# Abstracts of Faculty Talks

## Mathematical Association of America
## Allegheny Mountain Section Meeting
## Penn State Behrend
## Saturday, April 7, 2018

### 10:15 - 10:30

**Terry Blakney, Penn State Behrend, Burke 101**

*Comparing the Hybrid vs Standard Classroom*

In 2015, I was asked to develop a Hybrid Biostatistics Course. This talk will focus on the comparative outcomes of the Face to Face sections versus the Hybrid sections for two spring semesters and potential challenges and benefits between the courses.

**Jared Burns, Seton Hill University, Burke 102**

*Pompeiu Derivatives*

In this talk, we will give an introduction to the fun topic of Pompeiu derivatives. Pompeiu derivatives are real-valued functions of one real variable that are the derivative of an everywhere differentiable function, and yet also vanish on a dense set. Additionally, we will see some potential new extensions of old results.

**Anne Quinn, Edinboro University, Burke 103**

*A Mathematical Analysis of Social Math*

Although surfing social media sites is a favorite recreational pastime for many, the mathematics behind social media is even more interesting. I will discuss a variety of mathematical topics from my March 2018 Mathematics Teacher article on this topic, from simple multiplication rules to logarithms and exponents to network-encoded matrices. Topics will include: an analysis of big data sets for different platforms (Facebook, LinkedIn, and Twitter), the algebra behind viral posts, the reason so many people feel unpopular, and the social distance from you to anyone else in the world.

**Ivko Dimitric, Penn State Fayette, Burke 104**

*Use of Geometry of Point-Masses in Proving Theorems of Geometry*

The geometry of point-masses can be, and has been used effectively to prove some geometric results in elegant and sometimes unexpected ways. We demonstrate how that approach can be used to prove few theorems of geometry including the following theorem attributed to Newton: If ABCD is a tangential quadrilateral (for which there exists an inscribed circle touching all four sides), then the center of the inscribed circle belongs to the line segment joining the midpoints of the diagonals of that quadrilateral.

**Pam Wochko, West Virginia Wesleyan College, Burke 105**
*MAA Highlights 2018*
Learn about events, programs, resources, and opportunities available to you through the MAA. There will be time for your comments and suggestions.

**Reginaldo Marcelo, Ateneo de Manila University, Burke 106**
*Independent and Dominating Sets in the Generalized Hanoi Graphs*
In a graph $G = (V, E)$, a subset $S \subseteq V$ is an independent set if no two vertices in $S$ are adjacent, and it is a dominating set if every vertex that is not in $S$ is adjacent to a vertex in $S$. The independence number of $G$, denoted by $\alpha(G)$, is the maximum cardinality of an independent set; the domination number of $G$, denoted by $\gamma(G)$, is the minimum cardinality of a dominating set; and the independent domination number of $G$, denoted by $i(G)$, is the minimum cardinality of an independent dominating set. Given any graph $G$, it follows from the definitions that $\gamma(G) \leq i(G) \leq \alpha(G)$. Consider the generalized Tower of Hanoi puzzle that involves $p \geq 3$ pegs and $d \geq 1$ discs. The generalized Hanoi graph denoted by $H_p^d$, is the graph whose vertices are the different states of the puzzle with two states adjacent if and only if one can be obtained from the other by a single move. In this paper, we construct a maximal independent set in $H_p^d$, and a minimal dominating set in $H_3^d$. In the process we present an alternative proof of the following results: $\gamma(H_3^d) = i(H_3^d) = \lceil 3^d/4 \rceil$ and $\alpha(H_p^d) = p^(d-1)$.

## 10:35 - 10:50

**Andrew George, Penn State Behrend, Burke 101**
*Online Math Courses & First-year Students: The Aftermath*
At the behest of our Engineering school, I embarked on a three-year stint of teaching a sequence of pre-calculus courses for Engineering Technology students entirely online. I will present the striking – if not alarming – disparity between student satisfaction with these online courses and student achievement in these courses. The disconnect between student satisfaction and performance has implications when considering online instruction for first-year students.

**Cheng-Han Pan, West Virginia University, Burke 102**
*A Differentiable Monster in Function Extensions*
I will introduce a differentiable nowhere monotone function by taking the difference of two pompeiu functions and mention an extension method which, comparing to Jarnik's extension theorem, adds up more freedom.

**Paul Olson, Penn State Behrend, Burke 103**
*Geometric Power Series and Calculus*
Geometric series are a nice introduction to the work we do in calculus for power series representations. By considering convergent geometric power series, and applying calculus to these representations, we can generate other series representations for related functions.

**Richard Ligo, Gannon University, Burke 104**
*Shrinking Square Sets: A Fractal Illustration of Infinite Series*
In this talk we examine fractal objects composed of squares whose sizes decrease according to a given sequence. In particular, geometric sequences and the harmonic sequence give rise to surprising examples

illustrating relationships between convergence, divergence, geometric series, alternating series, p-series, and Maclaurin series. As part of our investigation, we evaluate infinite series and use self-similarity to calculate the sizes of specific and general objects.

**Tim Flowers, Indiana University of Pennsylvania, Burke 105**
*Share Your Ideas for Our Section*
This is a not a conference talk, in the traditional sense. Rather, this will be an open forum for you to provide feedback and input regarding the Allegheny Mountain Section. As the Chair of the section, I am interested in hearing suggestions that members may have. I will take the ideas provided back to the Executive Committee to explore. All ideas - from small tweaks to grand dreams and everything in between - will be welcome. I will also be happy to answer questions about our section and the MAA.

**David Offner, Westminster College , Burke 106**
*A New Characterization of Extremal Cop-win Graphs*
In the game of Cops and Robbers played on graphs, a graph is called cop-win if one cop can catch the robber. The capture time of a cop-win graph is the number of moves required to catch the robber. In this talk we present a new characterization of the graphs with the maximum capture time on a given number of vertices. The proof uses the corner ranking technique for characterizing cop-win graphs.

## 10:55 - 11:10

**Kate Overmoyer, Clarion University of Pennsylvania, Burke 101**
*Motivating Non-Majors in Elementary Statistics*
Throughout the seven years that I have taught Elementary Applied Statistics at Clarion University (both face-to-face and online), I have had both successes and failures in my attempt to motivate students and help them overcome their dislike of mathematics. In this talk, I will discuss how I have evolved as an instructor of this course and how projects have helped (or not) increase students' interest.

**Tom Cuchta, Fairmont State University, Burke 102**
*Discrete Special Functions*
"Special functions" are traditionally those "named" functions that we find useful – e.g. sine, logarithm, exponential, Bessel, etc. Usually these functions have a continuous real or complex independent variable.

We will look at one simple, yet general, technique to find discrete "analogues" of special functions. The recently defined "discrete hypergeometric series" which unifies many of these functions will be demonstrated.

Open questions accessible to undergraduates will be provided.

**Joshua Sasmor, Seton Hill University, Burke 103**
*On Taylor Polynomials with Rational Coefficients*
In many textbooks, the Maclaurin series for commonly used transcendental functions are provided to the student, who is later asked to calculate Taylor series for these same functions with other centers. The resulting series contain many transcendental coefficients, which may not always be useful. It would be convenient to have coefficients in the rational numbers. I think there is a neat way to do this that involves the idea of rewriting polynomials.

**Boon Ong, Penn State Behrend, Burke 104**
*Probability of Getting an Obtuse Triangle*
In this talk, I will discuss the likelihood of obtaining an obtuse triangle if one randomly choose three vertices. I will start with the Lewis Carroll Pillow Problem for points on the plane, and discuss what happens when points are chosen on a compact space like a surface of a sphere. I will also talk in details what wil happen when these points are chosen from the surface of a flat donut.

**Asif Mahmood, Penn State York, Burke 105**
*Non-Newtonian Flow-Induced Deformation in Absorbing Porous Biological Tissues*
We investigate the behavior of a spherical cavity in a soft biological tissue modeled as a deformable porous material during an injection of non-Newtonian fluid that follows a power law model. Fluid flows into the neighboring tissue due to high cavity pressure where it is absorbed by capillaries and lymphatics at a rate proportional to the local pressure. Power law fluid pressure and displacement of solid in the tissue are computed as function of radial distance and time. Numerical solutions indicate that shear thickening fluids exhibit less fluid pressure and induce small solid deformation as compared to shear thinning fluids. The absorption in the biological tissue increases as a consequence of flow induced deformation for power law fluids. In most cases non-Newtonian results are compared with viscous fluid case to magnify the differences.

**Kristen Puschel, Penn State New Kensington, Burke 106**
*Making Money on Graphs*
The idea behind pyramid schemes is that you pay money in and you make money when other people join and pay in too. Unfortunately, not everyone that joins a pyramid scheme can make money. In this expository talk, we'll look at graphs in which moving money around makes everyone richer.

## 11:15 - 11:30

**Antonella Cupillari, Penn State Behrend, Burke 101**
*The Monthly Math Problem Competition Meets History of Math*
Last fall at Penn State Erie we started running again a monthly Math Problem Competition, open to all students and whose goal is to get more students interested in mathematics (with the help of a $10 award). Finding puzzles/problems that are accessible to students in pre-calculus but still challenging enough for seniors with a science background is not an easy task. So, using my interest in history of mathematics to discharge my duties as the problem editor, in March I decided to use one of Maria Gaetana Agnesi's pre-calculus problems ... and rediscovered something interesting in the process.

**D.J. Galiffa, Penn State Behrend, Burke 102**

*Recent Developments in Discrete Quantum Orthogonal Polynomials*

We discuss the development of structure equations, with quantum orthogonal polynomial solutions, that contain a discrete difference operator. We connect these new relations with other results, and discuss future directions.

**Jeffrey Wheeler, University of Pittsburgh, Burke 103**

*Being a Nerd is Cool, Which is Why I Take Series Seriously*

In today's technological world, more and more aspect of every day life now involve some level of sophisticated mathematics. Secret messages, self-driving cars, satellite images of your house, picking batting order, positioning players in the field, error-correcting codes, scheduling major League Baseball, and predicting shopping habits (or when couples on Facebook are going to breakup), are just a few examples. Unfortunately, most students do not know the immense applications of our discipline until they take more advanced classes. We address this briefly and show a beautiful use of Power Series that is seldom covered in a standard Calc 2 course.