Abstracts (Alphabetical by Last Name of Speaker)

Name:	Bethany Adams
Advisor:	David Arnold
School:	College of the Redwoods
Title:	*Using Differential Equations to Model the Vegetation-Erosion Dynamic*
Abstract:	With the use of first order differential equations we are able to develop a set of equations, which can quite reasonably model the dynamic between vegetation and erosion in watershed systems. Depending on sets of initial conditions, we can determine whether certain watersheds are salvageable and develop plans for improving the vegetation or reducing erosion in at-risk areas.

Name:	Leslie Banta
Advisor:	Edith Mendez
School:	Sonoma State University
Title:	*You Know the Math, But Can You Explain It?*
Abstract:	This talk, geared toward those who are considering teaching or tutoring, takes a look at some of the common misconceptions students often have about mathematics and what teachers can do to help explain the "math behind the algorithm". We will look at experiences from the class "every teacher should take" and at ways to model a difficult concept so that our students can see what is really going on below the surface of the process.

Name:	Tova Brown
Advisor:	Viktor Ginzburg
School:	UC Santa Cruz
Title:	*The Mysterious Part of the Mapping Class Group*
Abstract:	The mapping class group of a surface is the group of classes of homeomorphisms from the surface to itself -- loosely speaking, the set of ways to put a one-piece spandex outfit on a donut. We will look at some examples, then use a motley assortment of tools to define a certain subgroup. This process involves a concept from algebraic topology and a journey through four-dimensional space, resulting in a close look at the mysterious part of the mapping class group.

Name:	Elijah Bunnell
Advisor:	Kemble Yates
School:	Southern Oregon University
Title:	*Galois Theory*
Abstract:	Analysis of automorphisms under extension fields which act like groups under composition.

Name:	Josh Clement
Advisor:	Izabela Kanaana
School:	Sonoma State University
Title:	*Fibonacci Identities*
Abstract:	Many people who are interested in Fibonacci numbers know a few Fibonacci identities, but not many know about the combinatorial proofs of these identities. Included in this talk are how Fibonacci numbers relate to the number of ways different types of boards can be tiled with squares and dominoes, as well as Lucas numbers and generalized Fibonacci (or "Gibonacci") numbers.

Name:	Cuong Dong
Advisor:	
School:	San Jose State University
Title:	*Limit of Symmetric Series*
Abstract:	Limit of sum of 1/(i^2*j^2) where i < j are integers can be found by a clever trick. However, another approach must be used to solve a more general problem: the limit of sum of 1/(i^a*j^a*...*k^a) where i < j < ... < k are integers and a is any number > 1.

Name:	Nick Dowdall
Advisor:	Sam Brannen
School:	Sonoma State University
Title:	*The Two Cevian Problem*
Abstract:	Given any triangle, two cevians from distinct vertices will partition the triangle into four convex polygons. We prove a necessary and sufficient condition for two of these polygons to have equal area. The well-known median concurrence and median partitioning theorems are shown as corollaries as well as the Pythagorean Theorem, the proof of which has striking similarities to the proof given by Euclid in the Book of Elements.

Name:	Elizabeth A. Giuliani
Advisor:	Elaine McDonald
School:	Sonoma State University
Title:	*Numerical Approach to Photon Paths*
Abstract:	We observe and measure the approximate behavior of a photon's true path trajectory on a surface with circular mirrors.

Name:	Jeff Graham
Advisor:	Tyler Evans
School:	Humboldt State University
Title:	*Group Actions and Cellular Automata Periodicity*
Abstract:	The research is concerned with finite cellular automata updated via additive rules, and when they will cycle. Some custom software has been developed to aid in this process.

Name:	Hieu D. Hoang
Advisor:	Chung-wu Ho
School:	Evergreen Valley College
Title:	*The Mother Worm's Problem*
Abstract:	The Mother Worm wishes to design a blanket that can cover her baby no matter in what posture her baby sleeps. Since they are poor, she wants to make the blanket as small as possible. Geometrically, we try to find a two-dimensional shape with the least area that can cover any curve of a fixed length. We will show how a partial solution made by a famed mathematician contains a mistake and we will try to find ways to correct the mistake.

Name:	Xiaoyu Hu, Yunha Chae, Hongyin Liang
Advisor:	Javier Arsuaga
School:	San Francisco State University
Title:	*Developing a Web-based Environment for Integrating Breast Cancer "omics" Data in the Clinical Setting*
Abstract:	In order to make an efficient use of the "omics" technologies in the clinical setting a number of computational and mathematical methods need to be developed. We are introducing a web-based environment, with mathematical and statistical capabilities, to investigate how the combination of different data types can help better improve the clinical diagnosis of a cancer patient. Here we present our recent advances on combining gene density, copy number and gene expression for different breast cancer data sets. *This research is supported by the San Francisco State University Center for Computing in the Life Sciences (CCLS) grant program.

Name:	Carolyn Lash and Michael Neff
Advisor:	Elizabeth Burroughs
School:	Humboldt State University
Title:	*Linear Algebra In High School*
Abstract:	This talk will consider the use of linear algebra in high school. We have interviewed practicing high school teachers to get their perspectives on linear algebra and its use in their classes. We will demonstrate what linear algebra looks like in high school by completing a basic linear algebra problem. We will discuss where linear algebra fits into the CA math standards.

Name:	Dustin Kerksieck
Advisor:	Stephen Devlin
School:	University of San Francisco
Title:	*Cooperation and Paternalism on Networks*
Abstract:	In particular, we look at individuals on each node of the network playing a Prisoner's Dilemma game against all neighbors. These individuals learn from past play and update strategies in real time. We consider the impact of the network topology on the spread of cooperation, and identify influential individuals in the network who can influence the play of others.

Name:	Rebecca Keller
Advisor:	Kemble Yates
School:	Southern Oregon University
Title:	*Conformal Mapping in the Complex Plane*
Abstract:	We are going to examine some comformal mapping and complex analysis ideas. The main part of the talk we'll look at the intersection of two specific curves and see what happens after applying a specific conformal mapping to them.

Name:	Gabriel Maybrun
Advisor:	Thomas Mattman
School:	CSU Chico
Title:	*Relationships Between 2-Bridge Knots, Boundary Slopes, and Continued Fractions*
Abstract:	It is conjectured that for a hyperbolic knot K in S^3, the diameter of the boundary slopes of K is at most twice the crossing number of K. We prove that this conjecture holds for 2-bridge knots and, in fact, equality holds. We do this by taking advantage of the relationships between continued fractions and the boundary slopes of 2-bridge knots.

Name:	Debbie McCullough
Advisor:	Larry Green
School:	Lake Tahoe Community College
Title:	*Know When to Hold 'Em, Know When to Fold 'Em!*
Abstract:	This presentation will consider using Game Theory as a strategy to win a game of poker. Through the use of matrices, we will calculate expected payoff and optimize the strategy used to obtain the largest possible payoff for specific scenarios. Focus will be given to deciding how often one should fold, bluff, or raise the bet given the probability of winning a game.

Name:	Jerod Michel
Advisor:	Kemble Yates
School:	Southern Oregon University
Title:	*Cyclotomic Polynomials*
Abstract:	"Cyclotomic Polynomials" is a presentation on the basic concepts of the cyclotomic polynomials over Q. This talk will begin with the definition of primitive nth roots of unity and then will lead into an interesting pattern which cyclotomic polynomials take that is a result of the behavior of the primitive nth roots of unity.

Name:	Andrew Miller
Advisor:	Elizabeth Burroughs
School:	Humboldt State University
Title:	*Linear Relations in Ocean Waves*
Abstract:	South of Eureka, California is the NOAA's Eel River buoy and west of Crescent City is the St. George Buoy. Both provide data regarding tides, ocean wave height, and storm motion. There is over 100 miles between the two buoys, an area for which there is no ocean data digitally available. The goal of this research is to determine if there exists a linear relation between the two buoys regarding the size of the ocean waves. This will be determined by selecting a well traveled fishing route in between the two points and examining the data there to see if there is any way to predict the wave size with the information from the other two points.

Name:	Danh Nguyen
Advisor:	Chung-wu Ho
School:	Evergreen Valley College
Title:	*On Cyclic Numbers*
Abstract:	The number 142857, when multiplied by 1,2,3,4,5,6, will result in products which can be obtained by cyclic rotations of its digits. Such a number is called a cyclic number. Formally, a k-digit positive integer N is a cyclic number if its products with 1,2,...,k can all be obtained by cyclic rotations of its digits. It is not known whether there are infinitely many cyclic numbers. We will describe how a cyclic number can be generated and will find all the cyclic numbers with 100 or fewer digits.

Name:	Steve Schluchter
Advisor:	Jim Sauerberg
School:	St. Mary's College of California
Title:	*The Complex World of Jumping Champions*
Abstract:	The jumping champion is defined as the most frequently occurring difference between consecutive prime numbers up to a given integer n. In 1999 a group of mathematicians studied this and conjectured that the jumping champion was growing roughly as the product of consecutive prime numbers. This talk will detail a summer research project which tried to come up with a jumping champion for Gaussian primes, which exist in the complex plane. This talk will detail all of the mathematics used (number theory) in the search for the jumping champion for Gaussian primes. Preliminary results are given.

Name:	Jason Smith
Advisor:	Bin Lu
School:	CSU Sacramento
Title:	*Ordering the First Known Cardinals*
Abstract:	At the end of the 19th century, George Cantor founded set theory. The study of cardinality attempts to disregard intuitive notions of "quantity", exploring infinity. We will survey Cantor's theory of cardinal numbers with the expressed interest of establishing the fallowing facts: (1) The countability of the natural numbers, integers, and rational numbers and the uncountability of the real and complex numbers, (2) Cantor's Theorem--there are infinitely many infinities, (3) The Cantor-Schroder-Bernstein Theorem, and (4) Establish the relationship $\|N\|<\|R\|$.

Name:	Erik Taylor
Advisor:	
School:	Sonoma State University
Title:	*Fibonacci and Data Compression*
Abstract:	Using Zeckendorf's Theorem that every positive integer can be written uniquely as the sum of non consecutive Fibonacci numbers, certain integer sets can be represented minimally in binary. The discussion will focus on existing uses of this concept in data compression and a new application for it that's been developed. Additionally, we'll hear about a approximate inverse to Binet's formula for the nth Fibonacci number which is important for the compression analysis. On input x as any real number greater than or equal to one, this function returns the least n such that the nth Fibonacci number is greater than or equal to x.

Name:	Krista Weisz
Advisor:	Kemble Yates
School:	Southern Oregon University
Title:	*RSA Cryptosystem*
Abstract:	I will be looking at mathematical applications used in the RSA cryptosystem for data protection.

Name:	Evan Willig
Advisor:	Beth Burroughs
School:	Humboldt State University
Title:	*Pentagons with Paper*
Abstract:	Can't get a straight edge and a compass for everyone in your class to participate in your geometric construction? Come learn how to create pentagons, five pointed stars, and dodecagons with nothing but folding and cutting paper.

Name:	Zachary Wood
Advisor:	Dan Balaguy
School:	Sierra College
Title:	*Heat Flow*
Abstract:	This semester, I am engaged in an honors contract that allows me to investigate a model that describes heat flow and how material reaches its steady state. The Runge-Kutta of order four technique is used to create this mathematical model.

Name:	Diana Zaccari, Susan Aten
Advisor:	Kathy Zhong
School:	CSU Sacramento
Title:	*Properties and Naming Schemes of Non-Uniform Convex Polyhedra or Johnson Solids*
Abstract:	A non-uniform convex polyhedra is one having angle measure of less than 360 degrees at each vertex. Norman Johnson named and numbered the non-uniform convex polyhedra which had regular faces. His conjecture was that there were only 92, a fact later proved by Victor Zalgaller. In addition to being convex with regular faces, the Johnson Solids have the property of unfolding, a special property by which a polyhedron can be dissected along its edges and presented in 2 dimensions without any overlapping of each face. We will discuss the various aspects of Johnson's naming scheme as well as this special property of unfolding that each solid shares. In addition we will have available 3 dimensional models of each of the Johnson Solids for exploration.

Name: Joan Zoellner
Advisor: Elizabeth Burroughs
School: Humboldt State University
Title: *Earthquake Induced Vibrations of Multi-Story Buildings*

Abstract: An application of linear systems of differential equations is the investigation of earthquake-induced vibrations of multistory buildings. The oscillations can be modeled using a second-order system of equations, where the homogeneous system describes the building's natural periods of oscillations, and the non-homogeneous system describes the result of the external force of the earthquake acting on the building. It is possible to determine the periods of earthquake-induced vibrations that would produce the maximum, and therefore most destructive, horizontal displacement within a given building. Buildings were modeled by the homogeneous system x''=Ax, where A depends on the masses of the floors of the buildings and the interactions of the floors with each other. The eigenvalues of A were extracted, and the respective natural frequencies and periods of oscillation for each floor of the building were found. The system was then analyzed with an external forcing term included. The results indicate that when the ratio of floor mass to floor stiffness is the same between two buildings, then the periods of natural vibration that are most destructive in those buildings will be the same. When the ratio is higher the periods of natural oscillation for the building will be smaller, and when the ratio is lower the periods of natural oscillation for the building will be larger.

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