**Abstracts**

**Invited Talk : “A Problem of Checkers: an exposition of a solution by John Conway”**

Dr. Al Dixon

College of the Ozarks

**“The Strictly Increasing Function”**

Paige Blades, Lyon College

Faculty Advisor: Dr. Megan Powell

My problem came from the 71st Putnam exam.  The question asks if there is a strictly increasing function such that  for all *x*.  I’m going to use improper integrals and the expansion of a Taylor Series to show no such function exists.

**“Factorization of Whole Positive Numbers”**

**Aaron Davis, Southwest Baptist University**

**Faculty Advisor: Dr. Steve Bowling**

Our current interest lies with the ever-growing popular topic of prime numbers, however, in this case we are interested in the prime factorizations of positive whole real numbers. Our hypothesis is that as *n*, *n* being a positive whole real number, gets bigger, the average number of prime factors less than or equal to *n* will increase as well. What we seek to gain from this research is what the standard deviation does as n gets large.

**"When Does Area Equal Arc Length?"**

Jonathan Dannatt, Lyon College

Faculty Advisor: Dr. Megan Powell

The problem posed by Math Horizons sets the solver on a mathematical quest for a function whose arc length is equal to the area under the curve. Before embarking on this quest we must first have the skills given to us by both Calculus I and Calculus II. Using properties of integrals and derivatives, I will find one such function.

**“The Monte Carlo Method”**

Brett Foster, Missouri State University

Monte Carlo Simulation is a general term used to describe the method of using random draws to approximate a solution to a problem.  In addition to taking a brief look at the history of Monte Carlo Simulations, the author will present two examples of Monte Carlo simulations: the first is a straightforward example intended to illustrate the concepts behind a Monte Carlo simulation, while the second example provides a more complex application of such simulations.

**“Gaussian Primes”**

Nathan Hall, Missouri State University

Faculty Sponsor: Dr. Les Reid

Gaussian Primes are the primes of the complex number system.  The lecture will guide the listener through the broader concept of what defines a prime number, how it pertains to the complex number system, and how to identify whether or not a given complex number is prime or not.  Following this, an open number theory question will be discussed, and what the outcome of the problem is expected to be.

**“A Degree Four Diophantine Equation”**

Nathan Hall, Missouri State University

Faculty Sponsor: Dr. Les Reid

The degree four Diophantine equation  will be discussed, showing both a two-dimensional and three-dimensional representation of the problem, along with its solution.

**“Properties of First-Degree Systems with Coefficients in Arithmetic, Polynomial, and Geometric Sequence”**

Gerhardt Hinkle, Central High School

Faculty Advisor: Dr. Les Reid

A recent International Baccalaureate Higher Level Mathematics Internal Assessment posed a problem concerning the solutions to two and three variable equations with coefficients in arithmetic sequence and two variable equations with coefficients in geometric sequence. This paper generalizes the result of that investigation to the greatest possible extent that can still yield meaningful results. It derives nontrivial, general solutions by writing the equations in summation notation as  (arithmetic sequences); , where  (polynomial sequences, a further extension of arithmetic sequences); and  (geometric sequences).

**“Rusty Compass Constructions”**

Lara Ismert, Pittsburg State University

Faculty Advisor: Dr. Leah Childers

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| Since antiquity mathematicians have developed methods of constructing numbers with only a compass and straightedge. After establishing what numbers are constructible and which are not constructible, a question of further restriction presents itself: What if the compass is rusted to one constant opening? The methods used to construct numbers with a regular compass must be adapted to the new and more difficult restriction of rusty compass constructions. We will show that numbers constructible with a regular compass are also constructible with a rusty compass, but the latter constructions often require more roundabout techniques.  **“Using Tangent Circles to Find a Practical Approach to an Ellipse and a Hyperbola”**  Jae Min Lee, Pittsburg State University  Faculty Advisor: Dr. Leah Childers  The concept of tangency is one of the most important topics in mathematics. This presentation starts off with the following problem: How does one find a circle that is tangent to two (or three) given circles? We will show that the condition for a circle being tangent to two circles prompts the definition of an ellipse and a hyperbola. This will be a chance to view an ellipse and a hyperbola from a different perspective.  **“Curves of Constant Width”**  Kelsey Ryan, Missouri State University  Circles are not the only curves of constant width; plenty of others exist.  Some of the curves are more famous than others and are used all around us.  While discussing these curves, we will look at their history and the applications of a few.  The geometry behind them even helps to identify how square holes can be drilled.  These curves are used worldly and are seen every day without any realization by most.  With this information, you will be able to see the uses of them and how they are built.  **“Curves in Two-Dimensional Vector Spaces over Finite Fields”**  Andrew Todd and John Pope, Lyon College  Faculty Advisor: Dr. Jeremy Chapman  The study of curves at the undergraduate level is taught almost exclusively within  the confines of or, where  is the underlying field. We take a look at basic  curves in , *p* prime, which is a two-dimensional vector space over the finite  field . Although  is very different from the two-dimensional vector  space , we find that several geometric properties of well-known curves still hold.  For example, the concept of the slope of a line in  is equivalent to that of a  line in . Furthermore, the notion of derivatives and related topics will be  examined in , with the goal of showing the degree of similarity between  and . |