METRO AND SEAWAY SECTIONS
MATHEMATICAL ASSOCIATION
OF AMERICA

2006 FALL MEETING
October 13-14, 2006
Marist College

Friday evening, Banquet speaker, Student Center
Some History of the Calculus of the Trigonometric Functions
V. Frederick Rickey, United States Military Academy, Westpoint

Can you evaluate the integral of the sine using Riemann sums? Do you think Archimedes could? Is it intuitively clear to you that the derivative of the sine is the cosine? If not, why not? What did Newton and Leibniz know about sines and cosines? When did sines become the sine function? Who is the most important individual in the history of trigonometry? Answers will be provided.

Biographical Information:
V. Frederick Rickey, a logician turned historian, became Professor of Mathematics at the United States Military Academy, West Point, NY in the summer of 1998. After earning three degrees from the University of Notre Dame (Ph.D. 1968) he went to Bowling Green State University where he rose through the professorial ranks to the rank of Distinguished Teaching Professor Emeritus. He has broad interests in the history of mathematics and is especially interested in the development of the calculus. He has been on leave five times, most recently in Washington D. C. where he was Visiting Mathematician at the MAA Headquarters. While there he was involved in the founding of Math Horizons, a magazine for mathematics undergraduates; became the first editor of electronic services for the MAA and built its first gopher and web pages; and wrote a successful NSF grant for an Institute for the History of Mathematics and Its Use in Teaching. He loves teaching and enjoys giving lectures to mathematicians about the history of their field. He received the first award from the Ohio Section for Distinguished College or University Teaching of Mathematics, and one of the first MAA National Awards for teaching.

Saturday morning, Student Center, Nelly Goletti Theater

Planar Linkages
Nancy Hagelgans, Ursinus College

A planar linkage is constructed in the plane from rigid links or rods that are connected with movable joints at their ends. Robot arms and carpenters' rulers are examples of planar linkages in which the links are connected to form a chain. We will examine the reachability regions of robot arms, which are chains with one fixed end. Then we will go on to solve the minimal folding problem of carpenters' rulers with links of different lengths. Finally, we will address some planar linkages that can be used to convert one type of motion to another type of motion.

Biographical Information:
Nancy Hagelgans is Professor Emerita of Mathematics and Computer Science at Ursinus College, where she taught a great variety of mathematics and computer science courses for 26 years and served two terms as department chairperson. She earned a Ph.D. in algebraic topology at Johns Hopkins University and later an M.S. in computer science at Villanova University. Her A. B. in mathematics was awarded by Goucher College, which she entered on a Ford Foundation Early Admissions Scholarship and where she was elected to Phi Beta Kappa. Her interests include discrete mathematics, computer solutions to mathematics problems, and student learning. She was a co-author of the MAA book "A Practical Guide to Cooperative Learning in Collegiate Mathematics." Currently she is a member of the MAA Executive Committee, Chair of the MAA Committee on Sections, Chair of the MAA Strategic Planning Working Group on Professional Development, and an adjunct faculty member in graduate computer science at Villanova University. She plays the violin in a symphony orchestra and various chamber music groups.

Increasing the Numbers of Mathematics Majors
William Y. Velez, The University of Arizona

In the late 1980's I began my efforts to increase the success rate of minorities in first semester calculus. The interventions that I devised were very time consuming and as the number of minority students increased, I could not manage that kind of effort. I developed my Calculus Minority Advising Program in an effort to meet with scores of minority students each semester. This program consists of a twenty-minute meeting with each student at the beginning of each semester. Over the years these meetings changed my attitude about the importance of mathematics in the undergraduate curriculum of students.

I took over the position of Associate Head for Undergraduate Affairs in the department three years ago. I set a very modest goal for myself: to double the number of mathematics majors. With 470 mathematics majors, I am halfway there. My work with minority students provided me with the tools to accept this new challenge of working with all students. This talk will describe my own efforts to encourage all of our students that a mathematics major is a great career choice.

Biographical Information:
I was born in Tucson, Arizona and grew up in the nurturing embrace of the Spanish-speaking part of the town. My parents were both born in Mexico, in the state of Sonora. Education was heavily emphasized in our home: my mother worked three jobs in order to send us to Catholic schools, through high school. All of my brothers earned their degrees from The University of Arizona, and our career paths, though much different, have focused on educating the community.

I earned all of my degrees from The University of Arizona, completing my doctoral degree in mathematics in 1975. My research interests have been in number theory and algebra. I have always been interested in the ways that mathematics is applied and I have held positions at various military labs, where I have applied mathematics to solve problems that have arisen in military communication systems.

I was a Program Officer at the National Science Foundation, where I directed the Algebra and Number Theory Program. I am a Founding Member of Society for the Advancement of Chicanos and Native Americans in Science and served as President of this organization from 1994-96. I served as the Director of the NSF funded Southwest Regional Institute in Mathematical Sciences from 1994-99

Saturday afternoon, Student Center, Nelly Goletti Theater
*The Mathematics of *Not* Voting*
William S. Zwicker Union College

Real legislators sometimes get sick, skip sessions, or duck issues by refusing to cast a vote. Yet the standard mathematical model for voting implicitly assumes that not voting ***yes*** is tantamount to voting ***no***. As a result, while real voting systems often count abstention or absence as a distinct "middle level" of approval, voting theorists have paid little attention to this until recently.

In the first part of the talk, we ask two questions:

- What is the meaning of "weighted voting" in the context of abstention?
- How simple does weighted voting become when the system is *anonymous* (all voters have equal influence)?

The answer to the first question turns out to be a bit surprising. The answer to the second is "pretty simple, so that a very thorough analysis is possible, but with just enough complexity for the mathematics to tell us something useful." In particular, there are practical voting rules that seem to have been overlooked, some of which represent tempting alternatives to rules that are in actual use.

In part 2, we turn to anonymous rules that make ***more*** than *3* levels of approval available to a voter. These are not empty generalizations – real systems (such as ones for determining a final course grade from several exam grades) fit this model. And the mathematics gets harder, i.e., more interesting!

The table below shows the number of possible voting systems with j levels of approval, in terms of the number n of voters. Do you see any patterns?

$n \rightarrow$ / $j \downarrow$	2	3	4	5	6	7
2	4	5	6	7	8	9
3	8	16	32	64	128	256
4	16	66	352	2431	21760	252586
5	32	352	9304	683464	161960220	
6	64	2431	683464			
7	128	21760	161960220			
8	256	252586				

Biographical Information:
Bill's 1976 Ph.D. is from MIT, where he received his training in mathematical logic. After early work in combinatorial set theory, he became interested in applications of mathematics to political science. He has published in the areas of voting, fair division, and cooperative game theory, and is on the editorial board of Mathematical Social Sciences and of the International Journal of Game Theory. He is the inventor of the hypergame paradox, and is the author, with Alan D. Taylor, of Simple Games (Princeton University Press, 1999). His entire career has been at Union College, where he is currently the William D. Williams Professor of Mathematics. Bill's hobbies include cooking, classical music, travel, and reading escapist fiction of dubious worth.

Saturday Afternoon, Donnelly Hall, Room 225

Panel Discussion: *New York State's K-12 Mathematics Curriculum and the National Forces That Mold It*
Facilitator: Joe Straight. SUNY Fredonia

Contributed Papers

Saturday Afternoon, Donnelly Hall, Room 225

Mathematics in Children's Books
Heather A. Lewis, Nazareth College

When our son brought home a suggested reading list for the summer, we noticed that there was no math and very little science among the 70+ suggestions. This led to a quest for books that have interesting mathematical content. This talk will cover the results of that search, showcasing books that are good to read in their own right but which also have some (sometimes surprising!) mathematics in them.

A Musical Exercise Used in a Liberal Arts Mathematics Course
Rehana Patel, St. John's University

For the past three years, I have been teaching a 'Mathematics for the Liberal Arts' core course at St. John's University. The students are mostly freshmen non-math majors for whom this is a terminal mathematics class. My intent for this course is that they learn some serious mathematics, so that they carry away a sense of the richness of the subject, but I have tried to use non-mathematical modes of articulation to help them understand these ideas. I will describe one such exercise: a musical activity conducted jointly with my colleague Heidi Upton, a musician and music educator, presented during a module on symmetry and groups, which led students to correlate musical and spatial patterns and eventually to recognize their common underlying mathematical structure.

Saturday Afternoon, Donnelly Hall, Room 100

An Optimal Estimator for the Unknown Number of Sides of a Fair "Die"
James Marengo, Rochester Institute of Technology

Consider a "die" with an unknown number theta of sides which are labeled with the positive integers one, two, … , theta. Assume that one and only one of the sides will come up whenever the "die" is tossed and that it is fair in the sense that each side comes up with the same probability. Now suppose that the "die" is tossed and that the numbers that come up are recorded. In this talk we will find an optimal estimator of theta based on this recorded data. This talk will illustrate the important ideas of bias, minimum variance, sufficiency, and completeness from the field of mathematical statistics and should be understandable to an undergraduate student who has had a basic probability course.

Visualizations in Fractional Calculus
Joseph D. Myers, US Military Academy

Fractional calculus has received renewed attention in the last several decades as a tool for modeling a variety of stochastic processes, such as diffusion in porous media, movement of option pricing, and folding of long-chained polymers. As one first begins to use fractional calculus as a modeling tool, it is useful to get a feel for how these operators behave and how they connect with existing intuition. This paper presents a few basic visualizations of differintegrals in order to gain such a feel. We demonstrate plots and animations of differintegrals over a variety of parameter ranges and lower boundary conditions. We illustrate the role of the behavior of the Gamma function in dictating how integrals of integer order require a lower boundary condition whereas derivatives of integer order do not. We then model the evolution of waves in an elastic medium with a fractional PDE of order between 1 and 2 to illustrate behavior lying between that of pure diffusion and propagation.

Bifurcations in the Lang-Kobayashi system
Tamas Wiandt, RIT, V. Kovanis (USAF)

Abstract: We investigate numerically and analytically a simple ODE model that captures key characteristics of external cavity semiconductor lasers. This model has the same set of fixed points as the ones derived from the celebrated Lang and Kobayashi single mode single delay rate equations. Pulsating phenomena originally found numerically at the level of the Lang and Kobayashi model are investigated in the context of the simple ODE model coupled with the observation that the free running semiconductor laser is a nearly conservative oscillator. We analyze some of the bifurcations at certain parameter levels.

Assuring an Adequate Source of (Pseudo-) Random Seeds: A Ready and Steady Supply
Danielle Mihram, G. Arthur Mihram, University of Southern California

We are responding here to the oft-voiced request for a ready source of random number seeds for use in Monte Carlo experiments (evaluations), in statistical sampling experiments, and within designed statistical experiments with large-scale, stochastic, and dynamic simulation models. We recall an oft overlooked property of the congruential (pseudo-) random number generators, particularly the mixed congruential generator: $Ik+1 \bullet aIk + c \pmod{m}$, $k = 0, 1, 2, \ldots (m\text{-}1)$, [1] wherein integral $I0 \bullet (0, m\text{-}1)$ represents its seed, itself expected to have been selected (separately) randomly. We first review the (two) Principia of Seeding to reveal a published miscomprehension (i.e., published errors) in its/their understanding. The Principia's resulting mandate(s) for random and statistically independent seeds implies that one may need to be more appreciative of the quantity of seeds which may, in any given application/experiment, be required. The mixed generator [1], with its parameters (a,c) selected from among their respective sets of admissible values, becomes a particular shuffling of a 'deck' of m numbered cards: 0, 1, 2, …, $(m\text{-}1)$, so that the random specification of the seed, I0, is in effect a random 'cut' of the pre-shuffled deck. (Of course, the deck itself can be considered to have been truly randomly shuffled whenever the parameterpair, (a^*,c^*), had themselves been (separately and uniformly) randomly selected, each from among its respective set of admissible values.) Two conclusions: (A) Shouldn't each of us therefore maintain our own [personal] "seedgenerator", defined by merely selecting (a^*,c^*) (separately, randomly, uniformly), each from its set of admissible values, and thereby providing a ready source of seeds? (B) Couldn't each of us—or, alternatively, couldn't each of our institution's 'mainframe' computers—'re-shuffle' periodically (say, monthly or annually) its operating system's (earlier pre-shuffled) 'deck', providing thereby a continually altered sequence of pseudo-random numbers?

Basic Calculator workshop
James Salvadon, Rockland C. College.

I would like to present a workshop that is designed of contents intended primarily for Math and Statistics instructors who would like to integrate technology into their course materials. Participants at this workshop will be guided through the most common basic functionalities and commands of the TI calculators. We will explore Specific Problems in the areas Pre calculus & Elementary Statistics that require the use of technology. A Q & A session will follow this workshop. Please bring a TI 83+/84 silver edition.

Saturday Afternoon, Donnelly Hall, Room 104

Two Approaches to a CNT Self-Folding Problem
Yozo Mikata, Lockheed Martin

This talk will examine the self-folding of carbon nanotubes (CNT) by using two different methods: force method and energy method. Approximate solutions are obtained for a critical threshold length for the self-folding of the carbon nanotube by each method. Some of the approximate solutions use the exact solution to Euler's elastica problem, which involves elliptic functions and elliptic integrals. Strength and weakness of each method will be discussed. Comparison of the results will shed light on what can happen in nature.

Fortunate Primes
Jay L. Schiffman, Rowan University

Reo Franklin Fortune (1903-1979) was a cultural anthropologist and lecturer at Cambridge University who for a time was married to social scientist Margaret Mead. What many anthropologists fail to realize is his connection to mathematics. Fortune conjectured that for each positive integer input n, the output Next Prime [euclid [n]] - euclid [n] + 1 always generates primes. Here euclid [n] represents the product of the first n primes plus 1 which number theory enthusiasts recall is utilized in Euclid's proof that there are infinitely many primes. To cite a simple example, euclid [3] = 2 * 3 * 5 + 1 = 31and Next Prime [euclid [3]] = Next Prime [31] = 37. Hence Next Prime [euclid [3]] - euclid [3] + 1 = 37 - 31 + 1 = 6 + 1 = 7, which is prime. Harvey Dubner proved in the last decade the primality for the initial one hundred inputs and Dr. Eric Weisstein of Wolfram Research Inc. in 2003 was able to extend the truth of the conjecture to the initial one thousand inputs. (The initial one thousand outputs are prime!) Utilizing MATHEMATICA programming, I have currently extended the search and found solely prime outputs for an additional five hundred inputs as of June 19, 2006. This work is ongoing and I seek to either extend the result to the first two thousand inputs or secure the first counterexample. In as much as euclid [1500] contains in excess of five thousand decimal digits, securing the Next Prime is rather labor intensive even for MATHEMATICA and around twenty five outputs are generated weekly. Supporting data will be provided as we explore a simple yet fascinating open number theoretic problem involving the remarkable prime numbers.

The Stern and Fibonacci diatomic arrays
Sam Northshield, SUNY-Plattsburgh

A 'diatomic array' is an array of integers similar to Pascal's triangle. We introduce the listener to two such arrays and some of their many amazing properties. Among these properties are surprising relations to Pascal's triangle modulo 2, an enumeration of the rationals, and hyperbolic geometry.

Feasible Task Schedules with Minimum Project Cost Solved by a Genetic Algorithm Michael L. Gargano, Pace University, Louis V. Quintas, Pace University

Suppose that a project consists of n separate tasks and one and only one task can be completed in one time period. However, since some tasks can be started only before others have been completed only feasible task schedules are considered. There is a cost associated with the time at which a task is completed and the project cost is equal to the sum of all the task costs. How can a feasible task schedule with minimum project cost be found for completing the entire project? This research proposes using a genetic algorithm to efficiently solve this problem.

Saturday Afternoon, Donnelly Hall, Room 106

A Method for Generating Integer Solutions to Matrix Equations
Raymond N. Greenwell and Stanley Kertzner, Hofstra University

We describe a method for generating all integer matrices X that satisfy the equation $AX=B$ for integer matrices A and B. The procedure is based on a modification of a theorem of Nathan Jacobson. We demonstrate that there exist invertible matrices, P and Q (with Q and its inverse being integer matrices) for which PAQ equals the diagonal matrix with 1's in the 1st r diagonal positions and 0's elsewhere. We prove conditions under which $AX=B$ for the integer matrix X, and provide a formula for X involving P, Q, and B when those conditions are met. The procedure for generating the matrices P and Q, as well as the general solution, is demonstrated with an example.

Arithmetic in the Ring of Formal Power Series over the Integers
Daniel Birmajer, from Nazareth College in Rochester.

We study the arithmetic (units, irreducible elements, unique factorization, etc.) in the ring Z[[x]] of formal power series in the indeterminate x with integer coefficients, and discuss some irreducibility criteria.

Uniformly Primary Ideals
Jonathan Cox, SUNY Fredonia

A primary ideal I is one with the property that if a product ab is in I and a is not in I, then b^n is in I for some n. However, in general n can become arbitrarily large. What happens if we require $n<=N$ for a fixed N? This talk gives some answers obtained in joint work with Hetzel. We have coined the phrase "uniformly primary of order N" to describe such an ideal. We will look at various conditions that guarantee an ideal is uniformly primary, as well as conditions that allow comparison of orders of such ideals. We will explore how the uniformly primary notion compares with that of primary and strongly primary in various types of rings. Finally, we will address why an algebraic geometer might care about such a topic.

Groups as Unions of Proper Subgroups
Mira Bhargava, Hofstra University

It is well known that a group cannot be the union of two of its proper subgroups. When is a group the union of n of its proper subgroups (n>2)? We will discuss this question and its many interesting variants.

Accuracy of Solving a Quadratic Equation
Abdramane Serme, Borough of Manhattan Community College

We start with the well known problem of solving a real quadratic equation $ax^2 + bx + c = 0$ (E). We have two roots given by the quadratic formula: $x = (-b +/- \text{sqr}(b^2 - 4ac)) / 2a$ (F) Shall we take the numerical computation and the accuracy of the solution this equation for granted?
1) when abs(b) >>abs($4ac$) then the equation (F) above can be written $x = (-b+/-\text{abs}(b))/2a$ so that the result will suffer massive cancellation.
2) the quadratic equation (E) when multiply by the 10 raises to the 20 and solve using (F) results in an overflow.
3) Solving (E) with a=10 raises to -20, b= -3 and c=2x10 raises to 20 using (F) will produce inaccurate solution while the technique uses in 2) will not work.
This simple example shows how difficult it is to come up with an algorithm that produces an accurate solution of a quadratic equation. Another example can be the accuracy of a solution of a linear system $AX = b$.

Saturday Afternoon, Donnelly Hall, Room 211

Experiences from Teaching a Mathematics Education Course in Macedonia
Risto Atanasov, SUNY Binghamton.

For several years in Macedonia I have been teaching a mathematics education course. The purpose of the course was to prepare the students to become high school teachers. In this presentation I will talk about the math education in Macedonia, how the course was organized and the experiences I got from teaching it.

Interdisciplinary Cross-Talk: Will it make a difference?
Trica M. Miles, United States Military Academy

Recent studies have shown that fewer students are pursuing careers in math, science and engineering. To increase students' awareness and interest in the disciplines of mathematics, engineering, and science, we have incorporated interdisciplinary cross talks into the core calculus sequence. In an interdisciplinary cross talk, educators collaborate and develop problem-solving scenarios incorporating mathematics and another field of study. We will present classroom examples that resulted in cross talks with colleagues in Computer Science, Civil Mechanical Engineering, Environmental Engineering, System Engineering, and Nuclear Engineering. The cross talks offer the students the opportunity to appreciate mathematics and its relationship to real world phenomena. We discuss student responses to this approach.

Mathematics in Learning Communities
Robert D. Keever, SUNY Plattsburgh

The academic goal of Learning Communities is to provide students with an integrated and cohesive semester of courses. This presentation/discussion will start with some background on Learning Communities, then move to my personal experience teaching Quantitative Reasoning in two very different Learning Communities, one focused on Biology and another on History/Literature. We will end with a discussion about other experiences and ways mathematics can be incorporated into other learning communities.

Speech across the Curriculum: It's About Time! Implementing Oral Communication activities in the Math classroom
Orlando B. Alonso and Louis Lucca, LaGuardia Community College

This paper contains the experiences of the author implementing strategies to develop oral communication skills in the mathematics classroom empowered by the use of technology and e-Portfolio. It reflects his participation in continuous professional development through Design for Learning (DFL), e-Portfolio and Oral Communication across the Curriculum seminars at LaGuardia Community College, where Mr. Alonso learned and put into practice innovative teaching ideas. The relevance of the results of this experience is materialized by the high quality of the speeches produced by his students, which were recorded in video tape and the quality of the student work in progress contemplated in their e-Portfolios. A sample of the students' e-Portfolio projects and videos can be seen at the author website.

Using Writing to Understand Functions
George McCormack, LaGuardia Community College

One method of instruction that mathematics teachers often shy away from is teaching their students how to make meaningful associations and analogies to mathematical concepts. One method that encourages students to attach their own experiences to mathematical ideas is to explain them in writing. Over the course of semester, in a remedial mathematics course, students were given writing prompts to help them understand the idea of a function. Functions were built up from the notion of set. The idea of a cross product was investigated. It was found that when students are guided in the use of association and analogy, they find it easier to explain mathematical ideas to one another and their conceptual understanding becomes more detailed.

Saturday Afternoon, Donnelly Hall, Room 236

Some Sequences of Graphs and their Chromatic Polynomials
Hossein Shahmohamad, Rochester Institute of Technology

The chromatic polynomial of a graph is the polynomial which counts the number of distinct proper vertex colorings of. By applying the addition-contraction method, chromatic polynomials of some sequences of 2-connected graphs satisfy a number of recursive relations. We will show that by knowing chromatic polynomial of a few small graphs, chromatic polynomial of each of these sequences can be computed by either utilizing matrices or generating functions.

Unfolding spaces and ends of groups by example
Tom Klein, Binghamton University

This will be a picture-based talk describing two related geometric ways of describing a group. For concreteness we will consider the descriptions for three specific groups: the integers, the integers cross product with the integers, and the free group on two generators. We first construct a space whose fundamental group (to be explained) is the given group, and then show how to "unfold" the space to reveal the group, allowing us to count the number of "ends" of the group. The underlying subjects of this talk are fundamental group and covering spaces, but only familiarity with the notion of a group will be assumed.

Fractal distribution networks and the kidney and lung optimal organ form
Walton R. Gutierrez, Touro College

A model is proposed to minimize the total volume of the main distribution networks of fluids in organs such as the kidney and the lung. A consequence of the minimization analysis is that the overall exterior form of the organs is a modified ellipsoid, a geometric form that is found in the main features of the external anatomy of these organs. The variational procedure implementing this minimization is similar to the traditional isoperimetric theorems of geometry.

Envelopes and String Art
Greg Quenell, SUNY Plattsburgh

Draw line segments connecting (0,9) with (1,0), (0,8) with (2,0), (0,7) with (3,0), and so on. The upper right edge of the resulting pattern suggests a curve, called the envelope of this family of line segments. We discuss an elementary way to find the equations for curves like this one, and explore some of the places where envelopes turn up, such as game theory, sliding-ladder problems, and arts and crafts.

The Geometrical Interpretation of Algebraic Equations
Shiyuan (Steve) Wei, Hostos Community College of CUNY

The geometrical method shows that the solutions of both absolute value equations $I\,x - a\,I + I\,a - b\,I = c$ and $I\,Ix - aI - I\,x - bI\,I = c$ are given by a single formula: $x = [(a+b) - c]/2$ or $x = [(a+b) + c]/2$.

Saturday Afternoon, Donnelly Hall, Room 238

How do Middle School Students Perceive the Importance of Math?
Denise Yull, Broome Community College

Success in higher-level math courses is one gatekeeper for successful admission into college, and middle school students' attitudes toward math may impact the decisions they make about the math courses they enroll in at the high school level. Do middle school students see math as important to their future educational or employment endeavors? In this talk I will report on a recent study I did in this context.

The William Varick Nevins III High School Mathematics Competition at Alfred University
Joseph Petrillo, Alfred University

Each autumn, Alfred University holds the annual William Varick Nevins III High School Mathematics Competition. The competition is open to all high school students and consists of thirty multiple-choice questions submitted by the mathematics faculty at Alfred University. The winner receives a renewable scholarship if he or she enrolls at Alfred. We will examine the history and details of the competition, which drew a record number of 370 students in 2005.

Calculus for Pre-service Teachers: Faculty members' and student teachers' perceptions
Lee Fothergill, Mount Saint Mary College

Since calculus is an introductory course to mathematics education programs a study should be conducted to explore how undergraduate mathematics faculty members could improve the teaching of calculus to benefit the preparation of pre-service secondary mathematics teachers.

The purpose of the study was to obtain the perspectives of faculty members who had experience teaching undergraduate calculus, recent student teachers, and current research in regards to a first semester undergraduate calculus course specifically designed for pre-service secondary mathematics teachers. The study began with a review of literature that examined recommendations in regards to the preparation of pre-service secondary mathematics teachers. Then, an online survey was created and sent to college faculty members who had experience teaching a first semester calculus course to help determine the aspects of calculus that mathematics faculty deem most important in the teaching of calculus to pre-service mathematics teachers. A similar survey was sent to recent student teachers; however, their survey contained additional open-ended questions. The student teachers explained what they believed was both helpful and lacking in their undergraduate calculus course in preparing to become a secondary mathematics teacher. Faculty members with experience teaching at the secondary level, faculty members without experience teaching at the secondary level, and student teachers' survey results were compared and there were some notable differences between faculty members without experience teaching at the secondary level and student teachers. The aspects that were ranked the highest were problem solving, visualization of function, applications outside of mathematics, and mathematical maturity. These aspects were perceived by the examiner to be consistent with the views of major mathematical organizations, such as the MAA and NCTM. However, research goes further to suggest that pedagogy such as, making connections to secondary curriculum, the use of technology, and the modeling of diverse instructional strategies also play an important role in the preparation of pre-service secondary mathematics teachers. In addition, a common recommendation from student teachers was for calculus instructors to teach using a variety of teaching methods that pre-service teachers can use in their future classroom.

Using Projects in Teaching Number Theory
Nancy King Harrison, Mercy College

In this presentation I will discuss the use of projects in teaching an undergraduate course in number theory with a prerequisite of precalculus. The goals of the projects, some sources of material for the projects, and some actual projects will be presented along with observations on the dynamics of group work since many of these projects are done in groups. Finally some favorable outcomes that have resulted from the use of projects will be noted.

Mathematical Modeling in the Classroom Using Electrical Circuits
MAJ Robyn Wood, MAJ Josh Helms, and CPT Brian Souhan, United States Military Academy

Mathematical concepts have more meaning when students experience an application of the concept they are studying. A basic electrical circuit is one such application that can be demonstrated throughout a student's core Mathematics curriculum. In this presentation we discuss how we introduce electrical circuits to students in a mathematical modeling class where they learn how to fit mathematical models to raw data. Electrical circuits provide an excellent source for this data; with a simple data collection device, sample data can be obtained in class. Students can choose to model this experimental data with any family of functions they have studied (linear, exponential, power, logarithmic, and trigonometric), and can eventually discover the connection between their functional model and the known equations that truly model the phenomenon in question. One obstacle with this application is getting instructors comfortable enough to work with the circuits. We will discuss all that went well with the use of this application and what we can improve on for next year.

Saturday Afternoon, Donnelly Hall, Room 240

Ordinate Geometry: Vignettes from the Seventeenth Century
Christopher Baltus, SUNY College at Oswego

Newton began, around 1667, his first version of the work classifying cubic curves: "If the line *BC* is conceived to be moved on the immovable line *AB* at a given angle *ABC* while some point *C* moving on it describe the curve *VC*, ..." This is the classic description of curves in *ordinate geometry,* a tradition carried from the Greeks in *The Conics* of Apollonius. However, Newton went on to arbitrarily place the origin, *A,* off the curve, and his whole work depends on transformation of axes; these are two features of the new *coordinate geometry*. Newton, like other mathematicians of his era, had feet in both worlds. Coordinate geometry was not the sudden invention of René Descartes. In this talk I propose to look at its long development -- and the persistence of ordinate geometry -- in vignettes from Descartes, Wallis, Newton, and l'Hospital.

Oresme, Galileo and the Law of Free Fall
Olympia Nicodemi, SUNY Geneseo

We shall look at the proofs that Galileo and his medieval predecessor, Nicole Oresme, supplied for the $t2$ law. Along the way, we shall look at a wonderful "proof without words" that Oresme used in summing a familiar series.

Breaking the Japanese Navy Codes
Marina Vulis

World War II code breaking played an instrumental role in winning the war. This presentation will discuss the cryptographic codes used by the Japanese Navy and the Diplomatic Corps during World War II. The description of the codes Purple and JN-25 will be given. The decoding of the Purple code MAGIC played in important role in the war against Japan, and the successful decoding of another Japanese Navy code JN-25 contributed to the Navy battles.

My journey through mathematics as a long time student and new teacher: A personal memoir
Gabriela Mendoza, SUNY at Binghamton

Mathematics has always been a feared subject for many and therefore rejected by a large number of students who sit in our classes. Their primary complaint against mathematics roots in their failure to understand how the subject will personally affect them. In my opinion, no matter what our students' major is, there is a need for some exposure to mathematics outside the computational aspect. I will talk about my personal experience with mathematics and how I incorporate what I have learned over the years into my classroom.

Mathematics Education in Secondary Schools in Malaysia
Normuhainiah M Ali, SUNY at Binghamton and Norhaniza Sarmin, Universiti Teknologi Malaysia

This talk will be about mathematics education in secondary schools in Malaysia, a country located in South East Asia. The primary and secondary education in Malaysia follow the British system, since it was ruled by the British from 1942 until its independence in 1957. We will first talk about the education system in general, then about mathematics education, including the curriculum and training of mathematics teachers.

Student Program

Saturday Afternoon, Donnelly Hall, Room 236a

Big Square Polyominoes and Other Exercises in "Game Theory"
Carol Callesano, Rochester Institute of Technology

The arena of counting problems is usually approached with theoretical intent, and the hope for applications to show themselves as the research progresses. Polyominoes are figures formed of congruent squares placed so that the squares share a side. One well-known application of common polyominoes is the game "Tetris", where unique shapes must be fit together in an efficient manner. Focusing on "big square" polyominoes allows for us to create the following question:

Given an $n \times n$ square, placed in the middle of an $(n + 2) \times (n + 2)$ square, how many different polyominoes can you create using k unit squares within the unfilled area?

Since the original shape is an $n \times n$ square, the rules for D4, the dihedral group of order 8, apply and create 8 basic operations to be performed on the big squares. There are therefore ten subgroups to be analyzed, as in D4, and each will be analyzed separately. This approach eliminates the possibility of a trivial solution such as C4n, k, which seems like a logical and complete formula for counting the shapes, but doesn't account for doubles and symmetries among the polyominoes generated. Subgroups of the squares are determined by the symmetries they posses, for example some will have diagonal symmetry while others rotational symmetry of 90 degrees. Each subgroup has its own formula for determining unique polyominoes of its type, and research continues on how to best and most efficiently combine all formulae into a single concise formula.

A Foray Into Biostatistics
Matthew Healy, Clarkson University

Using real data from the world famous Framingham Heart Study and the help of the Boston University Summer Institute for Training in Biostatistics, linear relations and odds ratios will be developed for various risk factors of cardiovascular disease.

A Mathematical Model for the Dynamics of NEO (Near Earth Objects)
Sandra Anita Lacea, SUNY Brockport

This paper is a continuation of previous work on the gravitational potential of the Earth. In modeling the potential we chose an equation derived from the classic two-fixed centers problem. With this potential
and with confocal ellipsoidal coordinates we write the differential equations of motion; we then integrate these equations using the Hamilton-Jacobi method. The result is an analytic solution presented in terms of elliptic integrals, used to study the dynamics of NEO.

Local Regularization Approach in the Solution of Ill-Posed problems
Kourosh Modarresi, Stanford University

Ill-conditioned problems result from the mathematical modeling of important areas like geophysics, antenna design, astrometry, computerized tomography, vision, medical imaging, image restoration, helioseismology and signal processing. The computational solution of these problems involves some kind of regularization. In this work, we focus on the concept of local regularization. This method allows us to apply different degrees of regularization and prevent over smoothing of the solution, which is a shortcoming of the global regularization approaches.

Half Teacher, Half Student
Chris Watts, SUNY Oswego

An undergraduate student discusses his experiences being a TA for an introductory proof-writing course. Points of emphasis will include: why students struggle, some solutions to help alleviate problems, and how the experience enriched the mathematical background of the TA.