideas per day: colorings, linear programming, polynomial ideals, group theory and induction.

Homework: Recommended

Class format: Interactive lecture

Prerequisites: None.

A Tour Of Paradox (🌶, Purple, $\boxed{\text{TW}\Theta\text{FS}}$)
This class has a new topic every day, all of which are 🌶.

(1) **A Tour of Paradox A: This Sentence Is A Lie**
Paradoxes of self-reference build contradictions from objects which reference themselves. We will build from the liar's paradox to Russell's paradox, and discuss the ideas behind foundational solutions to such paradoxes.

(2) **A Tour of Paradox B: Achilles Can't Catch A Tortoise**
Zeno's paradox of motion argues that, by the time Achilles has caught up to where a tortoise was, the tortoise has moved on; thus Achilles can never catch the tortoise. It is arguably resolved by viewing motion as a continuous process and using the machinery of calculus. We will introduce this paradox and its relationship to infinite sums and calculus.

(3) **A Tour of Paradox C: An Empty Pile is a Heap**
Many paradoxes of identity, like the sorites paradox and the ship of Theseus, deal with the fundamental issue that coarsely-defined statements like "this is a heap of sand" have fuzzy boundaries when affected by continuous or highly-granular processes. One possible resolution, phrased in modern mathematical language, is to accept a many-valued or continuous logic in which a statement can occupy a range of truth-values between true and false. We will discuss such paradoxes and proposed resolutions of this form.

(4) **A Tour of Paradox D: If The Eagles Lost The Superbowl, The Sun Would Fail To Rise**
The statement in the title is true, if you take the material conditional—anything follows from a false antecedent! (Go birds.) This is one of many examples of so-called paradoxes of the

material conditional, where our formal notion of implication disagrees with our casual linguistic use of the word. We will discuss several such issues in order to motivate relevance logic, which features a stronger implication resolving many issues of this form.

(5) **A Tour of Paradox E: Student Choice**
The final stop on our tour of paradox. During the week, we will decide together on a final paradox to cover.

Homework: None

Class format: Interactive lecture

Prerequisites: None

Einstein's Theory Of Gravity 2: General Relativity (🌶🌶🌶🌶, Laithy, TWΘFS)
This is the second of a series of classes on General Relativity.

Having understood the fundamentals of special relativity, we can now interpret and incorporate gravity in this new geometric perspective of spacetime. We will quickly discover that Newton's theory of gravity, in which he interprets gravity as a force between objects with mass, is inconsistent with the new theory of spacetime (special relativity). Einstein's revelation is that gravity should instead be interpreted as a manifestation of the curvature of spacetime caused by the matter around. This is called his theory of general relativity. He reformulated Newton's law of gravity, which relates the force of gravity with the matter density, to another equation in which he relates the curvature of spacetime with the matter density. These equations describe how matter determines the curvature of spacetime; they are the famous Einstein's field equations. In this geometric perspective, the motion of particles is no longer described by Newton's $F = ma$, but by the famous geodesic equation, which tells us how free particles follow the straightest possible paths through curved space.

To describe this mathematically requires differential geometry on curved manifolds. We'll develop the necessary tools: tensor calculus, covariant derivatives, parallel transport, Christoffel symbols, the Riemann curvature tensor, and the metric tensor. These allow us to write precise equations for how spacetime curves. The statement that objects follow straight paths in curved space becomes the geodesic equation—a system of coupled differential equations. Einstein's field equations, $R_{\mu\nu} - (1/2)g_{\mu\nu}R = T_{\mu\nu}$, relate spacetime curvature to matter and energy distribution.

Homework: Recommended

Class format: Interactive lecture

Prerequisites: Special relativity and courage to dive into something completely out of your reach.

Mathematical Logic, or How We Know We're Not Wasting Our Time (Completely) (🌶🌶🌶, Maya, TWΘFS)
Mathematical logic takes a "meta" view of mathematics, and asks questions about what is true and what is provable — and what the relationship between truth and provability is. Lucky for us, they are indeed related — but this isn't obvious, and in fact, it isn't even obvious what we mean by "truth". In this course we will say what we mean when we say a mathematical statement is true, and prove the theorems that establish the links between truth and provability. These are big and important facts, not to mention very cool.

Homework: Recommended

Class format: Interactive lecture

Prerequisites: This class has no specific prerequisites, but it will make no sense if you haven't seen a few different mathematical contexts (linear algebra, group theory, calculus all count as different contexts).

Representation Theory of Finite Groups (🌶🌶🌶🌶, Mark, TWΘFS)
This is a continuation of the week 3 course. If you didn't take that course but you want to join now, please consult with Mark.

Homework: Recommended

Class format: Interactive lecture

Prerequisites: Week 1 of this course, or equivalent knowledge

10:30 Classes

Combinatorics With Ultrafilters (🌶🌶🌶🌶, Steve, TWΘFS)
Combinatorics is full of results saying that functions on an infinite set are well-behaved infinitely much of the time. An easy example of this is the Pigeonhole Principle: given a function $f : \mathbb{N} \to X$, for a finite set X, no matter how crazy f is there is always some infinite set $S \subseteq \mathbb{N}$ on which f is constant – that is, some hole winds up with infinitely many pigeons. A slightly trickier instance of this is Infinite Ramsey's Theorem for pairs: if f is a function which assigns 0 or 1 to each pair of distinct natural numbers, there is some infinite set H such that any pair from H gets assigned the same color as any other pair. (If you haven't seen Ramsey's Theorem, don't worry — we'll prove it in class.)

However, what if "infinite" just isn't big enough? What if we want our function to be nicely behaved on a really big set? For example, for a function $f : \mathbb{N} \to X$ with X finite, maybe we want f to be constant on a set which is not only infinite, but closed under finite sums. Can we always find such a set – and if so, what's the most ridiculous way we can prove it?

In this class we'll do combinatorics using ultrafilters — bizarre, beautiful objects from the mysterious land of set theory! Ultrafilters cannot even be proved to exist without the axiom of choice, but that won't stop us from using them to build big homogeneous sets. Oh, and we'll also need to say the words "compact space", "topological semigroup" and "idempotent" a few times.

Homework: Recommended

Class format: Interactive lecture

Prerequisites: None.

History Of Math: The Origin Of Algebra (🌶, *Neeraja Kulkarni*, TWΘFS)
Often, the history of math is presented as a progressive evolution of ideas that culminate in the (supposedly) enlightened views of the present day. We won't do that in this course; instead we'll read some of the history of math focusing on the "discontinuities" or break points, by which I mean the times at which new ways of thinking about math caused the old ways to be more or less abandoned. We'll try to explore how ancient mathematicians thought about math with a view to understanding how they were different from the modern ones. Hopefully, this will give us some new perspectives on present-day math. We'll read extracts of writings by some of the following: Pythagoras, Plato, Aristotle, Diophantus, Descartes, Newton, Wallis. We'll focus on how each of the writers present mathematical ideas, i.e. the kind of formal language used or the lack thereof; and why the writers preferred their chosen mode of presentation.

Homework: Recommended

Class format: Interactive Lecture

Prerequisites: None.

Hyperbolic Geometry (🌶🌶, *Dan Zaharopol*, TWΘFS)
"Out of nothing I have created a strange new universe."

So said János Bolyai, the creator of hyperbolic geometry, as is now immortalized on decades of Mathcamp t-shirts. What he invented was a kind of geometry that is almost exactly like the Euclidean geometry we all learn in school... but with one crucial difference that changes everything.

We'll explore this geometry and learn how to work with it. It's a strange place: the angles of a triangle don't actually add up to π, and in fact the area of a triangle is *determined* by its area! There are more parallel lines than you can shake a stick at. It also has surprising and important connections to other areas of math, such as the surfaces that can (surprisingly) be given a hyperbolic structure. You'll even see (with much waving of hands and many incantations of "I am not a physicist") what this has to do with the big bang and the expansion of the universe!

Homework: Optional

Class format: Interactive Lecture

Prerequisites: None

Smhtiroglalgorithms (🌶🌶🌶, Zach, T$\boxed{\text{W}\Theta\text{FS}}$)

[Yo, banana boy]! Did you take a [lonely Tylenol] for a mild headache after a camper falsely claimed that zero is [never odd or even]? Did [some men interpret nine memos] to determine if the field trip to [my gym] is full? ([No, it is open on one position].) [Did Hannah see bees? (Hannah did.)] [Do geese see god]?

Learn efficient algorithms for searching and finding patterns in giant bodies of text, focused primarily on locating long palindromes efficiently. Naïve algorithms on length-n strings require approximately n^2 time, which becomes increasingly infeasible as big data gets bigger and data-ier (think giant DNA sequences, or the whole internet). We'll study two methods that achieve runtimes proportional to n instead of n^2, and their extensions to related string-processing tasks.

Homework: Optional

Class format: Lecture

Prerequisites: This theoretical computer science class does not directly involve programming and does not have a programming prerequisite, but we will assume some familiarity with foundational algorithmic concepts such as arrays and for-loops.

Trail Mix (🌶 → 🌶🌶🌶, Mark, $\boxed{\text{TW}\Theta\text{FS}}$)

Is your mathematical hike getting a little too strenuous? Would you like to relax a bit with a class that offers an unrelated topic every day, so you can pick and choose which days to attend, and that does not expect you to do homework? If so, some Trail Mix may be just what you need to regain energy. Individual descriptions of the four topics follow.

Trail Mix Day 1: The Prüfer Correspondence (🌶 → 🌶🌶).

Suppose you have n points around a circle, with every pair of points connected by a line segment. (If you like, you have the complete graph K_n.) Now you're going to erase some of those line segments so you end up with a tree, that is, so that you can still get from each point to each other point along the remaining line segments, but in only one way. (This tree will be a spanning tree for K_n.) How many different trees can you end up with? The answer is a surprisingly simple expression in n, and we'll find a combinatorial proof that is especially cool.

Prerequisites: None.
Class Format: Probably a bit of group work, as well as interactive lecture.

Trail Mix Day 2: Integration by Parts and the Wallis Product (🌶🌶🌶).

Integration by parts is one of the only two truly general techniques for finding antiderivatives that are known (the other is integration by substitution). In this class you'll see (or review) this method, and encounter two of its applications: How to extend the factorial function, so that $(1/2)!$ ends up making sense (although the standard notation used for it is a bit different), and how to derive the famous product formula

$$\frac{\pi}{2} = \frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdot \frac{4}{5} \cdot \frac{6}{5} \cdot \frac{6}{7} \cdots ,$$

which was first stated by John Wallis in 1655.

Prerequisites: Basic single-variable calculus.
Class Format: Interactive lecture.

Trail Mix Day 3: Perfect Numbers (🌶).
Do you love 6 and 28? The ancient Greeks did, because each of these numbers is the sum of its own divisors, not counting itself. Such integers are called *perfect*, and while a lot is known about them, other things are not: Are there infinitely many? Are there any odd ones? Come hear about what is known, and what perfect numbers have to do with the ongoing search for primes of a particular form, called Mersenne primes — a search that has largely been carried out, with considerable success, by a far-flung cooperative of individual "volunteer" computers.

Prerequisites: None
Class Format: Interactive lecture

Trail Mix Day 4: The Jacobian Determinant and $\sum_{n=1}^{\infty} \frac{1}{n^2}$ (🌶🌶🌶)
How do you change variables in a multiple integral? In the "crash course" in week 1 we saw that when you change to polar coordinates, a somewhat mysterious factor r is needed. This is a special case of an important general fact involving a determinant of partial derivatives. We'll see how and roughly why this works; then we'll use it to evaluate the famous sum

$$\sum_{n=1}^{\infty} \frac{1}{n^2} .$$

(You may well know the answer, but do you know a proof? If so, do you know a proof that doesn't require Fourier series or complex analysis?)

Prerequisites: Multivariable calculus (the crash course is plenty); some experience with determinants.
Class Format: Interactive lecture

11:30 Classes

Combinatorial Game Theory (🌶🌶, *Laura Pierson*, $\boxed{\text{TW}}\Theta\text{FS}$)
In Wythoff's game, there are two piles of objects, and two players take turns taking either some positive number of objects from one pile, or the same positive number from both piles. The goal is to make the last move. In Euclid's game, there are two numbers, and the two players take turns subtracting some positive multiple of the smaller number from the larger number, with the goal again being to make the last move. We'll see how both these games have surprising solutions involving the golden ratio! We may also explore other games of a similar flavor, time permitting. The class will be fairly interactive, with students working as a class to figure out the solutions to the games.

Homework: Optional

Class format: Interactive lecture

Prerequisites: None

Differentiating The Undifferentiable (🌶🌶🌶🌶, Sam, $\boxed{\text{TW}\Theta\text{FS}}$)
Your life as you know it has been a lie, you have been told that you can only differentiate a function if it satisfies the limit definition. But I will show you that not only is this untrue, but that we can even in some cases differentiate functions with jump discontinuities. "How?" I hear you scream, well, this is done by considering our function as what is called a distribution. A distribution allows us to study the behavior of how our function will act on other 'test functions'. An integration by parts kind of principle allows us to extend the idea of derivatives to such distributions. Not only this, but we can rigorously define certain mathematical objects, such as, the Dirac distribution (not a function), the principle value and more. Furthermore, we can even extend transformations like the Fourier transform to such distributions. Giving us a powerful tool to study all sorts of mathematics, from quantum mechanics, to differential equations, to inverse problems. Please come to my class to discover and learn how to use such wizardry.

Homework: Recommended

Class format: Interactive lecture and worksheets

Prerequisites: Convergence of sequences and series, continuity and differentiability of functions, integration by parts, open and closed sets, knowledge of point set topology would be beneficial but not required.

Error-Correcting Codes (🌶🌶, Narmada, TW$\boxed{\Theta\text{FS}}$)
Oh no!!!!!!! Nikita, the hat puzzle czar, has kidnapped 7 campers to play his evil game!!!!!!! Can the campers guess the colours of their hats with high probability? Their only chance for survival is to take this class and learn about error-correcting codes!!!!!!

In addition to saving you from Nikita, error-correcting codes show up everywhere from compact discs to QR codes. In this class, we'll study the mathematical foundation of linear error-correcting codes: vector spaces over finite fields. We'll define the perfect Hamming code that will save you from Nikita, and, if time permits, look at constructions of my favourite binary perfect code: the Golay code!

Homework: Recommended

Class format: Interactive lecture

Prerequisites: Intro linear algebra over $\mathbb{R}^n$: know what subspaces, bases, dimension, and linear maps are; Modular arithmetic. (You don't need to know what a finite field is, but you do need to know about $\mathbb{Z}/p\mathbb{Z}$ when p is prime.)

Flat Surfaces And Billiards (🌶🌶, *Jenya Sapir*, $\boxed{\text{TW}\Theta\text{FS}}$)
You might have seen some surfaces before, like donuts — sorry, coffee cups — sorry, I mean tori. You might even have seen how to build a donut out of a square piece of paper, first by taping opposite sides into a cylinder, then wrapping the ends of the cylinder together into a donut shape. (Let's ignore the fact that paper doesn't actually like to bend that way. We'll build a proper paper model of a donut in this class.)

Now imagine we put a very small, very simple, rover on the surface of our donut. Unfortunately, it is only programmed to go straight without turning (oops!) But still, will our rover get to see all (or most) of the donut? Will it get trapped in an infinite loop? What are its possible trajectories?

Amazingly, our rover's possible paths are closely related to the possible paths of a billiard ball hit on a (standard issue, frictionless) billiard table.

In this class, we will first study *flat surfaces*, that is, surfaces you can build by cutting shapes out of paper, and gluing them together. Not just donuts, but more complicated surfaces with higher *genus* — that is, more holes- like the surface of a pretzel. We will then try to understand the possible geometries — shapes — we can create like this. And we will study the different kinds of straight line paths we can have on these shapes. When do we have loops? When do the paths visit close to every point? Can we get stuck?

Then, we will switch to studying paths on billiard tables. And not just rectangular billiard tables, but other shapes, too, such as triangles, pentagons, and so on. And we will learn how we can sometimes "unfold" a billiard table into a flat surface. (I'll leave this process to your imagination, until we can properly cover it in class!)

Homework: Recommended

Class format: Mostly group work, some lecture.

Prerequisites: None.

The Other Analytic Number Theory (p-adics) (, Eric, $\boxed{\text{TW}\Theta\text{FS}}$)
While analytic number theory is a legit branch of math, and you might have learned about modular forms in the other other analytic number theory in weeks 1 and 2, this class is about another different analytically-flavoured branch of number theory! We'll learn about p-adic analysis: a new lens with which to tackle problems in number theory using tools from analysis and topology like power series and compactness. The p-adic numbers are an alternative to the real numbers, where all triangles are isoceles and the distance you travel on a hike is the same as the biggest single step you took.

We'll use p-adic analysis to prove a theorem about the structure of linear recurrence sequences (think Fibonacci). I really love this proof, here's two reasons why. 1: the form of the theorem falls out super naturally from the structure of the method we'll end up using in a way that I think is super interesting. 2: despite the statement of the theorem being purely about integers the only proofs known to the human race involve p-adic numbers, which is what makes this such a great conduit through which to learn about them!

Homework: Recommended

Class format: Mixture of interactive lectures and worksheets. My plan going in is that days 1 and 5 will mostly be interactive lectures, and days 2, 3, 4 will be worksheets which develop (respectively) p-adic numbers, p-adic topology, and p-adic functions.

Prerequisites: Fluency with modular arithmetic: the statement a is invertible $\bmod(n)$ iff $\gcd(a, n) = 1$ should be comfortable. Comfort with the idea of defining a function by infinite series, ideally you've seen power series representations of e^x and $\log(x)$ before. We will use some facts from linear algebra that were not covered in the intro class (Jordan normal form of matrices), but as long you are comfortable with matrix multiplication you'll be able to follow.

Two Cool Techniques Related To Exact Cover Problems (, Riley W, $\boxed{\text{TW}\Theta\text{FS}}$)
How many ways are there to cover a 9 by 12 checkerboard with triominoes? Such a combinatorial problem, where we need to find ways to create a partition of a large set using a family of subsets, is called an exact cover problem. This problem is generally NP-complete, but there are certain techniques that make solving them and learning about their solutions more feasible. As the name suggests, we will look at two related ideas.

One method is Donald Knuth's Algorithm X. The algorithm uses a clever idea for backtracking called dancing links. For fans of linked lists and depth-first searches only! We will also learn about binary decision diagrams and how they can help select uniformly random solutions to combinatorial problems.

Homework: Recommended

Class format: Interactive lecture

Prerequisites: Know common algorithms and data structures, including trees, recursion, depth-first-search, backtracking.

1:30 Classes

Continuous Functional Calculus on Hilbert Spaces (over $\mathbb{C}$): We Can Take The Square Root Of A Function Now?! (🌶🌶🌶🌶, Audrey, TWΘFS)
Using a bit of "spectral theory" (a sort of generalization of eigenvalues for infinite dimensional spaces) we can figure out how to apply continuous functions to linear functions in a coherent way. We can even ensure that these are in some sense "commutative" in the case where these are nice!

Homework: Recommended

Class format: Lecture

Prerequisites: Intro linear algebra — having a fairly solid grasp of vector spaces and linear functions. Students may find it helpful to know what a Hilbert space is, but it is not required and will be defined.

How To Solve An NP-Complete Problem (🌶🌶🌶, Glenn, TWΘFS)
Do you remember Misha's opening colloquium, on the very first day of Mathcamp? (It's okay if you don't.) He described the Hamiltonian path problem, which if you could solve efficiently (or prove that it cannot be solved efficiently), you would earn $1,000,000. It's one of the Millenium Prize Problems, equivalent to the *P vs. NP problem*, and Misha tried to convince you very strongly that this problem is difficult to solve.

But actually, modern computer scientists now consider NP-complete problems like Hamiltonian path actually kind of reasonable to solve! Although a problem with 3000 Boolean variables might naively take 2^{3000} attempts to try every possibility (for context, the heat death of the universe is predicted to happen within about 2^{500} picoseconds), advancements in the last 20 years have allowed programs called *SAT solvers* to solve most such instances that show up in practice in just a few seconds. Companies like Google and Amazon are regularly using these SAT solvers for advanced reasoning tasks like scheduling, resource allocation, and verifying security guarantees on code.

This class is about the theory and practice of SAT solving. Each day will focus on a different aspect, building on top of previous days:

- What is SAT, and how to solve a variety of problems using SAT
- The DPLL and CDCL algorithms that form the foundation of all modern SAT solvers
- Using the Z3 solver, and a little bit of SMT solving
- How the Resolution proof system relates to CDCL
- Why despite their effectiveness in practice, all CDCL-based solvers must take exponential time to prove the pigeonhole principle

Homework: Recommended

Class format: Interactive lecture

Prerequisites: None.

Infinite Trees (🌶🌶🌶, Susan, TWΘFS)
Last week we constructed an Aronszajn tree. This week our goal is to construct a Suslin tree! Come see how introducing the world's worst fortune teller into our Zermelo-Fraenkl set theory universe

makes it possible to build a tree with uncountable height, no uncountable levels, and no uncountable antichains.

Homework: Recommended

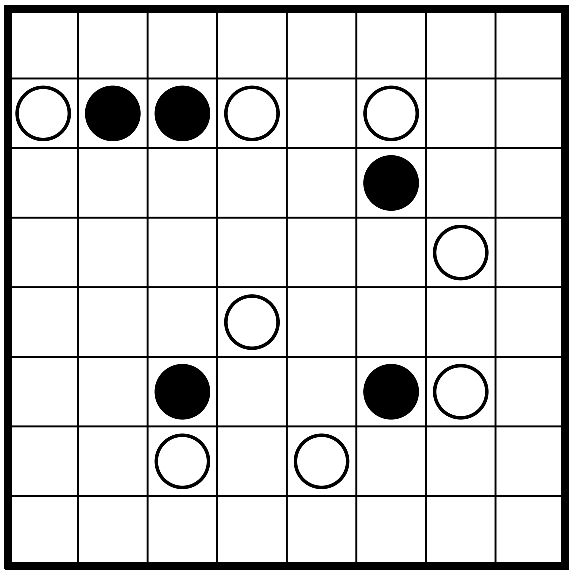
Class format: Interactive lecture

Prerequisites: Infinite Trees Week 1

Mathematical Concepts for Solving Puzzles (🌶🌶 → 🌶🌶🌶🌶, Della, $\boxed{\text{TW}\Theta\text{FS}}$)

I have a puzzle for you! Draw a white or black circle in every cell, such that

(1) the black circles are connected (meaning you can get from any black circle to another using only the cells with black circles, moving horizontally and vertically (not diagonally!)),
(2) the white circles are connected, and
(3) there is no 2 square with four circles of the same color.



This puzzle is hard! You can probably bash your way through it by trying lots of options until only one works, but there's a better way. By the end of this class, you will know some lemmas which make short work of the puzzle.

The days of this class are all independent, except that the final day builds on all of the previous days. Each day will have a new piece of math and (usually) a new puzzle genre or two, and you'll solve a series of puzzles and discover the math. So really this is five separate classes:

- MCSP: Planarity (🌶🌶, $\boxed{\text{T}}$WΘFS)
- MCSP: Jordan curves I (🌶🌶, T$\boxed{\text{W}}$ΘFS)
- MCSP: Parity (🌶🌶🌶, TW$\boxed{\Theta}$FS)
- MCSP: Jordan curves II (🌶🌶🌶, TWΘ$\boxed{\text{F}}$S)
- MCSP: Everything (🌶🌶🌶🌶(+🌶per day you missed), TWΘF$\boxed{\text{S}}$)

Homework: Optional

Class format: Many campers solving puzzles

Prerequisites: None

Seasonal Infectious Disease Models (🌶🌶, Kaia, $\boxed{\text{TW}\Theta\text{FS}}$)

Have you ever been watching a pandemic movie or a medical drama and heard reference to "R_0"?

This is the basic reproductive number– the expected number of people patient zero will infect. If $R_0 > 1$, the infection is expected to cause an outbreak, and if $R_0 < 1$, it's expected to die out.

But what exactly does this type of threshold quantity correspond to mathematically? Ordinary differential equations are some of the oldest tools for modeling the spread of diseases, but they're still used all the time today!

We'll talk about identifying and classifying equilibria of systems of differential equations, build and analyze compartmental models that track classes like susceptible, infected, and recovered individuals, and turn to our final question:

How can we understand diseases like the seasonal flu where parameters like the infection rate, instead of being constant, vary periodically?

Homework: Recommended

Class format: Interactive lecture

Prerequisites: Derivatives, eigenvalues and eigenvectors

Colloquia

Hyperspaces of Compact Sets (Maya, Tuesday)
We are often interested in notions of "smallness" — to take some examples on the real line, we can consider the sets which are countable, or that have measure 0, or are "meager". Descriptive set theorists use their superpowers to go one level up and look at the collection of small sets in a certain hyperspace — and this gives us a lot of information. In this talk I will describe that hyperspace and talk about a famous example: the sets of uniqueness.

Knots or Not (Audrey, Wednesday)
What is a knot, and how do we determine that two knots are the same or different? We will discuss this, and in particular, look at the Jones polynomial. Vaughan Jones found a groundbreaking invariant of knots by finding connections in seemingly unrelated areas of math, which earned him the Fields Medal in 1990.

Random Number Generators (*Neeraja Kulkarni*, Friday)
In probability, we usually think of a random number as an instance of an unbiased random variable, that is, as the output produced by a uniformly distributed random process. When we think of random numbers this way, it's impossible to know if a set of numbers were randomly generated without understanding where they came from. However, common sense dictates that if the process to generate these numbers is truly understood (and thus predictable), then the numbers could not be random. This talk will begin with an exploration of what it really means to be random. Then we will see a brief history of the algorithms used to generate so-called pseudorandom numbers.