ABSTRACTS

ASC Rm 104

10:15-10:30 Clickers in the Classroom
Kimberly Burch, Indiana University of Pennsylvania

A semester long study was conducted in two sections of Foundations of Mathematics investigating the effectiveness of classroom response systems, commonly called “clickers.” Students were instructed using traditional lecture techniques and with slides using the clicker technology. Data was collected from both groups including in-class exam scores, final exam scores, and homework averages. Of particular interest to the investigator was whether one method would help facilitate the understanding and retention of the material better than the other. I will present an analysis of my findings and the conclusions I have drawn.

10:35-10:50 Non-Formulaic Coordinate Geometry for Teachers
J. Lyn Miller, Slippery Rock University

No standard approach to teaching coordinate geometry would be complete without discussions of the distance and slope formulas, yet some students seem willing to sacrifice conceptual understanding for a "plug-and-chug" mentality. I will share activities and problems that require students (particularly, future elementary teachers) to reason about objects in the Cartesian plane without relying on formulaic computation.

10:55-11:10 Successes and Challenges Using WeBWorK in Calculus
Geoffrey Dietz, Gannon University

We will discuss some results of implementing online homework and Gateway Testing in first-year Calculus using the WeBWorK system developed at the University of Rochester. We will address effects to test scores, knowledge retention, and student feedback.

11:15-11:30 Mastery Exams in Calculus I: A Preliminary Report
Ryan Higginbottom, Washington & Jefferson College

Mastery Exams are brief tests of basic Calculus skills which are administered in both written and oral formats. The student has one or more interviews with the instructor, and once the instructor is satisfied that mastery has been achieved, the exam is complete. At Washington & Jefferson College, we implemented three Mastery Exams in our Calculus I classes for the first time during the Fall 2008 semester. In this talk, I will describe the rationale behind this decision and the outlook of our department on this undertaking.

ASC Rm 212

10:15-10:30 Another Way to Prove the (Positive) Rational Numbers Are Countably Infinite
Robert Fliess, West Liberty State College

The standard way to prove the Rational Numbers are countably infinite is the diagonalization method. This talk shows a way I learned many years ago, shown in a different way; using a one-to-one correspondence with Q in base 10, with Integers in another base.

10:35-10:50 The Basel Problem by Solving Triangles
Boon Ong, Behrend College

This talk will present yet another method of summing the converging *p*-series, zeta(2), using only basic transformation of the plane and methods taught in Calculus 2. This is another presentation of a paper appearing in the October 2008 issue of Monthly by Passare. There will be an area under the curve that clearly is the sum of our series and via a transformation, three times of that area is the area of a right-angle triangle. This transformation of the plane comes very naturally from solving a triangle using the sine rule.
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10:55-11:10 Behavior Always Exists (Or, Limiting Ourselves with Limits)
John Tolle, Penn State DuBois

We sketch a method of teaching the concept of limit which seeks to alleviate the student's cognitive load. The traditional approach intertwines two learning objectives which, we argue, ought to be separated. These are: (i) to appreciate the variety of local, and asymptotic, behavior exhibited by various functions and be able to ***describe that behavior somehow**; and (ii) to master the classical notation (e.g., involving the limit symbol) and use it to encode function behavior.

By concentrating on objective (i) first, we can defer the matter of whether a (local, asymptotic, full, or one-sided) limit ***exists*** or not, and instead seek to understand the behavior exhibited by the function in question. The student can describe this behavior somehow, because ***behavior always exists*** whether or not a limit does. So why not describe it in words?

The claim is that once students have gained experience with the complete variety of possible function behaviors, they can better appreciate the usefulness of the classical limit notation and more easily assimilate it into their existing framework of understanding.

11:15-11:30 Disruption of Symmetry Creates New Symmetries
Robert Sulman, Penn State Beaver

The quadratic $f(x)=ax^2+bx+c$ has symmetry about a vertical line. When we divide f by x^2+1 the symmetry above is disrupted. However, new symmetries are created and they are examined in this talk. Specifically, the graph of $g(x) = f(x)/(x^2+1)$ will always have a local minimum value y = m and a local maximum value $y = M$ when b is non-zero. It follows that $m + M = a+c$ and mM = -discriminant(f)/4 where $a>0$. When $a=1$, $g(-1/k) = g(0)$ as well, where k is the inverse image of 1 (i.e., where the horizontal asymptote crossing occurs). Now fix m = -1, implying that g has two distinct real roots $r<s$. Write $s = h(r)$ as a function of r (as r gets large positive, the distance between s and r must increase since m is constant). Then the graph of h has a slant asymptote through the origin. A strictly non-Calculus approach is used here, and therefore such a topic is readily accessible to Pre-Calculus students. The above came about from a hand out to my Pre-Calculus classes describing how to find local extremes of certain rational functions without Calculus.

ASC Rm 213

10:15-10:30 Some Implications of Representing Irrational Numbers by Regular Continued Fractions
Emily H. Sprague, Edinboro University of PA

It is well-known that the irrational numbers form a Polish Space. We demonstrate that through regular continued fraction representations of the irrational numbers we find a mechanism especially well-suited to build an explicit homeomorphism between the irrational numbers and the complete metric space of natural number sequences. We conclude by applying this mechanism to make explicit other useful mappings of the irrationals.

10:35-10:50 On Characters and Character Degrees
Thomas Wakefield, Slippery Rock University

In this talk, we will present an overview of character theory and the results obtained from examining the characters or character degrees of a finite group G.

10:55-11:10 Nested Travelling Salesperson Problem
Jennifer Gorman, Gannon University

In this talk we will explore a variant of the Travelling Salesperson problem called the Nested Travelling Salesperson problem. We will look at the problem on some special classes of graphs as well as investigate the differences between this problem and the Travelling Salesperson problem.

11:15-11:30 Casorati and Simons Operators in Submanifold Geometry and Some of Their Appearances
Ivko Dimitric, Penn State University Fayette

The Casorati operator and the (1,1) Ricci tensor of the tangent space make up the contracted Gauss equation for a submanifold of a Riemannian manifold. The trace of the Casorati operator (after suitable normalization) is the squared length of the second fundamental form, which is also the trace of an operator introduced by J. Simons as an essential part of the Jacobi operator that naturally arises in the study of variations of minimal submanifolds. Both operators figure prominently in the study of A-submanifolds and submanifolds of finite type. We will shed some light on the applications of these operators in the study of 2-type submanifolds of projective spaces via the immersions by projection operators.

ASC Rm 215

10:15-10:30 A Different Look at Albrecht and White's Path Counting in Grids
James Sellers, Penn State University

In a recent note in the Australian Mathematical Society Gazette, A.R. Albrecht and K. White considered a problem of counting the total number of paths from a cell in row 1 to a cell in row *m* of a *m x n* grid of cells with restrictions on the moves that are permissible from cell to cell. Albrecht and White determined a triple sum formula for *P_{m,n}*, the number of all such paths. In this talk, we revisit their problem and utilize generating functions in a natural way to prove an alternative formula for *P_{m,n}* which is just a single sum. The talk will be accessible to all students and faculty at the conference.

10:35-10:50 Missing The Forest to Count the Trees: Spanning Tree Enumeration in Complete and Non-Complete Graphs
George Dimitoglou, Hood College

Spanning trees have been studied extensively and have many practical applications. From astronomers using spanning trees to find quasar superstructures, to biomedical engineers detecting actin fibers in cell images, tree enumeration remains an interesting problem. In this paper we examine a simple, practical, algebraic approach for the enumeration of spanning trees in complete and non-complete graphs based on Cayley's formula and Kirchoff's Theorem.

10:55-11:10 Edge Ideals of Simple Graphs
Rachelle R. Bouchat, Slippery Rock University

Given a simple graph *G*, we will consider the ideal whose minimal generating set corresponds to the edge set of *G*. This ideal is called the edge ideal of the graph *G*. We will use graphical properties of *G* to study the algebraic invariants of the quotient ring associated to the corresponding edge ideal relating to its minimal free resolution.

11:15-11:30 Spectral Dynamics of Clique-Inserting on a Regular Graph
Zhibo Chen, Penn State University, Greater Allegheny Campus

This talk is based on my joint work with Fuji Zhang and Yi-Chiuan Chen. For a regular graph *G* of degree $r>2$, the graph obtained by replacing every vertex of *G* with a complete graph of order *r* is called the clique-inserted-graph of *G*, denoted as *C*(*G*). We analyze the spectral dynamics of iterations of clique-inserting on a regular graph *G*. Let *S*(*G*) denote the union of the eigenvalue sets of all iterated clique-inserted graphs of *G*. We discover that the set of limit points of *S*(*G*) is a fractal with the maximum *r* and the minimum -2, and that the fractal is independent of the structure of the concerned regular graph *G* as long as the degree *r* of *G* is fixed.

ASC Rm 312

10:15-10:30 Apportioning Seats in the U.S. House of Representatives
Michael Caulfield, Gannon University

We will explore methods for apportioning seats in the U.S. House, all of which were proposed in Congress and some of which were implemented. Rounding is often the key to the method, though sometimes the connection is not obvious. Spreadsheets illustrating the methods will be presented; they are available for classroom or other uses.

10:35-10:50 Accounting For Home Ice Advantage in Women's College Hockey Rankings
Michael Rutter, Penn State Erie-The Behrend College

To determine the at-large bids to the eight team NCAA Division I Women's Ice Hockey tournament, four factors are considered. The Ratings Percentage Index (RPI) is arguably the most important of the four as it is used as a tie breaker. This paper proposes an alternative to the RPI that utilizes individual game results as opposed to a team's record and the records of its opponents. The proposed method also improves on RPI by explicitly allowing for a tie as an outcome and accounting for a possible home ice advantage. While the home team may have limited tactical advantage, the schedule and type of travel may have an effect. A typical weekend road trip consists of consecutive games played in a 24 hour (or less) window preceded by a long bus trip.

10:55-11:10 A Resampling Approach to Earthquake Location Accuracy
KB Boomer, Bucknell University

When a seismic event occurs we need a database of accurately located Earthquakes to compare to discriminate between an earthquake and an explosion. International law allows an inspection within 5km of the calculated location of the event. This database then needs to include events with a Ground Truth accuracy of 5km or less (GT5).

We propose the use of statistical resampling techniques to empirically develop regional criteria. Resampling approaches do not require an a priori assumption of the error processes but rather obtains an empirical probability distribution. We take many samples of our observed data (i.e. resample) to investigate the behavior of the sample statistic. Based on calculations from the regional network of interest, criteria can be developed for specific networks.