MD-DC-VA Section MAA Fall 2007 Meeting at AACC

Contributed Paper Abstracts

Harel Barzilai, Salisbury University
A Knack for NAC? Numeracy Across the Curriculum
Writing Across the Curriculum (WAC) programs have become increasingly common at colleges and universities. While less recognized, the fundamental importance of quantitative literacy (QL) in an increasingly technological world has gained a measure of acceptance, with some QL requirements and individual courses being developed. What about the notion the QL "across the curriculum" is important -- what about Numeracy Across the Curriculum (NAC)? Starting with an exploration of what "QL" means, we will suggest that a key pair of WAC goals has a parallel set of goals in NAC, and will describe a local pilot NAC program at Salisbury University. In closing we raise questions about what it would take for QL to receive its "fair share" of consideration regarding what a contemporary college education should include. In other words, why do so many colleges have a knack for WAC, but lack NAC?

Alexander Bathula, Montgomery College (Rockville)
Teaching Tips & Memory Hints
Over the years I invented,collected, practiced these teaching tips and memory hints in my classes.

Chiru Bhattacharya, Randolph-Macon College
How the ancients summed it
I will discuss Euclid's derivation of the closed form of an infinite geometric series. The Indians gave an "intuitive" geometrical explanation for the formula which I will also discuss.

Elizabeth Theta Brown, James Madison University
Beyond Liberal Arts Math: A Math-Art Seminar for Advanced Majors
This talk is a report on a studio seminar, Art and Math in Relation, in which mathematics and studio art were used, separately and in combination, to explore the interactions of the two fields. Each discipline has a tradition of using the other as a means to realize its ends; artists have drawn creative inspiration and fabrication insight from mathematics, while mathematicians have used art as a means of developing intuition and communicating justifications. This course was designed for students who had upper level standing in either art or math, but not necessarily both. We outline topics and methodology, and discuss the benefits to math majors of this type of instruction.

Ezra Brown, Virginia Tech
More Names of (7,3,1)
(7,3,1) is a magical mathematical object with at least eighteen different names. including names associated with coding theory, the octonion units, Klein's quartic curve, map coloring on the torus, and the Seven Hats Problem. The speaker promises not to talk about all of them.

James Case
Checkers is a Tie Game: Anatomy of a Computer Proof
I shall explain how the emerging (highly experimental) science of competition led to an eventual proof (by computer) that unbeatable checkers strategies are available to both players.

Jerome Dancis, Univ. of Maryland, College Park
Remediation Up in MD & 2004 MD/DC/VA SECTION Statement
Increase in MD HS graduates needing remedial Math in MD colleges. Whites 33% (1998) to 40% (2005); African-Americans 56% (1998) to 67% (2005); Hispanic 44% (1998) to 58% (2005).

George DeRise, Thomas Nelson Community College
Monstrous Moonshine
It is incredible that there is a relationship between the largest sporadic group (the Monster Group) and the modular functions of analysis. And that all this is related to String theory. This will be a very intuitive talk.

Michael Hoffman, U. S. Naval Academy
Multiple Zeta Values: From Euler to the Present
Multiple zeta values can be defined by multiple series generalizing the usual Riemann zeta function series. In a paper published in 1776, Euler studied the double-series case. We discuss his main results, and compare them with some results that have appeared in the recent explosion of interest in multiple zeta values.

Ilhan M. Izmirli, American University
Euler's Theory of Harmony as Developed in "Tentamen novae theoriae musicae"
Euler had an interesting and novel approach to mathematizing musical harmony through a principle he called "De suavitate et principiis harmoniae". In this paper, we shall discuss how Euler used this principle to determine why certain combinations of notes sounded more pleasant than others and to construct "complete chords".

Dan Kalman, American University
Euler, Dilog, and the Basel Problem, Parts 1 and 2
Yet another proof is provided for Euler's celebrated result that $\sum_{k=1}^{\infty} \frac{1}{k^2} = \frac{\pi^2}{6}$. The proof begins with an utterly pedestrian approach: the use of generating functions. This leads immediately to a definite integral for Euler's sum, and one that Mathematica evaluates to give Euler's answer. However, using Mathematica's evaluation to establish Euler's result is a case of circular reasoning. To complete the proof, one needs a different way to evaluate the definite integral. Happily, just such a method is available, based on the work of -- Euler! In particular, the proof uses a curious identity involving the dilog function, as well as the famous equation $e^{i\pi} = -1$. And the manipulations that make up the core of the proof are just the sort of thing that Euler loved to do. The second part of the talk has two goals. First, I will trace the mathematical reasoning behind the formal manipulations in the dilog solution of the Basel Problem. Although the earlier presentation of the proof was in the Euler style, glossing over issues of convergence and properties of complex functions, each step can be justified using elementary results from complex analysis. Second, I will discuss efforts to determine whether Euler was aware that his dilog results could be used to solve the Basel Problem. At this point it doesn't look like he was, but research is continuing. Slides for this presentation can be found by going to www.dankalman.net.

Jody Lockhart, U. S. Naval Academy
The Skolem Problem for 2x2 Matrices
Using only elementary methods, we will show that the Skolem problem for 2x2 matrices is equivalent to a problem about arctangents. The solvability of both problems then follows from a result of Conway, Radin and Sadun.

Francoise Marchat, James Madison University
Building blocks to elementary statistics
Why is the "elementary statistics" class so hard? A progression based on learners' needs rather than professionals' habits is proposed. Discussion welcome.

Jan Minton, Roanoke College
Teaching Math and Art: Come share your ideas!
Anyone interested in sharing and hearing ideas about teaching a Math and Art course are invited to this session. If you have teaching experience in this area, please bring handouts - syllabi, references, sample assignments, etc. – to share.

Aurelia Minut, US Naval Academy

Maxwell's Equations in Liquid Crystals

In this talk, we introduce a new model of light propagation through a liquid crystal. Our goal is to solve, at least in some particular cases the equations resulting from this model. These are preliminary results.

Marcus Pendergrass, Hampden-Sydney College

The Naive Chain Rule

The "Naive Chain Rule" asserts that the derivative of a composition is the composition of the derivatives. In this talk we will explore function pairs for which the Naive Chain Rule holds. Along the way, we will encounter some interesting mathematics, including differential equations and discrete dynamical systems.

Andrea Sims, Virginia State University

Bernstein Inequality for subclasses of Polynomials of Degree 2

Denote the class of all algebraic polynomials $p(z)=\sum_{v=0}^{n} a^{v} z_{v}$ of degree at most *n* by P_n. It is well known from Bernstein's Theorem that $Max_{|z|=1} | p'(z) \leqslant nMax_{|z|=1} | p(z) | (p \in P_n)$. Equality holds if and only if $p(z)=cz^n$, *c* is a constant. Using basic results from Complex Analysis and knowledge of Trigonometry and Calculus, we will give proof of many subclasses of P_2.

Daniel Vasiliu, Christopher Newport University

Rank One Convexity and Quasiconvexity with Linear Constraints

Microstructures, as infinitesimal patterns, are abundant in nature. Here we consider a model for elastic crystals through a variational approach motivated by the symmetry properties of the stored-energy function. Any deformation of the crystal requires an elastic energy which is expressed as an integral of the stored-energy density function. The central assumption of the variational approach is that the crystal microstructure corresponds to minimizers or almost minimizers of the elastic energy. A direct method for proving existence of minimizers is to find minimizing sequences converging in some topology and check that the elastic energy functional is lower semicontinuous. Therefore, it is of special interest to find necessary and sufficient conditions for the stored density function in order for the above property to be achieved. We study the case when the gradient of deformation is restricted to be close to a linear subspace. This leads to a possible generalization of the rank one convexity and quasiconvexity concepts.

Marina Vulis, The University of New Haven

Arabic Contributions to Cryptography

The discussion will focus on the role of the Arabs in cryptography and cryptanalysis. In particular, they described various cipher systems, and cryptanalytic techniques.

William P. Wardlaw, U. S. Naval Academy

Matrices over Finite Fields

In this work with my colleague Amy Ksir, we play with matrices over finite fields to find when powers of a matrix form the multiplicative group of a field and count how many such matrices there are.

Mervin Woodlin, Virginia State University

Bernstein Inequality for Self- Reciprocal Polynomials of Degree 2

Denote the class of all algebraic polynomials $p(z)=\sum_{v=0}^{n} a^{v} z_{v}$ of degree at most *n* by P_n. It is well known from Bernstein's Theorem that $Max_{|z|=1} | p'(z) \leq n Max_{|z|=1} | p(z) | (p \in P_n)$. Equality holds if and only if $p(z)=cz^n$, *c* is a constant. The question is if *p* is self reciprocal, what is the best estimate of $Max_{|z|=1} | p'(z) |$ in terms of $Max_{|z|=1} | p(z) |$? Using basic results from Complex Analysis and knowledge of Trigonometry and Calculus, we will find the sharp estimate for the class of self reciprocal polynomials. Some properties of this class will also be discussed.

Fei Xue, Lynchburg College

Time scale, a bridge between differential and difference equations

The theory of time scales is a new subject in order to unify continuous and discrete analysis. Many differential and difference equations can be treated simultaneously by this new tool. Some basic definitions and properties will be given. Moreover, possible topics of future study and applications in other fields with regards to student research will be discussed.