M*A*T*H COLLOQUIUM

Fall 2025 103rd LECTURE SERIES

Sonoma State University Department of Mathematics & Statistics presents a series of informal talks open to the public

8/27/25

GLASS IN MATH, MATH IN GLASS - CLIFF STOLL, ACME KLEIN BOTTLES

KLEIN BOTTLES ? YEP, KLEIN BOTTLES ! YEP, YOU'VE FOOLED WITH A MOBIUS STRIP -- ONE SIDE AND ONE EDGE. WELL, CLIMB OUT OF FLATLAND AND CHECK OUT A KLEIN BOTTLE. ONE SIDE, NO EDGES, ZERO VOLUME AND IT'S HAPPIEST IN 4-DIMENSIONS. FIND OUT WHY TRENDY TOPOLOGISTS THROUGHOUT THIS UNIVERSE DEMAND THE ULTIMATE IN NON-ORIENTABILITY!

9/3/25

SUSTAINABILITY PROBLEMS - SARA JONES, SANTA ROSA JUNIOR COLLEGE

THIS TALK WILL INTRODUCE YOU TO SOME SUSTAINABILITY PROBLEMS AND GIVE YOU WAYS TO ACCESS THESE PROBLEMS EITHER THROUGH MOM OR FROM A WORD DOCUMENT FILE. WE WILL LOOK AT A STATISTICS PROBLEM ANALYZING AIR QUALITY INDEX (AQI), A FINITE MATH QUESTION ON RECYCLING AND REUSE, AND A LINEAR ALGEBRA PROBLEM ON SEA TURTLES.

9/10/25

CONCEPTIONS OF DERIVATIVE IN INTRODUCTORY CALCULUS -SABA GERAMI, CAL POLY SLO

RESEARCHERS STUDYING DERIVATIVE CONCEPTIONS OFTEN EMPHASIZE GRAPHICAL, SYMBOLIC, VERBAL, AND PHYSICAL REPRESENTATIONS USING LIMIT-BASED APPROACHES. WHILE FOUNDATIONAL AND ALIGNED WITH TRADITIONAL CALCULUS INSTRUCTION, THIS FRAMEWORK DOES NOT CAPTURE THE CURRENT SCOPE OF THINKING ABOUT DERIVATIVES. RECENT LITERATURE ON DERIVATIVE TEACHING REVEALS ADDITIONAL CONCEPTIONS, PARTICULARLY THOSE GROUNDED IN INFINITESIMAL-BASED REASONING. I PRESENT THE CONCEPTIONS OF DERIVATIVE (COD) FRAMEWORK TO OFFER A MORE COMPREHENSIVE PERSPECTIVE ON CONTEXTUAL AND COGNITIVE PROCESSES WHEN THINKING ABOUT DERIVATIVES. THE FRAMEWORK PROVIDES RESEARCHERS WITH A COMPREHENSIVE LENS, WHILE OFFERING INSTRUCTORS AWARENESS AND LANGUAGE FOR INTENTIONAL SELECTION AND USAGE OF DERIVATIVE REPRESENTATIONS BASED ON THEIR STUDENTS' CONCEPTUAL NEEDS.

9/17/25

TRIGONOMETRY BEFORE CALCULATORS - MIKE NAKAMAYE, UNIVERSITY OF NEW MEXICO (RETIRED)

OFTEN USED TO ANSWER ASTRONOMICAL QUESTIONS, TRIGONOMETRY WAS A MAJOR FOCUS IN ANCIENT MATHEMATICS. HOW DID MATHEMATICIANS CALCULATE OR ESTIMATE TRIGONOMETRIC VALUES IN THIS TIME? WHAT VALUABLE LESSONS CAN WE TAKE FROM THEIR INVESTIGATIONS FOR TODAY'S CLASSROOM? AND HOW EXACTLY DO OUR CALCULATING DEVICES ESTIMATE/FIND TRIGONOMETRIC VALUES?

9/24/25

WHAT DOES COMBINATORICS HAVE TO DO WITH THE CHAIN RULE? - HAILE GILROY, MCNEESE STATE UNIVERSITY ***VIA ZOOM

COMBINATORIAL DESIGNS IS A BRANCH OF DISCRETE MATHEMATICS THAT FOCUSES ON ARRANGEMENTS OF OBJECTS ACCORDING TO A SET OF RULES. IN CALCULUS I, THE CHAIN RULE IS A NOTORIOUSLY DIFFICULT CONCEPT FOR INSTRUCTORS TO EXPLAIN AND FOR STUDENTS TO MASTER, BUT, GIVEN THE OPTIMAL PRACTICE, COULD STUDENTS UNDERSTAND THE CHAIN RULE MORE EFFICIENTLY? IN THIS TALK, WE EXPLORE A PROBLEM IN COMBINATORIAL DESIGN THEORY AND HOW IT CAN BE APPLIED TO CONSTRUCTING CHAIN RULE HOMEWORK.

10/1/25

INTERNET SCALE: LEARNING WHEN TO IGNORE THE BOX- REBECCA NAUGHTON

SINCE 2002, HYPERSCALERS HAVE SCALED THEIR COMPUTE INFRASTRUCTURE MORE THAN 100X. LEARNING HOW TO STAY AHEAD OF THAT GROWTH CURVE IS BOTH TECHNICALLY AND LOGISTICALLY CHALLENGING, NOT TO MENTION EXPENSIVE. SOLVING FOR GROWTH TURNS OUT TO BE AS MUCH PRAGMATIC PLANNING AND DATA ANALYSIS AS TECHNICAL WIZARDRY.

10/8/25

JAPANESE PUZZLE BOXES AND RECURRENCE RELATIONS - DEAN GOOCH, SANTA ROSA JUNIOR COLLEGE

I WILL TALK ABOUT MY INTEREST IN JAPANESE PUZZLE BOXES AND HOW ONE OPENS THESE SOMETIMES DIFFICULT PUZZLES. A WHILE AGO, I HAD NOTICED A JAPANESE PUZZLE BOX FOR SALE ONLINE THAT REQUIRED 324 STEPS TO OPEN IT. IT WAS A LITTLE EXPENSIVE, BUT WHEN I DECIDED TO FINALLY PURCHASE THIS BOX, WE WERE IN COVID LOCKDOWN AND I WAS REALLY BORED. I HAD THE BOX SENT FROM JAPAN AND "OPENED" IT, BUT I WAS TOO LAZY TO COUNT ALL OF THE STEPS. I CREATED AND SOLVED A RECURRENCE RELATION BASED ON THE MECHANISM OF THE PUZZLE BOX. UNFORTUNATELY, I MADE A BAD ASSUMPTION THAT LED ME TO GET AN INCORRECT ANSWER. (CURSES!!) AFTER SOME THOUGHT AND MORE PUZZLE BOX COVID PURCHASES TO HELP OFFSET MY DISAPPOINTMENT, I FOUND THE FLAW IN MY REASONING AND WAS ABLE TO FINALLY OBTAIN THE SOLUTION IN THE BACK OF THE BOOK. THIS TALK WILL INCLUDE THE SOLUTION TO SOME SIMPLE RECURRENCES TO PRIME THE AUDIENCE INTO HELPING ME SOLVE MY PROBLEM.

10/15/25

THE PYTHAGOREAN PROPOSITION AND THE ENDURING BEAUTY OF MATHEMATICS- JOHN MARTIN, SANTA ROSA JUNIOR COLLEGE

IN THE 1800’S CHARLES DODGSON OBSERVED, “THE PYTHAGOREAN THEOREM IS AS DAZZLINGLY BEAUTIFUL NOW AS IT WAS THE DAY WHEN PYTHAGORAS FIRST DISCOVERED IT.” IN THIS TALK, WE WILL EXPLORE THE HISTORY OF THE THEOREM AND THE BEAUTY THAT IT STILL REVEALS TODAY.

10/22/25

MY MATHEMATICS AS A QUEER RESISTANCE TO TOXIC MASCULINITY - BRIAN KATZ, CSU LONG BEACH ***VIA ZOOM

AS A QUEER AND GENDER-NONCONFORMING PERSON, I HAVE EXPERIENCED THE TOXIC EXPECTATIONS OF MASCULINITY FROM SOME DISTANCE. CURIOUSLY, FROM THIS VANTAGE POINT, MASCULINITY SEEMS TO AS A STATE OF KNOWING RATHER THAN ONE OF BEING IN IMPORTANT WAYS THAT PARALLEL DOING MATHEMATICS. IN THIS TALK, I WILL DISCUSS THESE PARALLELS AS WELL AS SOME DETAILS OF HOW I EXPERIENCE A QUEER MATHEMATICS AS RESISTANCE TO THE TOXIC FORMS OF BOTH MASCULINITY AND MATHEMATICS. DON'T WORRY, THERE WILL BE LOTS OF SILLY POP-CULTURE REFERENCES.

10/29/25

THE MATHEMATICS OF BEAUTIFUL GRAPHICS - STEVE TRETTEL, UNIVERSITY OF SAN FRANCISCO

PHOTO-REALISTIC IMAGES GENERATED BY COMPUTERS ARE NOW AN INTEGRAL PART OF OUR EVERYDAY LIVES, APPEARING IN EVERYTHING FROM MOVIES AND ADVERTISEMENTS TO ART AND EDUCATION. WHILE IT'S WIDELY RECOGNIZED THAT CREATING THESE IMAGES INVOLVES PROGRAMMING, IT'S LESS COMMONLY KNOWN THAT MUCH OF THIS PROGRAMMING IS GROUNDED IN MATHEMATICS—SPECIFICALLY, CONCEPTS YOU LEARN IN A MATH DEGREE! IN THIS TALK, WE'LL EXPLORE THE THEORY OF PATH TRACING, A METHOD FOR GENERATING IMAGES BY SIMULATING THE BEHAVIOR OF MILLIONS OF LIGHT RAYS AS THEY INTERACT WITH A SCENE. BY LEVERAGING TOOLS FROM ALGEBRA, CALCULUS, LINEAR ALGEBRA, AND PROBABILITY, WE'LL GRADUALLY DEVELOP A REALISTIC SIMULATION, OBSERVING HOW THE QUALITY OF OUR IMAGES IMPROVES AT EACH STEP.

11/5/25

LIGHTS, CAMERA, ALGEBRA! THE MATHEMATICS OF COMPUTER VISION - JESSIE LOUKS - TAVITAS, SACRAMENTO STATE

ALGEBRAIC VISION, LYING IN THE INTERSECTION OF COMPUTER VISION AND PROJECTIVE GEOMETRY, IS THE STUDY OF 3D OBJECTS BEING PHOTOGRAPHED BY MULTIPLE CAMERAS. TWO NATURAL QUESTIONS ARISE: (1) GIVEN A 3D OBJECT AND MULTIPLE IMAGES OF IT, CAN WE DETERMINE THE RELATIVE CAMERA POSITIONS? AND, (2) GIVEN MULTIPLE IMAGES AS WELL AS RELATIVE CAMERA LOCATIONS, CAN WE RECONSTRUCT THE OBJECT BEING PHOTOGRAPHED? CARLSSON AND WEINSHALL SHOWED IN 1998 THAT THE ALGORITHMS TO SOLVE THESE PROBLEMS ARE INTRINSICALLY CONNECTED. A BENEFICIAL COROLLARY OF RECENT JOINT WORK WITH ERIN CONNELLY AND TIMOTHY DUFF IS A FORMALIZATION OF THIS “DUALITY” MECHANISM. IN ORDER TO PROVIDE A DEEPER UNDERSTANDING OF THESE RESULTS, ALONG WITH CARLSSON-WEINSHALL’S DUALITY, WE WILL DETOUR INTO PROJECTIVE GEOMETRY, RENAISSANCE ART, AND PRINCIPLES OF DUALITY IN MATHEMATICS BEFORE DISCUSSING ANY THEOREMS.

11/12/25

BEYOND FUNCTIONS: A GENTLE DIVE INTO DISTRIBUTIONS AND THEIR HIDDEN STRUCTURE - ALI BEHZADAN, SACRAMENTO STATE ***VIA ZOOM

MANY INTEGRALS, DERIVATIVES, AND LIMITS THAT ARISE NATURALLY IN ANALYSIS OR PHYSICS SIMPLY DON’T MAKE SENSE—UNTIL WE EXPAND OUR NOTION OF THE OBJECTS FOR WHICH CALCULUS OPERATIONS SUCH AS DERIVATIVES AND LIMITS ARE MEANINGFUL. DISTRIBUTIONS, OR GENERALIZED FUNCTIONS, PROVIDE A POWERFUL FRAMEWORK THAT NOT ONLY RESOLVES THESE PARADOXES BUT ALSO OFFERS A UNIFIED LANGUAGE FOR WORKING WITH PDES, AND MORE. IN THIS TALK, I WILL DISCUSS THE MOTIVATIONS BEHIND DISTRIBUTIONS, EXPLORE SOME OF THEIR KEY PROPERTIES, AND SHOW HOW FAMILIAR FUNCTION SPACES FIT NATURALLY WITHIN THIS BROADER SETTING. ALONG THE WAY, WE'LL SEE EXAMPLES WHERE CLASSICAL ANALYSIS FALLS SHORT AND HOW THE DISTRIBUTIONAL VIEWPOINT STEPS IN WITH CLARITY AND ELEGANCE.

11/19/25

WHY TEACH? BECOMING A MIDDLE OR HIGH SCHOOL STEM TEACHER - SSU STEP CENTER AND ALUMNI MATH TEACHER PANEL

REPRESENTATIVES FROM THE SSU STEP (STEM TEACHER EDUCATION PATHWAYS) PROGRAM WILL BE TALKING ABOUT WHAT IT'S LIKE TO BE A MIDDLE OR HIGH SCHOOL MATH TEACHER AND HOW UNDERGRADUATE STUDENTS CAN BECOME ONE. WE WILL HAVE A PANEL OF SSU GRADS WHO ARE CURRENTLY WORKING AS MATH TEACHERS AND WILL DISCUSS THEIR EXPERIENCES.

SERIES SUPPORTED BY INSTRUCTIONALLY-RELATED ACTIVITIES FUNDS

IN PERSON: DARWIN 103

WEDNESDAYS AT 4PM

via zoom @ https://bit.ly/Fall2025MathColloquium