MD-DC-VA Section MAA Fall 2006 Meeting
Hampden-Sydney College and Longwood University, Farmville, VA
Contributed Paper Abstracts

Alexander Bathula, Montgomery College
The Tangent Line Problem and its consequences
Using the definition of the derivative of a function at a point *(a,f(a)),* we get the slope and equation of the tangent line at that point. What are some of the consequences if we start with that tangent line…

Ezra Brown, Virginia Tech
11 Things I Like About 11
Eleven is a versatile and widely travelled number. It has connections with such mathematicians as Mersenne, Pascal, Steiner, Mathieu, Golay, and Ramanujan. It appears in the worlds of partitions, modular surfaces, error-correcting codes, simple groups, block designs, quadratic number fields, perfect error-correcting codes, and elliptic curves. This talk will be about some of these -- and by the way: did you know that there are eleven nets for a cube?

Chiru Bhattacharya, Randolph-Macon College
Factoring Hadamard Difference Sets
Kibler listed down all (16,6,2) difference sets by performing an exhaustive computer search. We present an interesting factoring idea that reveals how to obtain these difference sets using basic group theory ideas.

George DeRise, Thomas Nelson Community College
A Physics--Math (Bilingual) Dictionary
The physicist's concept of gauge theory describes reality, in particular the four forces of nature. What does this have to do with the abstract mathematical concept of principal fibration? Everything! I will present a short bilingual dictionary. This talk is quite intuitive.

Richard Hammack, Virginia Commonwealth University
What does a graph fraction look like?
If *G* and *H* are graphs, is there a meaningful way to construct a fraction *G/H*? Would such an object be a graph? Could it be drawn? The answer to each of these questions is "yes." Edge colorings are used to extend the graph Cartesian product to an operation that allows for the formation of graph fractions. Fractional graphs form a group that is isomorphic to the nonzero rational numbers.

Ilhan M. Izmirli, American University
Who Really Discovered E=mc^2?
There have been claims, since early 1950s that Einstein should not be credited for developing one of modern physics best known equations, E=mc^2. For one thing, some historians of science claim that similar relations were proposed in mid 1880s by J. J. Thompson and O. Heaviside. Besides, some physicist (notably Plank) had argued that one of the postulated Einstein used in his derivation was not exact. In this paper we shall give a brief history of the mass-energy concept and examine the validity of these claims.

Ryan Johnson, University of Mary Washington
Investigation of a Min-Max Scheduling Problem
We consider the arragement of $n = jk$ students into j groups, each of size k, and satisfying the condition that no two students are grouped together more than once. After a certain number of days, say $m(j,k)$, the schedule will not be extendable because of the condition. We explore the minimum and maximum values for $m(j,k)$ using elementary counting techniques and graph theory.

Daniel Joseph, Virginia Military Institute
A Major Difference Between Rabbits and Cows (And the Link Between Them)
The Fibonacci Sequence (Leodardo's rabbits) has many interesting identities. For some of these there are analogous identities in Narayana's cow sequence, {1, 1, 1, 2, 3, 4, 6, ...}, which arises from the recurrence relationship S(n)=S(n-1)+S(n-3), S(1)=S(2)=S(3)=1. Our quest for an analogous identity to 3F(n)=F(n+2)+F(n-2) led us to a different "identity" in Narayana's cow sequence and finally to a Gibonacci (generalized Fibonacci) identity that linked them.

Robb T. Koether, Hampden-Sydney College
Scissors, Paper, Stone, and a Biased Coin
We begin with the traditional game of Scissors, Paper, Stone and add a twist: A referee tosses a biased coin. If the coin lands heads, then Player 2 is not permitted to choose Stone. If the coin lands tails, then Player 2 is not permitted to choose Scissors. Furthermore, although both players know the probability of heads, Player 1 is not told how the coin actually landed. What are the players' optimal strategies?

Dan Kalman, American University
The Most Marvelous Theorem in Mathematics
Marden's theorem establishes an amazing connection between the complex roots of a cubic polynomial and those of its derivative. The roots of the polynomial define a triangle in the complex plane. The roots of the derivative are two points inside the triangle. But where? The answer will surprise you.

Kurt Ludwick, Salisbury University
PascGalois Activities for a Number Theory Class
PascGalois is visualization software developed at Salisbury University, originally designed for use in abstract algebra classes. In my talk, I will describe one or two of the PascGalois actvities I have developed for number theory classes. These activities reinforce principles such as inductive reasoning and analysis of natural numbers based on prime factorization, and one introduces an interesting, not-well-enough known result called the Lucas Correspondence Theorem.

Carla D. Martin, James Madison University
The Rank of a 2x2x2 Tensor
The maximum possible rank of a 2x2 matrix is 2. However, what is the maximum possible rank of a 2x2x2 tensor? In this talk I will illustrate some of the main differences between the rank of a matrix and the rank of a tensor. In particular, computing the rank of a 2x2x2 tensor is a much deeper problem than one might expect.

Mark Meyer, American University
The value of entertainment in a mathematics course
During the academic year 2005-2006 students at American University wrote and performed a play about infinity and participated in a jeopardy style gameshow. In this paper we analyze these experiences to explore the values of entertainment projects in a mathematics course. Student surveys and faculty interviews are used to argue that beyond entertaining students, such projects can change attitudes, raise interest and offer new and novel perspectives on mathematical content.

Roland Minton, Roanoke College
More on Elvis, the Calculus Dog
Two or three sentence description of the proposed talk: => The most famous dog in mathematics is Elvis, a Welsh Corgi who became famous for solving a standard calculus optimization problem. A new optimization problem is solved here, with new experimental data fromElvis. Interesting properties of the solution are developed, and speculations about Elvis's thought process are explored.

Marcus Pendergrass, Hampden-Sydney College
Birthday Problems, Old and New
The "Birthday Problem" has an honored place in the lore of Probability. In this talk I will present several variations on the Birthday Problem, including the following: "In a room with *n* people, what is the probability that two people who know each other have the same birthday?" These variations will expose ties between the Birthday Problem and graph theory, in particular graph colorings and random graphs.

George Rublein, College of William and Mary
Update on the William and Mary QL requirement
William and Mary protocols for General Education courses inmathematics insist on "required applications of mathematics to real-world problems". Such applications are now in use in all sections of both semesters of the standard calculus courses. Work supported by NSF.

Vincent van Joolen, US Naval Academy
A Closed Form Solution for Determining the Weights of Finite Difference Approximations of Derivatives
A closed form solution for determining weights and remainders for finite difference approximations of derivatives is derived on uniform and non-uniform grids. Vandermonde matrices result in the derivation and the final solution is shown to contain Schur polynomials.

Zhifu Xie, College of William and Mary
Regularization Of Singularity and Periodic Solution with Collisions
Newtonian N-body problem has collision singularities if two of bodies collide at one time. We construct new coordinates and time transformation that regularize the singularities of simultaneous binary collisions in the collinear four-body problem. We also construct a family of periodic solutions involving collisions and we animate such motions using a computer program.