2010

8th 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

Kaleb McKale

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 2010 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

Mathematical Models: Important Tools in the Study of Disease Control

Dr. Linda Allen, Horn Professor

Mathematical models for the spread of infectious diseases provide a framework for studying the progression of an epidemic. In addition, mathematical models allow various intervention and disease control strategies to be tested before they are implemented. Models have been constructed for many diseases including influenza, HIV-AIDS, SARS, plague, West Nile virus, and Hantavirus. These models have been useful in testing drug therapies and vaccination and quarantine strategies. In this workshop, we will construct some simple mathematical models for the spread of an infectious disease and illustrate how the models can be used in the study of disease control.

The Mathematics of Juggling

Dr Ram Iyer, Associate Professor, and Dr. Arne Ledet, Associate Professor

In juggling, the balls follow distinctive patterns. These patterns can be described mathematically in several ways, for instance as strings of numbers or by means of directed graphs. We will explain these mathematical descriptions, and illustrate how they relate to the actual juggling.

Predator-Prey and Competing Populations

Dr. Sophia Jang, Associate Professor

This workshop will use computer simulations to study mathematical models of population interactions. We shall explore the cyclic behavior of the predator-prey interactions and of competition outcomes for two competing populations. We shall see when the predator and prey populations can coexist and when the predator will drive the prey population to extinction in a predator-prey system. We shall also examine which population can out compete the other population in a model of two competing populations.

Why Math? Careers and Academic Opportunities for Math Majors

Levi Johnson, Graduate Student

Just at Texas Tech University, there are more than ten different colleges and schools. Students can select majors ranging from English to architecture to political science. So, why would anyone choose to major in mathematics? How does a math degree distinguish someone from an engineering or science degree? How do math students compare on pre-professional tests like the LSAT or MCAT? This workshop will attempt to deal with these questions and more.

How to Kill a Zebra and Raise a Family

Dr. Clyde Martin, Horn Professor

The lions of Africa have a very formal arrangement in families and related lions. The questions that we will pose are related to how large a pride should be. We will ask such questions as: "Why aren't there 100 players on the field during a football game instead of 11? Why aren't football teams restricted to two players? Why doesn't a pride of lions have 100 members? Why don't lions live alone? We will try to understand the mathematics of these questions and then ask and answer the most important question: What kinds of problems can we study if we know mathematics?

Why is Statistics Significant? A Two-Tale Talk

Dr. Alex Trindade, Associate Professor, and Emily Powell

Tale I will be an overview of what statistics is, how statistics is present behind the scenes in every field of scientific endeavor, what statisticians do, and how to become a statistician. (Presented by Dr.Trindade.) Tale II will consist of a presentation by a senior undergraduate student who will describe her work experience through an Honors Project on statistical simulation. (Presented by Emily Powell.)

What's Calculus Really All About

Dr. Brock Williams, Associate Professor

What's the big deal about calculus? Why do we need calculus anyway? Isn't algebra enough math for anybody? In this workshop we'll describe what calculus really is, why it's so much more powerful than algebra, and how we can solve the problems that arise in the real world. We'll also discuss the big ideas calculus students need to understand and how we can help them do so.

Workshops for Teachers

Integrating Math and Science in K-12 Classrooms

Dr. Jerry Dwyer, Associate Professor

A rationale for integrating math and science in middle and high school classrooms will be presented. The benefits of such an approach will be discussed. Examples of model activities will be described. All topics will be presented at a level accessible to teachers and students from grades 5 to 12.

Circles: from pi to the volume of the sphere

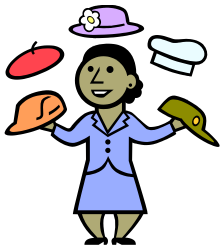
Dr. Gary Harris, Professor

We'll begin with constancy of the ratio of the circumference of a circle to its diameter to get the definition of Pi and the formula for the circumference of a circle. We'll then derive the formula for the area of a circle and end with the derivation of the volume of a sphere. The discussion will be appropriate for both middle and high school instructors.

Career Panel

Panel Coordinator

Dr. Delores Ludwig



Participants:

Dr. Iris V. Rivero is an Associate Professor of Industrial Engineering at Texas Tech University. She received a B.S., M.S., and Ph.D. in Industrial and Manufacturing Engineering from the Pennsylvania State University. She has industrial experience in the field of advanced manufacturing systems and materials at Detroit Diesel Corporation and Honeywell Engines & Systems. In addition, she participated as a faculty fellow at the NASA's Marshall Space Flight Center and has worked on funded projects from NASA, DOE, and SME. Her research involves manufacturing and structural characterization of nanocomposites for aerospace and biomedical applications. She is passionate about running and traveling.

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 two graduate students, as well as many donors and volunteers from the Department of Mathematics and Statistics at Texas Tech University.