

**7th Emmy Noether
High School Mathematics Day**



**Department of Mathematics and Statistics
Texas Tech University
May 6, 2009**

Acknowledgments

The 2009 Emmy Noether High School Mathematics Day Committee thanks the following sponsors for generously supporting this event.

Friends of Emmy Noether are individuals that have made monetary donations in support of this event. Their support is greatly appreciated and has a direct impact on the success of this very worthwhile cause. So we recognize and thank them:

**Dr. Linda and Dr. Edward Allen,
Dr. Jane Winer and Dr. Monty Strauss,
Dr. Lawrence and Patty Schovanec,
Dr. Roger Barnard and Dr. Delores Ludwig,
Dr. Victoria Howle and Dr. Kevin Long,
Dr. Eugenio Aulisa and Dr. Magdalena Toda.**

In addition, the following organizations have made substantial donations without which this event would not be possible:

**Mathematical Association of America (MAA - Tensor Project)
Washington DC**

**Mathematical Association of America (MAA)
Texas Tech University Student Chapter**

**Society for Industrial and Applied Mathematics (SIAM)
Texas Tech University Chapter**

**Department of Mathematics and Statistics
at Texas Tech University**

Campus Map



Program Schedule

- 9:30-9:50** **Registration and opening ceremony. Welcome and Introduction by: Dr. Lawrence Schovanec (Dean of the College of Arts and Sciences at Texas Tech University), Dr. Jane Winer (Dean Emeritus of the College of Arts and Sciences at Texas Tech University and Special Assistant to the President), Dr. Magdalena Toda (Associate Professor, Texas Tech University, Mathematics and Statistics Dept). (CHEM 49)**
- 10:00-11:10** **Student Competition (CHEM 49 & CHEM 107)**
- 10:00-10:40** **Workshop for Teachers – Mathematics and Statistics**
MATH 115 Dr. Jerry Dwyer
- 10:40-11:20** **MATH 115 Dr. Brock Williams**
- 11:30-12:45** **Lunch at the Merket Alumni Center (MERK)**
- 1:00-1:50** **Workshops for Students**
- MATH 009 Dr. Sophia Jang**
MATH 108 Dr. Chris Monico
MATH 109 Dr. Magdalena Toda
MATH 110 Dr. Alex Trindade
MATH 113 Dr. Victoria Howle and Dr. Kevin Long
LIBR PC-1 Dr. Raegan Higgins (ATLS, West Basement)
- 1:10-1:50** **Workshop for Teachers**
MATH 111 Dr. Gary Harris
- 2:00-2:40** **Career Panel led by Dr. Delores Ludwig (CHEM 49)**
Panelists: Tony Burse
Dr. Maria Perbellini
Dr. Magdalena Toda
- 2:40-3:00** **Awards, Evaluations, and Closing: Dr. Wayne Lewis (Professor, Texas Tech University, Mathematics and Statistics Dept) and Dr. Roger Barnard (Professor, Texas Tech University, Mathematics and Statistics Dept). (CHEM 49)**

2009
7th Emmy Noether
High School Mathematics Day

The Committee

Dr. Magdalena Toda (Chair)

Dr. Eugenio Aulisa

Dr. Roger W. Barnard

Dr. Jerry Dwyer

Jennifer Emerson

Dr. Gary Harris

Dr. Raegan Higgins

Dr. Wayne Lewis

Dr. Chris Monico

Dr. Monty J. Strauss

Dr. Brock Williams

Life is good for only two things, discovering mathematics and teaching mathematics.

Simeon Poisson

Emmy Noether (1882 - 1935)

In 1935, the year of Emmy Noether's death, Albert Einstein wrote in a letter to the New York Times, "In the judgment of the most competent living mathematicians, Fraulein Noether was the most significant creative mathematical genius thus far produced since the higher education of women began." Born in 1882 in Germany, Emmy Noether persisted in the face of tremendous obstacles to become one of the greatest algebraists of the 20th century.

Known primarily for her profound and beautiful theorems in ring theory, Emmy Noether's most significant achievement runs deeper: she changed the way mathematicians think about their subject. "She taught us to think in simple, and thus general, terms... homomorphic image, the group or ring with operators, the ideal... and not in complicated algebraic calculations," said her colleague P.S. Alexandroff during a memorial service after her death. In this way, she cleared a path toward the discovery of new algebraic patterns that had previously been obscured.

Despite her intellectual achievements and the recognition of such mathematicians as David Hilbert and Hermann Weyl, Emmy Noether endured years of poor treatment by German universities, where for a time she could not even lecture under her own name. Weyl later wrote that, even when the Nazis prevented her from lecturing, "her courage, her frankness, her unconcern about her own fate, her conciliatory spirit, were, in the midst of all the hatred and meanness, despair and sorrow... a moral solace." Forced out of Germany by the Nazis in 1933, Emmy Noether came to Bryn Mawr College, where she soon collected many students and colleagues around her. She died there just two years later at the age of fifty-three.

Mission Statement



- To provide women students with a unique, high-quality experience designed to foster interest in mathematics and careers in mathematics, engineering, and science.
- To provide women students the opportunity to experience a university environment.
- To gain insight into women professors' experiences and educational opportunities associated with mathematics.
- To provide women students the opportunity to learn that careers in mathematics, science, and engineering are attainable.

If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is.

John Louis von Neumann

Message from the Committee

The 2009 Emmy Noether High School Mathematics Day is a continued effort by a group of faculty members, graduate and undergraduate students at the Department of Mathematics and Statistics at Texas Tech University to expand the department's outreach efforts to make a difference in our high school graduates. This annual event was initiated in 2003 with a hope to help generate high school graduates who are strong in the areas of science, mathematics, communication, and problem solving. The program also hopes to provide the opportunity for participants to discover and be enlightened about possible careers in mathematics.

Once again, we are planning a mathematics competition, several workshops for students as well as for teachers, and a career panel. The planned activities will demonstrate the application of mathematics to diverse disciplines, particularly to the fields of engineering, science, and computer science, and to a wide range of career opportunities. The competition will help students not only develop their mathematical skills and knowledge, but also learn to communicate and reason mathematically - both orally and in writing. In addition, through their experiences in the Emmy Noether High School Mathematics Day, they will gain a sense of confidence in their own ability and potential. Faculty from our department will serve as workshop instructors. They will offer workshops in their area of specialty and interest. Undergraduate and graduate students majoring in mathematics and members of MAA and SIAM will serve as program escorts and mentors. We expect that the participants will develop into a peer group of high-achieving, motivated students who look to higher education and a degree in mathematics. Through the Career Panel component of the program, we hope to expose the high school students to adults from diverse professions.

Our department has developed strategic partnerships with local educational and outreach organizations in our outreach and recruitment efforts. It has an established summer program with a high school graduation rate of 100% of its participants. We are constantly seeking to open our outreach efforts beyond our small summer program and anticipate the same level of success. With our combined efforts, we hope this day will provide opportunities for targeted students to prepare for success in the mathematical fields and assist them from public school into college. We hope that this day will be a valuable experience not only to high school students but also to high school teachers and will continue to serve as a model for future outreach programs in Lubbock.

Workshops for Students

Fun with Difference Equations

Dr. Raegan Higgins

This is a brief and down-to-earth introduction to difference equations. We will introduce a variety of basic sequences. We will see how to establish recursive relationships and in some instances, see how to use these recursive relationships to establish explicit formulas.

Optimization: the art of making things better through math

Dr. Victoria Howle and Dr. Kevin Long

What do protein structure, investment planning, engineering design, delivery truck routing, and soap bubbles all have in common? All are problems in optimization, the branch of mathematics studying how quantities take on their minimum or maximum values. For example, a trucking company will want to deliver as many items as possible while using as little fuel and driver time as possible, and a building engineer will want to minimize construction costs subject to safety code constraints. Remarkably, many problems in the natural world are also fundamentally based on optimization: for example, proteins will spontaneously fold into a configuration that minimizes a quantity called free energy, and soap bubbles will naturally take on a state of minimum energy. We'll show some examples of optimization in the real world, and then talk about how one goes about computing the optimal value of a mathematical function.

Mathematics and Biology

Dr. Sophia Jang

This workshop will introduce students to how mathematics can be applied to study biology. We will look at how the long time trend of a single population and of population interaction can be described by some simple maps. We will explore the cyclic behavior of the predator-prey interaction and of competition exclusion for two competing populations.

Mathematics of 3-D Animation

Dr. Chris Monico

More and more movies and television shows make use of Computer Generated Imagery (CGI). Some movies, like Wall-E, were created entirely by computer. It might be surprising to learn just how much mathematics goes into this process. In this talk, we'll give a brief overview of the process of 3-D animation and some of the mathematics behind it.

Is the Universe Curved?

Dr. Magdalena Toda

This is a brief introduction to some theories which mean to confirm or infirm the belief that the universe is curved. We will discuss the mathematical ideas behind the notion of curvature, and we will look at some elementary examples which make this notion more approachable.

So, you want to be a Statistician?

Dr. Alex Trindade

This will be an overview of what statistics is, how statistics is present behind the scenes in every field of scientific endeavor, what statisticians do, some projects I've worked on, and how to become a statistician.

Workshops for Teachers

A conceptual approach to calculus

Dr. Jerry Dwyer

We will explore some of the fundamental analysis underlying the familiar concepts of calculus. Group work and inquiry based instruction will be modeled. Teacher feedback will be solicited in order to develop approaches for diverse student populations.

Just, where are the two roots of a quadratic polynomial, I mean really?

Dr. Gary Harris

In this workshop we will see how to exploit the graphing capabilities of MAPLE to locate, in real space, the roots of any quadratic polynomial with real coefficients. The locations of the roots of the polynomial $x^2 - x - 3$ in real space may not be particularly surprising; however, the locations of the roots of the polynomial $x^2 + x + 1$ in real space may be quite surprising.

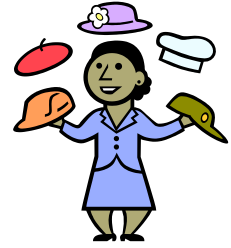
Real uses of imaginary numbers

Dr. Brock Williams

We typically introduce imaginary numbers to students as a way to deal with that pesky minus sign which sometimes shows up under the square root in the quadratic formula. But what good are these imaginary numbers anyway? Are they just figments of some mathematician's demented imagination? Or are they really useful for something we and our students care about? In this workshop we'll discover real world uses of imaginary numbers ranging from biology to image recognition.



Career Panel



Panel Coordinator
Dr. Delores Ludwig

Participants:

Antionette (or Toni) Burse White is a native of Lubbock, TX and has worked at Texas Tech University in Career Services for over 20 years. She has worked in many roles in Career Services, including student assistant, scheduling coordinator, counselor and currently Assistant Director. Her duties include being career liaison for the colleges of Arts & Sciences and Visual & Performing Arts and TTU student athletes as well as career programming for Mentor Tech and coordinating Career Services Seminar Series. She has a Bachelor of Science in Biochemistry and a Master's of Higher Education.

Dr. Maria Perbellini is an Associate Professor at Texas Tech University, College of Architecture. Together with Dr. Christian Pongratz, she co-authored a book on Young American Architects involved in Digital Design, a Monograph on Peter Eisenman, and a newly released book called "Cyberstone". Dr. Perbellini received her Bachelors of Architecture from the Istituto Universitario di Architettura di Venezia (IUAV) in Italy and a Master of Architecture from the Pratt Institute in New York. She worked in New York, for Peter Eisenman, John Reimnitz Architect and the Regional Plan Association of New York. Dr. Perbellini is recipients of several International Design Awards and Architectural Competitions Awards. Its work is extensively published and internationally recognized. Dr. Perbellini taught at the School of Architecture, University of Texas (UT) at Austin, and she has been a visiting professor at Yeungjin Jr. College, Taegu, Korea. She gives lectures throughout Europe, USA and Asia, besides an ongoing participation to Seminars and Reviews as guest critic in several Universities.

Dr. Magdalena Toda received her PhD degrees in Mathematics from the Polytechnic University of Bucharest and the University of Kansas in the Spring and Summer of 2000, respectively. She came to Texas Tech in 2001 when she was hired as an Assistant Professor. She received her tenure and promotion to Associate Professor in 2008. Her research area is Differential Geometry and most of her publications are in this field. She is a recipient of the President's Award for Excellence in Teaching (2008). She has been a coordinator of the Emmy Noether High School Mathematics Day since 2006. She has received a lot of help in this endeavor by the organizing committee, currently consisting of ten faculty members and one graduate student, as well as many donors and volunteers from the Department of Mathematics and Statistics at Texas Tech University.