Abstracts of Faculty Talks

Mathematical Association of America
Allegheny Mountain Section Meeting
West Virginia University
Saturday, April 14, 2012

10:15–10:30

Nicholas Martin, Shepherd University, Armstrong Hall 315
e backwards
Using standard Calculus methods, we show that if e is a number such that the exponential function with base e is its own derivative, then it must be equal to its usual definition as a limit of the standard sequence that is used as a definition of e, and also as the sum of the infinite series of the reciprocals of the factorials.

Geoffrey Dietz, Gannon University, Armstrong Hall 306
What is So Negative About Negative Exponents?
Motivated by a question from a Calculus student at Gannon University, I investigated bias against negative exponents in high school algebra textbooks. Although bias against negative exponents has been present (to varying degrees) over a long period of time, it appears to have intensified recently. Since comfort with negative exponents is important for students of Calculus, I was surprised that modern algebra textbooks continue to treat negative exponents as something to avoid. In this talk we will look at the origins of negative exponents and see how they were taught in the U.S. by analyzing and rating samples of U.S. high school algebra texts published over the last two centuries.

Ted Erickson, Wheeling Jesuit University, Armstrong Hall 303
Use of the iPad in the classroom
The iPad is suitable for classroom demonstrations, classroom support, and classroom management. Classroom management tools include an visual attendance "app" which can be used together with the built-in camera. Many texts are now available on-line via CourseSmart. iBooks and iAnnotate can be used to view and highlight pdf files. A statistical software package Statistical Visualizer is helpful in demonstrating with graphs for various distributions. Geometer's Sketchpad has a free app for the iPad called Sketchpad Explorer allows Sketch- pad documents to be viewed and manipulated. DropBox is a convenient way to share files between computers and iPads.

Papiya Bhattacharjee, Penn State Erie, The Behrend College, Armstrong Hall 206
Topologies on Min(L)
A frame is a complete lattice which satisfies a strong distributive law, known as the frame law. Given a frame L, the collection of all minimal prime elements of L is denoted by Min(L). We can endow the set Min(L) with two different topologies, known as the Zariski topology and the Inverse topology. In this talk the speaker will describe these two topological spaces and different properties that these spaces satisfy.

David Miller, West Virginia University, Armstrong Hall 117
Extra-Ordinary Calculus
In this talk, I will give a brief introduction ExtraOrdinary Calculus - derivatives and integrals of arbitrary order, or what is commonly called Fractional Calculus. The talk will start with some preliminary information and then move into some examples of derivatives and integrals of a few basic functions (power functions and exponentials).

Henry Escuadro, Juniata College, Armstrong Hall 112

The Total Detection Numbers of Graphs

Let G be a connected graph of size at least 2 and $c : E(G) \rightarrow \{0,1,...,k-1\}$ an edge coloring (or labeling) of G using k colors (where adjacent edges may be assigned the same color). For each vertex v of G, the color code of v with respect to c is the k-tuple code(v) = $(a_0, a_1, \cdots, a_{k-1})$, where ai is the number of edges incident with v that are labeled i ($0 \leq i \leq k-1$). The labeling c is called a detectable labeling if distinct vertices in G have distinct color codes. The value val(c) of a detectable labeling c of a graph G is the sum of the colors assigned to the edges in G. The total detection number td(G) of G is defined by td(G) = min{val(c)}, where the minimum is taken over all detectable labelings c of G. In this talk, we investigate the total detection numbers of complete graphs and cycles.

Dan Shifflet, Clarion University of Pennsylvania, Armstrong Hall 119

Discussion Boards and Senior Seminar: Discovering the Lighter Side of Mathematics

From paradoxes to puzzles to puns, there are many exciting, intriguing and yes, hilarious reasons to be a math major. Shouldn't our students be rewarded with these lighter topics of mathematics for all their hard work? I say yes! In this talk I will outline the fun ideas I felt our senior seminar students would appreciate the most and how I implemented the class discussion board to help them discover these topics.

Robert Vallin, Slippery Rock University, Armstrong Hall 120

Spreading the Word on Ana Sets

The Ana Set is an example of a verbal sequence. Start with the word “a” at Step 0. For Step 1, replace the “a” with “ana”. In Step K, every “a” in Step K-1 is replaced with “ana” whilst every “n” is replaced with “ann.” In this talk we will introduce the Ana Set along with it’s cousin the Golden Ana Set and show a way to visualize the sequence. This leads us to the Cantor Set, the Fibonacci sequence, sums of sets, and more.

10:35–10:50

John Tolle, Penn State DuBois, Armstrong Hall 315

A Proof of a Familiar Series Result

Calculus students learn about the convergence of the series 1 + 1/4 + 1/9 + 1/16 + 1/25 + ... The instructor usually mentions that the value of the series is known to be pi-squared over 6. Many instructors know of a proof involving Fourier series, beyond the scope of a standard calculus course. What many do not know is that there is a double-integration proof which can be included in the third semester of calculus (multivariable calculus). The proof uses Taylor series to show that the above series has the same value as that of a certain improper double integral. Through a clever change of variables, the integral is evaluated and shown to equal pi-squared over 6.

Yu-Ju Kuo, Indiana University of Pennsylvania, Armstrong Hall 306

Mentoring and Networking Mathematics and Science Majors in Applying Mathematics

Activities, experiences, and results from creating a blended math and science cohort of upper-level undergraduates and graduate students in the M.S. in Applied Mathematics program are summarized. With funding support from the National Science Foundation's Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program, we seek to expand recruitment, improve retention, and further develop student skills in applied mathematics. Scholarship program activities establish a supportive connection of master's students with undergraduates. Science majors take coursework towards a minor or double major in a mathematical area. Through networking of science and mathematics majors, cohort students participate in interdisciplinary activities, investigate careers or graduate schools, communicate with external mentors, and attend workshops on use of mathematical software and technology. Many sponsored events are open to the community and positively impact the local academic culture. On assessments, students report improved satisfaction with the academic environment, their selected major, and their career plans.

Peter Olszewski, Penn State Erie, The Behrend College, Armstrong Hall 303

Money, That's What I Want!

Recently, the mathematics department at Penn State Erie, The Behrend College, has discontinued a mathematics class for liberal arts majors called Insights into Mathematics and has replaced it with The Mathematics of Money. This course has proven to be a wonderful addition to our mathematics department. Ever since I started teaching the class, I have noticed that students who say they "can't do mathematics" or "aren't good at mathematics" do much better when problems have dollar signs attached to the numbers. This is more evident from the older adult learner's point of view. I believe a large part of students' difficulty with mathematics is failing to make the connection between abstract concepts and the practical. The algebra used in this class is minimal. Students are not running around trying to hunt down the value of x without motivation, as they would be in a traditional College Algebra class. In this talk, I will present how I teach the course using various clever techniques and technologies such as the Texas Instruments Graphing Calculator, Microsoft PowerPoint presentations, and Microsoft Excel spreadsheets.

Tim Flowers, IUP, Armstrong Hall 206

A Combinatorial Proof of Class Number Identities

We will consider an identity for sums of Hurwitz class numbers and state identities which arise from taking subsums of this identity. The Hurwitz class numbers can be defined by counting classes of binary quadratic forms. To sketch a combinatorial proof of these identities, we will use a theorem of Deuring which gives a relationship between quadratic forms and isomorphism classes of elliptic curves over a finite field.

Ivko Dimitric, Penn State Fayette, Armstrong Hall 117

Invariant functions and construction of n-to-1 maps

We exhibit several examples of n-to-1 functions of real variable, satisfying the property that for every y in the range, there exist exactly n values in the domain that are mapped into y. For odd n these examples can be found to be continuous (and differentiable) everywhere, whereas for even n such examples are necessarily discontinuous. In connection with this, various invariant functions are being considered, including even, odd, derivative invariant, stacked periodic, and omega-invariant functions. This talk is completely accessible to undergraduate students.

Michelle Previte, Penn State Erie, Armstrong Hall 112

The Growth Rate of Infinite Trees

In this talk, we define and compute the growth rate of self-similar infinite trees.

Emily Sprague, Edinboro University of PA, Armstrong Hall 119

Mathematics of Musical Consonance, A First Year Experience

In Fall 2011 Edinboro offered my FYE seminar, the Mathematics of Musical Consonance for the first time. This partly analytic and partly anecdotal talk follows up on last year's report of the officially proposed course outline by reporting on the mathematical and pedagogical directions which evolved in response to student interests during the actual conduct of the course.

Mark Wilson, West Virginia University Tech, Armstrong Hall 120

A Prominent West Virginia Mathematician: JFN

This presentation explores the life of John F. Nash, a prominent mathematician from Bluefield, WV. The paper recounts Nash's childhood, his progression through Carnegie Mellon and Princeton University, and appointment to the MIT faculty. Topics include his early contributions to math and discussion of Nash's obscurity after developing paranoid schizophrenia. After a 20 year non-productive period, Nash emerged as a Princeton math faculty member and was awarded the Nobel Prize in economics for work on game theory.

10:55–11:10

Qing Wang, Shepherd University, Armstrong Hall 315
Modeling of Mixed Immuno-chemotherapy of Tumors by Impulsive Systems
This talk presents a new model describing tumor cell growth in response to the mixed immuno-chemotherapy using impulsive differential equations. Numerical simulation results are given to illustrate the effect of the mixed immuno-chemotherapy compared to that of immunotherapy or chemotherapy as a monotherapy on tumor response.

Laura Pyzdrowski, WVU, Armstrong Hall 306
WvEB Mathematics: A successful web enhanced project offering college level courses to high school students
West Virginia University offers web enhanced college-level courses for high school students as a part of the State funded WvEB Math Project. The main goal of the project is to allow students a smooth transition into college level mathematics. High school mathematics teachers facilitate at each site and work with a university instructor of record to offer the course. Results from a matched pair study using an alternate version of the math ACT test indicate no significant difference in mathematics achievement change of those enrolled in the on campus sections when compared to students in the WvEB section. The session will discuss results of that study as well as provide an overview of the course structure and course components will be discussed. This project was funded in part by the NSF, CCLI project number 0339117.

Kim Roth, Juniata College, Armstrong Hall 303
Using Bootstapping and Randomization in Introductory Statistics
Bootstrapping and Randomization tests are computationally intensive methods of approximating sampling distributions. Currently in statistics education teaching these techniques first rather than the normal and t based procedures is becoming common. I will discuss how I incorporated these materials into Introduction to Probability and Statistics and how the students received it.

D.J. Galiffa, Penn State Erie, Armstrong Hall 206
On the Higher-Order Sheffer Orthogonal Polynomial Sequences
In this talk, we discuss several features from the presenter's recently accepted research monograph (Springer Briefs in Mathematics) of the same name as the above title. We first give a summery of the analyses conducted on the orthogonal Sheffer sequences, which was conducted by J. Meixner and I.M. Sheffer. Then, we give examples of the applications of Sheffer sequences, including; first and second-order differential equations, approximation theory and quantum mechanics. From there, we address some of the new results on an extension of the Sheffer sequences, which includes an approach for obtaining orthogonal polynomials that uses computer algebra (Mathematica). Lastly, we talk about some future directions of this research.

Hollie Buchanan, West Liberty University, Armstrong Hall 117
Squaring Without Carrying: Does This Base Make My Million Look Fat?
A positive integer is said to be skinny if no carrying is required when squaring is performed. We consider the problem of determining numbers that are skinny in a particular base and that of determining the bases for which a number is skinny or not. In particular, we estimate the number of bases for which a large integer is skinny.

David Offner, Westminster College, Armstrong Hall 112
Cops and Robber on the hypercube
The game of Cops and Robber is a two-player, perfect-information game played on an undirected graph G. A robber and a fixed number of cops each occupy vertices of G, and take turns moving to adjacent vertices. The cops win if a cop ever occupies the same vertex as the robber. The cop number is the minimum number of cops required to guarantee a winning strategy for the cops, and this number can be interpreted as a measure of the difficulty of searching the graph. We investigate the cop number for variations of this game on the hypercube.

Adam Roberts, Clarion University, Armstrong Hall 119
Use of Popular Literature in Seminar Courses
This talk will explore the use of the book *The Drunkard's Walk* by Leonard Mlodinow in a Junior Seminar course for mathematics and secondary education mathematics majors. An overview will be given of the role the Junior Seminar course plays in the curriculum and how a popular text fits into that role. Conclusions about the use of such books and insights from the seminar discussion among the students will also be discussed.

David Miller, West Virginia University, Armstrong Hall 120
An Introduction to the PhD option in the Research in Undergraduate Mathematics Education (RUME) at WVU
In this talk we will give an introduction to the RUME Phd option at WVU, talk about the degree requirements, comprehensive exams, faculty in mathematics education, and research areas.

11:15–11:30

Joe Previte, Penn State Erie, Armstrong Hall 315
Even vs. Odd Food Chains
In this talk we will show that even and odd chains exhibit different qualitative behavior. Odd chains tend to be limited only by resources, whereas even food chains are self-limited. This has been known as the Hairston-Smith-Slobodkin Conjecture in Biology.

Courtney Nagle, Penn State Erie, The Behrend College, Armstrong Hall 306
Prerequisite Notions for an Introductory Conception of a Functional Limit
The limit concept is the foundation of calculus. Unfortunately, studies have shown that many students lack a strong conceptual understanding of limits and instead have several misconceptions. While past research has examined students' development of limit ideas at the premathematics, introductory calculus, and formal calculus stages, they have not examined precalculus students' understandings. In this study, 150 precalculus students were engaged in a series of limit tasks. Their responses were qualitatively analyzed via grounded theory to identify the underlying knowledge concepts and then statistically analyzed via correlations, factor analysis, simplex models, Guttman scalograms and regressions to examine their relationships. Results suggested that several concepts formed a developmental progression of students' understanding of limits. The results also showed that students who used the ideas of "closeness" and "approaching" completed more tasks successfully. These results suggest that pre-calculus emphasis on "closeness" and "approaching" can aid students' understanding of limits.

Melissa Sovak, California University of Pennsylvania, Armstrong Hall 303

Creative Ways to Assess Mathematics

For years, educators have debated the best methods for assessing student's progress in mathematics. Many have argued that traditional methods of quizzing and testing fail to accurately capture a true measure of students' understanding. Indeed, using traditional in-class testing methods limits the number and scope of questions that can be asked of a student and restricts the instructor's ability truly test the breadth and depth of a student's knowledge on particular subjects. While take-home tests can solve some of these problems, instructors are often reluctant to use these because there is ample opportunity for students to seek assistance from each other and turn in work that is not reflective of their own understanding. This presentation offers some alternative solutions to the assessment problem that allow for an instructor to include problems that are more complex in nature. These alternative solutions include team assessments and guided projects. Team assessments present a small team of students with several in-depth problems which they must discuss and offer solutions to. Guided projects ask a team of students to prove or derive substantial results based on a step-by-step process outlined within the problem. These projects allow students to use their knowledge from several courses to come up with one substantial result. The talk will cover specific examples from of each type of assessment, grading guidelines, student reactions and lessons learned. Specific courses for which examples will be given include Calculus II, III and IV.

Kate Overmoyer, Clarion University, Armstrong Hall 206

Examining the Growth of an Entire Function

The growth of an entire function is related to not only the number of zeros it has (as the study of polynomials suggests), but also their distribution in the complex plane. In this talk, we will examine the entire function S(z), having as zeros {m+in: m and n are integers}. We will compare the growth of S(z) to an exponential function of the form e^(cz^2).

Michael Woltermann, Washington and Jefferson College, Armstrong Hall 117

Archimedean Areas

Archimedes knew that the area of a parabolic sector (inside the parabola) cut by a chord is twice the area of the (exterior) sector determined by the tangent lines at the ends of the chord. The purpose of this talk is to look at the converse for functions y=f(x) with y''>0.

Antonella Cupillari, Penn State Erie, The Behrend College, Armstrong Hall 112

An Integrated Calculus Assignment in a Can

How are the dimensions and shapes of the cans on a supermarket shelf chosen? Are these choices optimal as far as material used and storage space? These were the opening questions for a first semester calculus class series of assignments focused on tuna cans. The assignments started with geometrical constructions, used calculus, required three dimensional thinking, and quite a bit of writing