

**SCHEDULE SUBJECT
TO CHANGE**

Math Day 2020

Student Schedule

March 23, 2020

SCHEDULE AT A GLANCE

8:00 am – 8:55 am	Check-in: Kane Hall, 1 st Floor Lobby
9:00 am – 9:10 am	Welcome Address: Bernard Deconinck, <i>Chair of Applied Math, University of Washington</i>
9:10 am – 9:55 am	PLENARY ADDRESS: <i>It's All Fun and Games Until Someone Becomes a Mathematician</i> , Allison Henrich, <i>Professor of Mathematics, Seattle University</i> Live in Kane 130; streaming in Kane 110 and Kane 120 (Admission is limited to room capacity.)
10:15 am – 10:55 am	Session I: Field Trips leave from outside Kane Hall Lobby at 10:05 am
11:15 am – 11:55 am	Session II: Field Trips leave from outside Kane Hall Lobby at 11:05 am
Noon – 1:10 pm	Student Lunch: We recommend students bring lunch. The HUB on campus has a <i>very limited</i> number of eateries open for purchasing lunch.
Noon – 1:10 pm	Teachers' Lunch
1:20 pm – 2:00 pm	Session III: Field Trips leave from outside Kane Hall Lobby at 1:10 pm

Cutting Edge Topics in Mathematical Science Presented by Top Faculty and Professionals

Students do not need a ticket to attend the lectures below. Admission is limited to room capacity.

SESSION I: 10:15 – 10:55 am	SESSION II: 11:15 – 11:55 am	SESSION III: 1:20 – 2:00 pm
Geometry in Nature: Why Bubbles are Round and Honeycombs Hexagonal, and More... <i>David Simmons, Graduate student in Mathematics, University of Washington</i> Location: Kane 110	The Quadratic Formula and Its Big Siblings <i>Bryce Goodwin, UW Undergraduate Mathematics Student</i> Location: Kane 110	Counting the Presents in The Twelve Days of Christmas <i>Stark Ledbetter, Graduate student in Mathematics, University of Washington</i> Location: Kane 110
How to Be Extremely Good at Dots and Boxes <i>Jonah Ostroff, Lecturer, Dept. of Mathematics, University of Washington</i> Location: Kane 120	Power of Three <i>Tom Edgar, Associate Professor of Mathematics, Pacific Lutheran University</i> Location: Kane 120	Deceptively Simple Problems in Mathematics <i>Farbod Shokrieh Assistant Professor of Mathematics, University of Washington</i> Location: Kane 120
Making a Theremin Out of 3 AM Radios and Some Trigonometry <i>Austin Roberts, Professor of Mathematics, Highline College</i> Location: Kane 130	The Curvature of Space <i>Jack Lee, Professor, Dept of Mathematics, University of Washington</i> Location: Kane 130	Warped Spaces <i>Alex Nichifor, Senior Lecturer, Dept. of Mathematics, University of Washington</i> Location: Kane 130
Sum-Free Subsets <i>Bobby Wilson, Assistant Professor of Mathematics, University of Washington</i> Gugenheim 220	Finding Patterns in Differences: The Mathematics Behind the Game SET <i>Bianca Viray, Associate Professor, Dept. of Mathematics, University of Washington</i> Gugenheim 220	Crazy Games and Crazier Numbers <i>Monty McGovern, Professor, Dept of Mathematics, University of Washington</i> Gugenheim 220
Panel Discussion: Undergraduate Life <i>Undergraduates will discuss courses, activities, and will answer questions.</i> Location: Savery 260		Information Session: UW Admissions <i>Hear from a UW Admissions representative about the ins and outs of the UW Admission process.</i> Location: Savery 260

**HAVE SOME FREE TIME?? NOT SURE WHAT TO DO??
VISIT THE ALL-DAY DROP-IN PUZZLE ACTIVITY IN KANE HALL LOBBY**

Drop in any time during Math Day!

Problem-Solving Strategies with Puzzles (All Sessions) – Investigate some math challenges in tessellating, spatial reasoning, and interactive problem-solving. Puzzles are provided by Math 'n' Stuff (8926 Roosevelt Ave. NE, Seattle, 206-522-8891)

Lecture Abstracts - Tickets NOT Required

**** Session I – 10:15 – 10:55 am ****

Geometry in Nature: Why Bubbles are Round and Honeycombs Hexagonal, and More... - Ever wonder why bubbles round or why bees build their honeycombs using a hexagonal pattern? These shapes aren't a coincidence. Many objects in the world around us naturally take certain shapes due to their special geometric properties. In this talk we'll explore some of the mathematical reasons behind these geometric phenomena.

How to Be Extremely Good at Dots and Boxes - Dots and Boxes is a pencil-and-paper game that you may have played before: draw a square array of dots, take turns drawing lines between them, and try to complete more boxes than your opponent. The rules are quite simple, but the math is remarkably complicated! We'll learn a few layers of strategy you can use to astound and humiliate your friends, and then discuss how variations in the rules can affect this strategy.

Making a Theremin Out of 3 AM Radios and Some Trigonometry - By sensing the movement of your hands through mid-air, a Theremin makes a kind of music made famous in science fiction. I will demonstrate how to make a basic Theremin out of 3 AM radios. Along the way, I will use some simple trigonometry (mainly sine waves) to explain how the Theremin decides what tone to make. No trigonometry background is necessary, but it would be helpful if you have ever graphed a sine or cosine curve.

Sum-Free Subsets - In this talk, we will discuss a beautiful result and proof due to Paul Erdos concerning the operation of adding two sets of positive integers to each other. Furthermore, we will explore a question about Erdos' theorem that was not resolved until relatively recently. Finally, an application to structure theory of sets of real numbers and points in higher dimensional real spaces will be discussed.

Panel Discussion: Undergraduate Life – Come hear undergraduates discuss their classes, activities, interests and life at the UW.

SESSION II – 11:15 – 11:55 am

The Quadratic Formula and Its Big Siblings - The quadratic formula gives us a solution to any quadratic equation in terms of radicals and its coefficients. There are also increasingly complicated formulas for cubic and quartic equations. However, there cannot be such a formula for polynomials of 5th degree or higher. This lecture will investigate how these formulas are derived, and why this 5th degree barrier exists.

The Power of Three - We investigate three applications associated with the field of three elements. In particular, we will discuss arithmetic over this field and see how the algebra arising from this number system applies to the world of games (Myst, SET, and Tricoloring pyramids).

The Curvature of Space - Do you think that everything there is to know about geometry was already discovered ages ago? Think again. Since the time of Euclid, the history of geometry has been a dramatic saga that your high-school teachers might not tell you about. It led, more than a century ago, to the mind-bending mathematical discovery that the three-dimensional space we live in might be "curved," in much the same way as the two-dimensional surface of the earth is curved.

Finding Patterns in Differences: The Mathematics Behind the Game SET - SET is a card game where the goal is to find collections of three cards where each of features (color, shape, number, and shading) are all the same or all different. This simple game surprisingly leads to lots of interesting mathematics, including a question which remains unsolved!

SESSION III – 1:20 – 2:00 pm

Counting the Presents in The Twelve Days of Christmas - We'll use combinatorics to count the total number of presents in the song "The Twelve Days of Christmas." The first method uses Pascal's Triangle, one of the most basic tools of combinatorics. Then we'll see a more clever and intuitive method, using a powerful concept called a bijection.

Deceptively Simple Problems in Mathematics – Pick a positive integer. If it is odd, multiply it by 3 and add 1. If it is even, divide it by 2. Repeat this operation over and over. It is believed that, no matter what number you start with, you will eventually reach the number 1. However this has never been proved, and the problem is believed to be hopelessly difficult. We actually do not even know if the problem "can be proved" or not! In this lecture, I will talk about this and related problems, and will tell you the few things that we do know about them.

Warped Spaces - What would the world look like if you lived in a strange place where the sum of the angles in a triangle is not 180 degrees, and it's not true that a line has a unique parallel through a given point? The familiar set of rules for lines and angles on a plane is just one possibility for the geometry of a space. We'll take a look at alternative, non-Euclidean geometries, and the resulting "curved" spaces. Some Escher prints show beautiful models of such worlds. In fact, modern physics suggests that our own universe is non-Euclidean, despite our intuition to the contrary.

Crazy Games and Crazier Numbers - By looking at two-player games from a mathematical point of view you will be led to some unusual but quite interesting games and bizarre numbers that you never learned about in school and that your teachers don't want you to know about. Join me on this mathematical adventure.

Information Session: UW Admissions – Hear from a UW Admissions representative about the ins and outs of the admission process.

Field Trip and Activity Abstracts — TICKETS REQUIRED

Applied Physics Lab (All Sessions) Applied Physics Laboratory Tour —The North Polar ice cap has thinned by 30% in the last 20 years. Internal bleeding can be stopped, tumors can be "cooked," and kidney stones can be pulverized—all with ultrasound. An underwater glider literally glides untethered through the ocean without a propeller and can remain underway for up to one year collecting oceanographic data. An ocean observatory is now operational, consisting of fiber optic cables and oceanographic and geophysical instruments on the small tectonic plate off the coast of Washington and Oregon called the Juan de Fuca plate. This project enables anyone to look in on the ocean and seafloor off our coast. The science, engineering, and mathematics behind these discoveries and devices will be presented and/or demonstrated. The actual topics covered will depend on the availability of personnel and equipment.

Campus Tours (All Sessions) - Tour the University of Washington campus.

Knights and Liars (Sessions II & III) - During the lecture, students will work on the collection of logical problems of increasing difficulty about liars and knights, princesses and tigers, and so on. We'll be using these problems to explore certain aspects of mathematical logics: elements of Boolean algebra, logical operators, truth tables.

Mathematical Card Tricks (Sessions I & II) - Learn how to impress your friends and family with a deck of cards and your brain. No sleight of hand is necessary, just some clever math. The ideas involved are based on a relatively young field of mathematics called Combinatorics. Combinatorics is the study of discrete objects, counting arrangements of those objects, and optimizing their properties.

Paper Origami (All Sessions) - The class will introduce students to a process that allows us to fold spherical models from one sheet of paper. Students will fold two to three models depending on time and skills.

Planetarium (All Sessions) - Come explore astronomy at the UW planetarium! Learn about the night sky, stars, galaxies and the planets in our solar system. Get an up close look at nebulae and galaxies, or zoom out to the farthest edges of the universe, all on a 30 foot dome with an all-digital system powered by Microsoft's Worldwide Telescope.

Plasma – The Fourth State of Matter (All Sessions) – Plasma is a super-heated gas that has unique electromagnetic and fluid properties, which make it relevant to fusion energy, and advanced space propulsion, photolithography, and astrophysical jets. The ZaP Flow Z-pinch experiment at the University of Washington explores an innovative plasma confinement concept that uses the JxB force to compress and a sheared flow to stabilize an otherwise unstable plasma. Because the plasma temperature easily exceeds 1 million degrees, highly advanced instruments must be used to make measurements without perturbing the plasma.

Seismology Lab (All Sessions) –Visit the home of the largest seismic network in the United States outside California. The Pacific Northwest Seismic Network (PNSN) operates a real time network of 250 seismometers in Washington and Oregon, monitoring earthquake activity and the Cascade Volcanoes as a partner agency of the Cascade Volcano Observatory.

This map shows only buildings where NON-Ticketed Lectures occur.

(lecture admission limited to room capacity)

All students with tickets for activities/field trips: Join the activity group which meets outside of Kane Hall. Groups depart from the statue to the activity location at times indicated below.

Session I: 10:05 am * Session II: 11:05 am * Session III: 1:10 pm

Note: If you miss your activity group, drop-in activities are available during all sessions in Kane Hall Lobby

