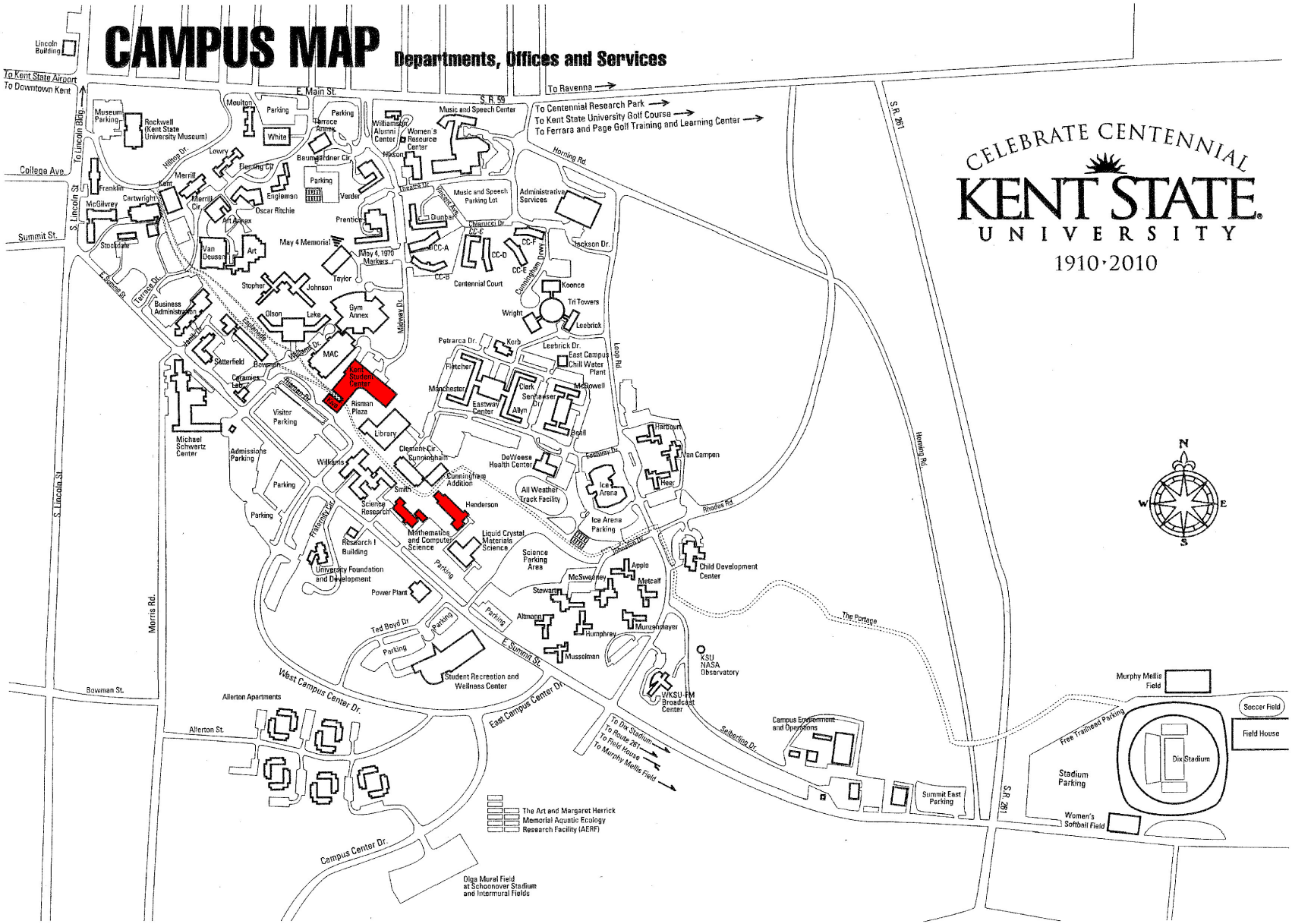
Program of Activities
For the 94rd Annual Spring Meeting of the

Mathematical Association of America

Ohio Section

Spring 2010
Kent State University
Kent, Ohio
April 16-17, 2010


CAMPUS MAP
Departments, Offices and Services
CELEBRATE CENTENNIAL
KENT STATE UNIVERSITY
1910·2010
To Kent State Airport
To Downtown Kent
E. Main St.
To Ravenna
To Centennial Research Park
To Kent State University Golf Course
To Ferrara and Page Golf Training and Learning Center
College Ave.
Summit St.
S. Lincoln St.
Lincoln Building
Museum Parking
Rockwell (Kent State University Museum)
Moulton
Parking
White
Terrace Annex
Williamson Alumni Center
Women's Resource Center
Music and Speech Center
S.R. 59
Horning Rd.
S.R. 261
Hilton Dr.
Lowry
Baumgardner Cir.
Fleming Cir.
Merrill
Kent
Franklin
Cartwright
McGilvrey
Merrill Cir.
Englemen
Oscar Ritchie
Art Annex
Verder
Theatre Dr.
Vincent Ave.
Music and Speech Parking Lot
Administrative Services
Prentice
Dunbar
Chancellor Dr.
CC-E
CC-F
CC-A
CC-D
CC-B
Centennial Court
Commonwealth Dr.
Jackson Dr.
Van Deusen
Art
May 4 Memorial
May 4, 1970 Markers
Taylor
Stopher
Johnson
Stockdale
Terrace Dr.
Business Administration
Olson
Lake
Gym Annex
Midway Dr.
Koonce
Tri Towers
Wright
Leebrick
Petrarca Dr.
Korb
Leebrick Dr.
East Campus Chill Water Plant
Long Rd.
Fletcher
Manchester
Clark
McBowell
Eastway Center
Allyn
Senhauser Dr.
Behill
Hartbourn
Van Campen
Hear
Satterfield
Bowman
MAC
Kent Student Center
Ceramics Lab
Risman Dr.
Risman Plaza
Visitor Parking
Library
Michael Schwartz Center
Admissions Parking
Clemente Cir.
Cunningham
Williams
DeWeese Health Center
Cooltury Dr.
Ice Arena
Cunningham Addition
All Weather Track Facility
Ice Arena Parking
Rhodes Rd.
Smith
Henderson
Science Research
Parking
Research I Building
Mathematical and Computer Science
Liquid Crystal Materials Science
Science Parking Area
Theatre Dr.
University Foundation and Development
Power Plant
Apple
Metcalf
McSweeney
Stewart
Child Development Center
Ted Boyd Dr.
Altmann
Humphrey
Munzenmayer
Musselman
The Portage
Morris Rd.
Bowman St.
Allerton Apartments
Allerton St.
West Campus Center Dr.
East Campus Center Dr.
E. Summit St.
Student Recreation and Wellness Center
XSU NASA Observatory
WKSU-FM Broadcast Center
Campus Employment and Operations
Solberton Dr.
To Dix Stadium
To Route 261
To Field House
To Murphy Mellis Field
Summit East Parking
Free Trailhead Parking
Stadium Parking
Dix Stadium
Murphy Mellis Field
Soccer Field
Field House
Women's Softball Field
The Art and Margaret Herrick Memorial Aquatic Ecology Research Facility (AERF)
Campus Center Dr.
Olga Mural Field at Schoonover Stadium and Intermural Fields
N
W
E
S

MAA Ohio Section

Program

Friday, April 16

11:30-4:00	Registration	MSB Library (3rd Floor)
12:00 – 1:20	Student Team Competition	MSB 115, 120, and 121
12:00-1:00	Committee Meetings:	
	CONCUR	MSB 211
	CONSACT	MSB 213
	CONSTUM	MSB 274
	Centennial Committee	MSB 276
1:00-4:00	Vendor and Book Exhibits	MSB Library (3rd Floor)
1:30-1:45	Welcome & Announcements	Henderson 201
1:45-2:45	Invited Address: **"The Internationalization of Mathematics in a World of Nations: 100 - 1960"** *Karen Parshall, University of Virginia*	Henderson 201
2:45-3:15	Break	MSB Library (3rd Floor)
3:15-4:15	Invited Address: **"Geometry and the Real World"** *John Oprea, Cleveland State University*	Henderson 201
4:25 – 6:20	**Contributed Paper Sessions**	MSB 104, 106, 109, 115, 120, 121
4:25 – 6:20	Executive Committee Meeting	MSB 376
6:30- 6:50	Social Time	KSU Student Center 306
6:30 – 8:00	Student Pizza Party	MSB Library (3rd Floor)
6:50- 8:00	Banquet	KSU Student Center 306
8:10-9:00	After-Dinner Talk: **"Moebius Madness"** *Ivars Peterson - Director of Publications and Communications MAA*	KSU Student Center 306
9:00 -	Business Meeting and Presentation of the Ohio Section Teaching Award	KSU Student Center 306

Saturday, April17

8:00-10:15	Registration	MSB Library (3rd Floor)
8:00-10:15	Vendor and Book Exhibitions	MSB Library (3rd Floor)
8:00-8:50	Coffee & Pastries	MSB Library (3rd Floor)
8:05-8:50	Executive Committee meeting continuation (if necessary)	MSB 376
8:05 – 8:50	Liaison's and Dept Chairs Meeting	MSB 109
8:50-9:00	Announcements	Henderson 201
9:00-10:00	Invited Address: **"Newton's Clock: Chaos in the Solar System"** *Ivars Peterson – Director of Publications and Communications MAA*	Henderson 201
9:55-10:15	Break	MSB Library (3rd Floor)
10:25-11:40	**Contributed Paper Sessions**	MSB 104, 106, 109, 115, 120, 121
11:50-12:50	Invited Address: **"Generalization Euclid V: In Search of the Unique Other"** *Mark Miller, Mariette College*	Henderson 201
12:50	**Closing Remarks**	Henderson 201

Abstracts of Invited Addresses

Friday

Speaker: Karen Parshall
Title: *The Internationalization of Mathematics in a World of Nations: 1800 – 1960*
Abstract: Mathematics has a history both grounded in time and place and, to some extent, transcendent of time and place. As an area of inquiry—but more fundamentally as a language through which to interpret nature—it has the ability to transcend time and place, even though for given time periods it may make sense to speak at least loosely of Mesopotamian or Greek or medieval Islamic or Chinese or European . . . mathematics. Over the course of the nineteenth and through the twentieth century, mathematics became not only a language but also an endeavor shared and developed internationally. How did this transformation occur? This talk will attempt to shed light on the answer to that question.

Speaker: John Oprea
Title: Geometry and the Real World
Abstract: More and more, problems in the sciences are finding solutions in the form of "shapes". Geometers have ways of measuring shape and of determining shape through optimization. We shall discuss various "real-life" problems that exemplify the principle that Nature's penchant for economy produces the shapes we see in everyday life. Problems to be discussed include: the shapes of soap films, Mylar balloons, water droplets in space and shallowest pneumatic domes

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Speaker: Ivars Peterson
Title: Moebius Madness
Abstract: Since its discovery in the 19th century, the astonishing one-sided, one-edged Möbius strip has confounded and fascinated generations of people, inspiring stories, magic tricks, patents, artworks, cartoons, playground equipment, and much else. Learn more than you ever thought possible about how a mathematical object conquered the modern world.

Saturday

Speaker: Ivars Peterson
Title: Newton's Clock: Chaos in the Solar System
Abstract: With astronomical questions inspiring new mathematics, the remarkable insights of Johannes Kepler, Isaac Newton, and Henri Poincaré paved the way to celestial mechanics and modern notions of chaotic dynamics. The result is a new picture of a solar system less placid and predictable that its venerable clockwork image would suggest.

Speaker: Mark Miller
Title: Generalizing Euclid V: In Search of the Unique Other
Abstract: Euclid postulated that for any given non-incident point-line pair (*p, l*), there was a unique other line *m* containing *p* and missing *l*. In this talk, we consider generalizations of this notion appearing in graph theory, abstract algebra, and finite geometry. Along the way, we also consider the meta-question, "Why are these things appealing to (some) mathematicians?" (*N.B.* In fact, the first sentence of this abstract is incorrect. Sometimes a white-lie is preferable to an inconvenient truth. We will consider some reasons for this as part of the talk.)

Brief Biographies of Invited Speakers

Karen Parshall – University of Virginia

Karen Hunger Parshall is Professor of History and Mathematics and Associate Dean for the Social Sciences at the University of Virginia. She earned her PhD in history from the University of Chicago, under the supervision of I. N. Herstein (in mathematics) and Allen G. Debus (in the history of science). Her research interests lie in the history of science and mathematics in the nineteenth and twentieth centuries, with a special mathematical focus on the history of algebra and its various technical developments, such as the theory of algebras, group theory, and algebraic invariant theory. Her work also focuses on the development of national mathematical research communities, as well as on the internationalization of mathematics in the nineteenth and twentieth centuries. She has been editor of *Historia Mathematica*, was the recipient of a Guggenheim Fellowship (in 1996), and served as chair of the International Commission for the History of Mathematics from 2002 to 2009. Her most recent book is *James Joseph Sylvester: Jewish Mathematician in a Victorian World* (Johns Hopkins, 2006).

John Oprea – Cleveland State University

John Oprea received his Ph.D. in 1982 from Ohio State University and has been at Cleveland State University since 1985. His interests lie in both algebraic topology and differential geometry and he has written extensively in these areas. His books include: Differential Geometry and its Applications (MAA Classroom Resources 2007), The Mathematics of Soap Films (AMS Student Math Library 2000), Symplectic Manifolds with no Kaehler Structure (with A. Tralle, Springer Lecture Notes 1997), Lusternik-Schnirelmann Category (with O. Cornea, G. Lupton and D. Tanre, AMS Monographs 2003) and his most recent, Algebraic Models in Geometry (with Y. Felix and D. Tanre, Oxford U Press 2008). Oprea was awarded the Lester R. Ford award from the Mathematical Association of America in 1996 for his American Mathematical Monthly paper Geometry and the Foucault Pendulum. In 2008, he was named as the Cleveland State College of Science Outstanding Researcher and received the University Distinguished Faculty Award for Research. He is currently an associate editor for the Journal of Geometry and Symmetry in Physics.

Ivars Peterson – Director of Publications and Communications - MAA

Ivars Peterson is Director of Publications and Communications at the Mathematical Association of America in Washington, D.C. For more than 25 years previously, he was a writer at *Science News*. He also served as editor of *Science News for Kids* and *Science News Online* and wrote the weekly online column *Ivars Peterson's MathTrek*.

Ivars Peterson received his education from the University of Toronto, where he earned a Bachelor of Science degree (majoring in physics and chemistry) and a Bachelor of Education degree. He taught high school science and mathematics for eight years. In 1980, he left teaching to obtain a master's degree in journalism from the University of Missouri in Columbia. He served as an intern at *Science News* in Washington, D. C., then joined the weekly magazine's staff.

Peterson's first book, *The Mathematical Tourist: Snapshots of Modern Mathematics* (W.H. Freeman, 1988; rev. ed., 1998), was widely and favorably reviewed. He followed up that success with *Islands of Truth: A Mathematical Mystery Cruise* (W.H. Freeman, 1990), *Newton's Clock: Chaos in the Solar System* (W.H. Freeman, 1993), *Fatal Defect: Chasing Killer Computer Bugs* (Times Books, 1995), *The Jungles of Randomness: A Mathematical Safari* (Wiley, 1998), *Fragments of Infinity: A Kaleidoscope of Math and Art* (Wiley, 2001), and *Mathematical Treks: From Surreal Numbers to Magic Circles* (Mathematical Association of America, 2002).

He has collaborated with his wife, Nancy Henderson, on two books introducing selected topics in contemporary mathematics to children of middle-school age: *Math Trek: Adventures in the MathZone* (Wiley, 2000) and *Math Trek 2: A Mathematical Space Odyssey* (Wiley, 2001). For more than 10 years, he wrote the "Math Page" column for the children's magazine *Muse*.

In 1991, Ivars Peterson received the Joint Policy Board for Mathematics Communications Award recognizing him for his "exceptional ability and sustained effort in communicating mathematics to a general audience."

During the spring semester of 2008, Ivars Peterson served as the Basler Chair of Excellence for the Integration of the Arts, Rhetoric, and Science at East Tennessee State University in Johnson City, where he taught a course on "Communicating Mathematics."

He lives in Washington, D.C., with his family.

Mark Miller – Marietta College

Mark Miller completed his undergraduate degree in 1988 with a major in mathematics education at John Brown University, in Siloam Springs, Arkansas. He then returned to his home in Colorado where he taught high school mathematics and social studies, worked for an environmental litigation support contractor, and dropped in and out of graduate school. In 1999 he graduated with his in Ph.D. in Applied Mathematics from the University of Colorado at Denver, under the direction of Stanley E. Payne (formerly of Miami University). He then moved to Marietta College where he is currently Chair of the Department of Mathematics and Computer Science. His mathematical interests are in combinatorial structures and finite geometries. When not doing mathematics, he enjoys playing bridge, working crossword puzzles, and trying to figure what the television show *LOST* is actually about. He is an elder at the First Presbyterian Church of Parkersburg, and he is the recording secretary for the Marietta Reading Club.

Contributed Paper Session I

Friday, April 16

Time	MSB 104 Session Chair Gordon Swain	MSB 106 Session Chair Jon Stadler	MSB 109 Session Chair Chandra Dinavahi	Notes
4:25-4:40	***A History of the Function*** Abstract #29 Sean M. McGraw Ashland University	***The Greatest Prime Factor Function and Some Applications*** Abstract #15 Greg Back Ohio Northern U.	***The Complex World of Chaotic Fractals*** Abstract #2 Kora J. Ridings The University of Findlay	
4:45-5:00	***The Parallel Climbers Puzzle*** Abstract #31 Shawn M. Kiss Ashland University	***The Perron-Frobenius Theorem with Applications to Sports Ranking Models*** Abstract #16 John T. Holodnak Ohio Northern Univ.	***Using Mathematics to Bring Down Terrorism*** Abstract #3 Brittany Fanning The University of Findlay	
5:05-5:20	***Math Madness*** Abstract #38 Mollie S. Sturm Ashland University	***Perturbations in the Aerospace Sequence of Attitude Determination Using Quaternions*** Ashland #21 Kevin Earnest Ohio Northern Univ.	***Numerically Estimating the Diffusivity of Soil*** Abstract #28 Shelly M. McGee The University of Findlay	
5:25 – 5:40	***The Distribution of Primes Modulo 3 and 4*** Abstract #40 Todd M. Polak Ashland University	***A Nonvanishing Result for Certain Sums …*** Abstract #32 Caitlin M. Zook Ohio Northern Univ.	***Variations and Generalizations of Fibonacci Numbers and Coin Tossing*** Abstract #13 MB Rao University of Cincinnati	
5:45-6:00	***An NBA Fan's New Year's Resolution*** Abstract #48 Nico Blankenship Ashland University	***Statistics Education: Research and Resources for the College Statistics Instructor*** Abstract #50 Leigh Slauson Capital University	***Diagonally Switchable 4-Cycle Systems*** Abstract #52 Chandra Dinavahi The University of Findlay	
6:05-6:20	***Origins of Sudoku*** Abstract #51 Alan Dunson Ashland University	***Palindromes, Polynomials, and Polya*** Abstract #8 Jon D. Stadler Capital University		

Contributed Paper Session I

Friday, April 16

Time	MSB 115 Session Chair David Singer	MSB 120 Session Chair John Tynan	Notes
4:25-4:40	***Definable Sets, Types, and O-Minimal Structures*** Abstract #45 Jason R. Messer Case Western Reserve University	***Using Tangles (the toy) to Make Tangles (the knot)*** Abstract #22 John Tynan Marietta College	
4:45-5:00	***Chessboard Tiling Problems with Polyominoes*** Abstract #42 David T. Kent Case Western Reserve University	***Probability in the Yell Game II*** Abstract #26 Christopher N. Swanson Ashland University	
5:05-5:20	***An Introduction to the World of P-adic Numbers*** Abstract #46 Matthew D Hartman Xavier University	***A Short Bio of Several Extraordinary Mathematicians*** Abstract #1 Thomas Dence Ashland University	
5:25 – 5:40	***Algebraic Cryptanalysis with Groebner Bases*** Abstract #24 James P. McShane Xavier University	***Knot Mosaics*** Abstract #43 Jacob Shapiro Denison University	
5:45-6:00	***Sumario Compendioso: The First Mathematics Work Published in the New World*** Abstract #23 Fabiola M. Arce Xavier University	***Envy-free Cake Division*** Abstract #44 Jacob Shafer Denison University	
6:05-6:20	***Mathletics*** Abstract #30 Melisa S. Shock Wittenberg University	***Markov Chains and Children's Board Games*** Abstract #25 Tiffany E. McKee Marietta College	

Contributed Paper Session II

Saturday, April 17

Time	MSB 104 Session Chair Gordon Swain	MSB 106 Session Chair Phil Blau	MSB 109 Session Chair Drew Pasteur	Notes
10:25-10:40	***Unlocking the Key: A Mathematical Look at Instrument Tuning*** Abstract #27 Matthew Schwan Ashland University	***Mortality and the Kaplan Meier method*** Abstract #4 Laurel Gaab Cleveland State University	***Predicting High School Football Playoff Seeds Using Monte Carlo Simulation*** Abstract #19 Drew Pasteur College of Wooster	
10:45-11:00	***To Deal or Not to Deal*** Abstract #34 Nathan W. Ferron Ashland University	***The Search For A Perfect Cuboid*** Abstract #7 Brian A Feister Cleveland State University	***An Introduction to Disease Modeling, with a Focus on Malaria*** Abstract #35 Mary D Rhollans College of Wooster	
11:05-11:20	***Redistricting-Gerrymandering: A Mathematical Evaluation*** Abstract #36 Michael R. Nelson Ashland University	***Mathematical Model of Marriage and Divorce*** Abstract #47 Richard Felton Cleveland State University	***An Investigation of the Isoperimetric Inequality*** Abstract #41 Moriah E. Wright: Youngstown State University	
11:25 – 11:40	***Cyclogons: Rolling with Polygons*** Abstract #37 Andrew D. Rowe Ashland University	***Approximation of Irrational Numbers with Rational Numbers Using Farey Sequences*** Abstract #49 Ian Morrison Cleveland State University	***A New Take on Cauchy's Determinant Theorem of 1841*** Abstract #6 Stuart Clary & Dale H. Mugler The University of Akron	

Contributed Paper Session II

Saturday, April 17

Time	MSB 115 Session Chair Barbara D'Ambrosia	MSB 120 Session Chair Adam Parker	MSB 121 Session Chair Michael Zwilling	Notes
10:25-10:40	***Patterns in Primitive Pythagorean Triples*** Abstract #5 Michael J Joseph John Carroll University	***Relative Class Number For Real Quadratic Fields*** Abstract #33 Amanda Furness Wittenberg University	***The Pythagorean Theorem of Faculty Softball*** Abstract #14 Michael Zwilling Mount Union College	
10:45-11:00	***Calculus Applets Made Easy (Part 1)*** Abstract #11 Barbara D'Ambrosia John Carroll University	***A Groebner Basis Approach to Number Puzzles*** Abstract #17 Alex A. Griffith Wittenberg University	***Molecular Symmetry: An Application of Group Theory*** Abstract #39 Benjamin A. Nowicki Youngstown State University	
11:05-11:20	***Calculus Applets Made Easy (Part 2)*** Abstract #10 Carl Spitznagel John Carroll University	***Is Deal or No Deal Cheating Its Contestants?*** Abstract#12 Daniel R. Shifflet Bowling Green State University	***Nearly Normal Tridiagonal Matrices*** Abstract #18 Ben Mackey Kent State University	
11:25 – 11:40	***The Stitz Zeager Open Source Precalculus Project*** Abstract #9 Carl Stitz & Jeff Zeager Lakeland Community College		***On a generalization of Brockett's double bracket equation*** Abstract #20 Alessandro Arsie University of Toledo	

Abstracts of Contributed Papers

[Friday 4:25 – 4:40]

A History of the Function

Sean M McGraw
Ashland University
smcgraw@ashland.edu

Abstract #29: The concept of "function" is one of the most dynamic ideas in the history of mathematics. Since its conception, there has been much variation as to both the interpretation and applications. Although the idea originated thousands of years ago, the explicit form of the function only began to evolve in the 17th century, during the development of Calculus and Analysis. This talk will give a brief, yet thorough, overview of some of the historical figures and events that have shaped the function concept into what it is today.

The Greatest Prime Factor Function and Some Applications

Greg Back
Ohio Northern University
g-back@onu.edu

Abstract #15: We use the greatest prime factor function to explore the properties of the set of prime numbers. The concept of prime numbers deals primarily with multiplicative properties of integers; by considering also the additive properties of prime numbers, a rich mathematical structure emerges. We first investigate the properties of a family of magmas based on the addition of prime numbers and the greatest prime factor function. Then, the same function is used to define a family of recurrence relations on prime numbers.

The Complex World of Chaotic Fractals

Kora J Ridings
The University of Findlay
ridingsk@findlay.edu

Abstract #2: The beauty of fractals surrounds us from the universe down to subatomic particles. The mathematical study of fractals, leads to fascinating branches of mathematics called chaos theory and complexity theory. This presentation will explore the relationship between these two theories.

Definable Sets, Types, and O-Minimal Structures

Jason R Messer
Case Western Reserve University
jason.messer@case.edu

Abstract #45: In Model Theory, definable sets, types, and o-minimal structures occupy common ground. This talk will introduce, assuming no background in Model Theory, some key concepts in the subject, including the motivation for these ideas and the characteristics they share.

Using Tangles (the toy) to Make Tangles (the knot)

John Tynan
Marietta College
tynanj@marietta.edu

Abstract #22: In Knot Theory, Conway developed a notation using tangles to help list all of the knots with 11 crossings or less. Having this notation, it is quite easy to use two pieces of string to create the knot by simply twisting the ends in a specified manner depending on the Conway notation of the knot. One of my students pointed out that when he was using his Tangle (toy) to create the knot that he was unable to connect the ends together, as one end was a male connector and the other was female. We naturally wondered if you could determine the starting position of the Tangle to guarantee being able to close the Tangle at the end to finish the knot. This talk will give definitive answers as to how to start for all knots whose Conway notation has four or less numbers in it.

[Friday 4:45 – 5:00]

The Parallel Climbers Puzzle

Shawn M Kiss
Ashland University
skiss@ashland.edu

Abstract #31: Graph theory is a powerful tool used for multiple purposes. In my talk we will see how Ashland's Professor Dence decides to settle a dispute with Leonhard Euler, the famous Swiss mathematician, as we explore the the Parallel Climbers Puzzle and how it is solved using graph theory.

The Perron-Frobenius Theorem with Applications to Sports Ranking Models

John T Holodnak
Ohio Northern University
j-holodnak@onu.edu

Abstract #16: We outline the concepts from linear algebra that are necessary to understand the Perron-Frobenius Theorem, which concerns the eigenvalues and eigenvectors of non-negative, irreducible matrices. The proof of the theorem is briefly discussed. In addition, we examine the role played by the theorem in the development of a sports ranking model, and apply the model to National Football League data.

Using Mathematics to Bring Down Terrorism

Brittany Fanning
The University of Findlay
fanningb@findlay.edu

Abstract #3: Where should international resources be deployed in order to have the greatest detrimental effect on the three most active international terrorist groups? This research investigates this question using data from the 2004 Global Terrorism Database and different mathematical techniques from graph theory and discrete mathematics. A discrete graph will be created that will model the terrorism activity of different terrorism groups and the efficiency of this graph will be computed. Each node of the graph will then be tested to see the effect on the efficiency of the graph if that node is removed.

Chessboard Tiling Problems with Polyominoes

David T Kent
Case Western Reserve University
dxk147@case.edu

Abstract #42: Polyominoes are figures formed by combining unit squares (e.g., the pieces in Tetris are all tetrominoes). The chessboard is another famous polyomino, and this talk will examine some interesting problems concerning tiling this 8x8 grid. Which combinations of polyominoes can cover the board? Which combinations cannot be used? What if the board is mutilated? Can we say anything about general requirements for tiling? Such questions will be answered, and those answers proved as cleverly as possible.

Probability in the Yell Game II

Christopher N. Swanson
Ashland University
cswanson@ashland.edu

Abstract #26: In the Yell Game, players stand in a circle, close their eyes, and on the count of three, open their eyes, looking directly at another player. If two players are looking directly at each other, they yell and are out of the game. At the 2009 Spring Meeting, I presented a formula for the probability exactly y pairs of people yell when n people play the game. In this talk, I will use this formula to derive formulas for the mean and the variance of the number of pairs of yells, show an alternative derivation of these formulas, and show how to calculate the mean rounds until there is only 1 or 2 players left when starting with n players. This talk should be at an appropriate level for an undergraduate math major who has taken a probability course.

[Friday 5:05 – 5:20]

Math Madness

Mollie S Sturm
Ashland University
msturm1@ashland.edu

Abstract #28: Every year, millions of people attempt to predict the outcome of the Division I NCAA Men's Basketball Tournament by filling out a bracket. Two popular ranking methods, known as the Colley Method and the Massey Method, rate teams based on strength of schedule and game point differentials, respectively. Ranking methods can then be applied to the bracket prediction process to see if a mathematically produced bracket can better predict the outcome of this tournament. I will apply these ranking methods to the Men's 2010 Big Ten Conference Tournament.

Perturbations in the Aerospace Sequence of Attitude Determination Using Quaternions

Kevin Earnest
Ohio Northern University
k-earnest@onu.edu

Abstract #21: This presentation investigates ways to represent rotations, the ring of quaternions, the problem of attitude determination of high velocity aerospace devices leading to the aerospace sequence of rotations, perturbations of this aerospace sequence, and the causes of these perturbations.

Numerically Estimating the Diffusivity of Soil

Shelly M McGee
The University of Findlay
mcgee@findlay.edu

Abstract #28: Civil engineers are interested in knowing the diffusivity of chemicals in soil to estimate the remediation time. Civil engineers at Texas Tech University have used vials with permeable membranes to monitor the time required to reach equilibrium of the chemical of interest inside and outside the vial. These researchers have also used multiple vials close together to monitor time required for the chemical of interest to diffuse from a vial at a central location to vials at other locations. The development of the computer algorithm from a one-dimensional forward in time finite difference code in Microsoft Excel to a full three-dimensional backward in time finite difference code in Matlab to estimate the diffusivity parameter of the soil will be discussed.

An Introduction to the World of P-adic Numbers

Matthew D Hartman
Xavier University
hartmanm@xavier.edu

Abstract #46: With applications to number theory, P-adic numbers are simply another way to represent numbers. However, upon adding a non-Archimedean valuation, strange properties arise. In this talk, we will show how rational numbers are represented P-adically, and venture into some of the unique topological properties presented by this bizarre valuation. For example- every closed ball is equivalent to a finite union of open balls.

A Short Bio of Several Extraordinary Mathematicians

Thomas Dence
Ashland University
tdence@ashland.edu

Abstract: #1 A short biographical sketch of two prominent mathematicians will be presented, though you probably are not familiar with both of them, since their names are not present in standard calculus texts. They have done some exceptional work that should interest you. A contest will be held to guess the identity of the second individual - a chance for you to win $5. Are you listening Don Hunt?

[Friday 5:25 – 5:40]

The Distribution of Primes Modulo 3 and 4

Todd M Polak
Ashland University
tpolak@ashland.edu

Abstract #40: Prime numbers are a topic of interest to many people. In particular, mathematicians have studied their distribution. With the help of mathematical software, I have looked at the frequencies of primes with particular remainders modulo 3 and modulo 4. This exploration has answered some questions but raised more.

A Nonvanishing Result for Certain Sums …

Caitlin M Zook
Ohio Northern University
c-zook@onu.edu

Abstract #32: A nonvanishing result for certain sums and its application to singularities of multiple L-functions.

Variations and Generalizations of Fibonacci Numbers and Coin Tossing

MB Rao
University of Cincinnati
marepalli.rao@uc.edu

Abstract #13: Fibonacci numbers arise in nature. They arise in mathematics too. In a simple coin tossing experiment, we demonstrate how they arise in a novel way. By extending the coin tossing experiment, we show that generalizations and variations of these numbers manifest in a natural way.

Algebraic Cryptanalysis with Groebner Bases

James P McShane
Xavier University
mcshanej@xavier.edu

Abstract #24: FLURRY is a toy cipher that mimics some of the key features of the AES in use by the US Government. In order to investigate the cryptanalysis of this cipher, we represent its elements by means of a Groebner basis for the polynomial ring over a field of the form GF(2^n). The important elements of Groebner basis theory will be discussed to explain how this operation takes place.

Knot Mosaics

Jacob Shapiro
Denison University
shapir_j@denison.edu

Abstract #43: A knot mosaic is a regulated way of depicting knots on an n x n matrix with individual entries consisting of 11 different predetermined 1x1 tiles. Lomonaco and Kauffman used this representation in their 2008 paper as a possible structure to describe quantum knots. In their paper, a series of open questions were posed. We explore two of these. One regarding the mosaic number of a knot, that is the smallest integer n required to fit a given knot on an n x n board. We also obtained several results regarding the number of different knots that can fit on an n x n board for a fixed n. This presentation is intended for a general audience.

[Friday 5:45 – 6:00]

An NBA Fan's New Year's Resolution

Nico Blankenship
Ashland College
nblanken@ashland.edu

Abstract #48: For his 2010 resolution, a Cincinnati native wants to figure out the fastest way to visit each Eastern Conference stadium once for a NBA contest. Steven recalls from his Discrete Math days that the Traveling Salesman Problem is similar in nature to his dilemma. He hopes by using matrices, for the NBA schedule and travel time between cities, that he will find the quickest trip in a mathematical fashion. Will his methods truly give him the fastest trip?

Statistics Education: Research and Resources for the College Statistics Instructor

Dr. Leigh Slauson
Capital University
lvslauson@me.com

Abstract #50: Statistics is still one of the most difficult subjects for college students to learn and for instructors to teach. This talk will highlight what the growing field of statistics education has to offer those who teach statistics. These include the *GAISE* report, which was guided by current research in statistics education, and resources for the classroom, such as activities, websites, workshops and webinars, all of which are available for free. This talk will also highlight the findings of the author's own research concerning the effectiveness of active learning techniques in a statistics classroom.

Diagonally Switchable 4-Cycle systems

Chandra Dinavahi
The University of Findlay
dinavahi@findlay.edu

Abstract #52: A 4-cycle system is said to be diagonally switchable if each 4-cycle can be replaced by another 4-cycle obtained by replacing one pair of non-adjacent edges of the original 4-cycle by its diagonals so that the transformed set of 4-cycles forms another 4-cycle system. The existence of diagonally switchable 4-cycle system of K_v has already been solved. In this presentation we will discuss a similar result for $K_v - I$, where I is any one factor of K_v. K_v : Complete graph on " v" vertices.

Sumario Compendioso: The First Mathematics Work Published in the New World

Fabiola M Arce
Xavier University
arcef@xavier.edu

Abstract #23: *El Sumario Compendioso* is considered the first mathematics book published in the New World. The book was published in 1556 in Mexico City and was written by Juan Diez Freyle, a mysterious Spanish mathematician. This talk will cover a brief history of the Spanish colony New Spain and a review of the algebra of that time period. In addition, I will give an outline of the contents of the "Sumario." We will review a multiplication method presented by Diez Freyle which is very strange looking to modern readers and an algebra problem similar to a problem those of European mathematicians.

Envy-free Cake Division

Jacob Shafer
Denison University
shafer_j@denison.edu

Abstract #44: Most people with siblings cannot get through their childhood without using the "one cuts, one chooses" method to divide a piece of cake. This is a simple solution to the problem of dividing something between two people. But, how would we fairly divide a piece of cake among 3 people with different likes and dislikes? This talk explores several means of dividing cake and how envy-free division could be used for more real-world applications beyond cake. This talk is intended for a general audience.

[Friday 6:05 – 6:20]

Origins of Sudoku

Alan Dunson
Ashland University
adunson@ashland.edu

Abstract #51: The popular game Sudoku is a modern day Japanese invention that has made its journey to the United States and taken it by storm. This talk will focus on the history of Sudoku and traits it shares with "Magic Squares" and "Latin Squares". Although Latin Squares have been in existence for over 200 years, and Sudoku only slightly more than a few decades, I will show that the two have much in common both in theory and in practice.

Palindromes, Polynomials, and Polya

Jon D Stadler
Capital University
jstadler@capital.edu

Abstract #8: Polya's enumeration theorem provides an elegant method for counting items such as bracelets with beads of many, though possibly identical colors, as well as more sophisticated objects such as chemical compounds, groups, and graphs. Articles and texts describing the theorem first introduce Burnside's Lemma, which enumerates orbits of a set on which a group is acting. However, a careful analysis of permutations of the palindrome "Madam in Eden, I'm Adam" allows us to provide the general idea of the theorem using only elementary counting techniques and the multinomial theorem.

Mathletics

Melisa S Shock
Wittenberg University
s10.mshock@wittenberg.edu

Abstract #30: There have been many techniques and inventions discovered throughout time to improve the game of softball. This project studies different pitch counts in a softball game and the outcome of the count. With this information, can we model the outcome of a potential pitch given a specific pitch count?

Markov Chains and Children's Board Games

Tiffany E McKee
Marietta College
tiffany.mckee2@gmail.com

Abstract #25: Markov Chains are used to model the popular children's board games Chutes and Ladders and Candy Land. Specifically, transition probability matrices are found and used to calculate the average number of turns to win and the n-step probabilities.

[Saturday 10:25 – 10:40]

Unlocking the Keys: A Mathematical Look at Instrument Tuning

Matthew Schwan
Ashland University
mschwan@ashland.edu

Abstract #27: A broad introduction to why, mathematically, musical instruments are built to play certain pitches and not others. Examines how scales have developed historically, leading up to the system used by modern Western music, in a way that non-musicians can understand and that mathematicians can appreciate. Assumes no background in music theory.

Mortality and the Kaplan Meier method

Laurel Gaab
Cleveland State University
laurelg8@hotmail.com

Abstract #4: Death is the one thing that will inevitably happen to everybody. When it comes to calculating death using probability, a table called the Commissioners Standard Ordinary Mortality Table is often used. There is currently a more recent mortality table (2001), however it only states the deaths per 1000, while I am more interested in using a cumulative effect, as they did in the 1980 table. The Kaplan Meier method is a great way to look at a cumulative probability of survival and death. Using the 1980 CSO mortality table, I will use the Kaplan Meier method to take a look at survival rates. I will be comparing survival curves between males and females, and estimating the distribution of the life expectancy curves.

Predicting High School Football Playoff Seeds Using Monte Carlo Simulation

Drew Pasteur
College of Wooster
rpasteur@wooster.edu

Abstract #19: Ohio high school football has 24 regions, each made up of about 30 schools with similar enrollments. In each region, eight playoff teams are selected and seeded using a computational rating system. Teams receive points for each win, with more points awarded for beating larger schools; additional points are awarded for each win by a defeated opponent. With hundreds of games each week, many matching teams from different regions, it is difficult to predict the playoff teams, let alone seeds. Using a separate power rating system to determine win probabilities on future games, we simulate remaining regular-season games many times, computing the playoff points each time. This leads to predictions of playoff teams and seeds, and conditional probabilities for each team. To assess accuracy, we compare our predictions to official weekly playoff points, during the 2009 season.

Patterns in Primitive Pythagorean Triples

Michael J Joseph
John Carroll University
mjoseph10@jcu.edu

Abstract #5: We will find and prove patterns of divisibility by small primes in primitive Pythagorean triples.

Relative Class Number For Real Quadratic Fields

Amanda Furness
Wittenberg University
s10.afurness@wittenberg.edu

Abstract #33: We examine relative class numbers associated to class numbers in quadratic fields. Given a square-free positive integer m and an arbitrary positive integer f, we will define the relative class number H(m,f). It is not known if for every m there exists an f for which the relative class number is 1. We will prove that such an f exists for certain values of m.

The Pythagorean Theorem of Faculty Softball

Michael Zwilling
Mount Union College
zwilliml@mountunion.edu

Abstract #14: Bill James' Pythagorean Theorem of Baseball will be derived, and extended to the faculty softball team.

[Saturday 10:45 – 11:00]

To Deal or Not to Deal

Nathan W Ferron
Ashland University
nferron@ashland.edu

Abstract #34: This talk is about the NBC Game Show Deal or No Deal. Using a computer program to simulate the game play with several different strategies, data is compiled on the amount of money won each time. These strategies reflect mathematical concepts such as the expected value of the game and the value of the deal offered at each stage. The strategies will be judged on whether the amount of money won beats the game's expected value.

The Search For A Perfect Cuboid

Brian A Feister
Cleveland State University
bfeister@hotmail.com

Abstract #7: The perfect cuboid - a rectangular prism with integer edges, face diagonals, and space diagonal - is an interesting geometric object. They have been sought for over 200 years, and none have been found. However, they have not been proven to be impossible, either. We study Pythagorean triples and how their properties extend to perfect cuboids to aid us in our search. We also examine a parametrization of perfect cuboids and an algorithm to generate them. Finally, we'll take a look at an approach which may lead to a proof of nonexistence.

An Introduction to Disease Modeling, with a Focus on Malaria

Mary D Rhollans
College of Wooster
mrhollans10@wooster.edu

Abstract #35: Models can be used to represent the spread of a disease within a population, and the nature of the disease determines the requisite human states. The model's equilibria can be used to make predictions about the disease's presence in the population, and bifurcations can be used to indicate the model's sensitivity to specific parameters and/or rates. We focus specifically on modeling malaria in sub-Saharan Africa, and in doing so have created a model that tracks two vector species, humans and mosquitoes, and utilizes current research to determine the parameter values that produce the model's equilibria and bifurcations. These findings, along with the validity and potential uses of the model are discussed.

Calculus Applets Made Easy (Part 1)

Barbara D'Ambrosia
John Carroll University
bdambrosia@jcu.edu

Abstract #11: Using the free software package GeoGebra, it is easy to quickly create demonstrations for Calculus and other courses. These demonstrations can also be converted to Java applets for use on the internet.

A Groebner Basis Approach to Number Puzzles

Alex A Griffith
Wittenberg University
s11.agriffith@wittenberg.edu

Abstract #17: In this talk we illustrate how certain number puzzles can be described as systems of polynomials, and how these polynomials can help us find and count solutions. To do this, we use Buchberger's Algorithm to compute Groebner Bases. We begin by outlining a Mathematica program we wrote that solves specific KenKen puzzles and then present a technique for counting the number of possible n x n Latin Square and Sudoku boards. When finding a Groebner Basis is not computationally feasible, a modification to our counting technique can give an upper bound for the number of distinct boards.

Molecular Symmetry: An Application of Group Theory

Benjamin A Nowicki
Youngstown State University
banowicki@student.ysu.edu

Abstract #39: Chemistry and abstract mathematics may seem to be unrelated but one link between these subjects exists in molecular symmetry. Chemists often consider a molecule's symmetry which reveals properties of the molecule. When chemists want to represent a molecule's symmetries they use a branch of mathematics called group theory. We will demonstrate the symmetry operations on common molecules and determine the group associated with the molecule's symmetries.

[Saturday 11:05 – 11:20]

Redistricting-Gerrymandering: A Mathematical Evaluation

Michael R Nelson
Ashland University
mnelson@ashland.edu

Abstract #36: This presentation will discuss the redistricting of congressional districts that result from a national census, and will evaluate possible Gerrymandering of congressional districts using mathematical methods. The eccentricity or irregularity in the shape of a district, and the compactness of a congressional district regarding the relationship between its area and perimeter, will be calculated and used to evaluate the possibility of Gerrymandering. Examples from Ohio will be analyzed.

Mathematical Model of Marriage and Divorce

Richard Felton
Cleveland State University
richfelton@aol.com

Abstract #47: John Gottman has used mathematics to model husband-wife relationships, resulting in an ability to predict with 94% accuracy which couples will divorce within four years. With two-thirds of marriages ending in divorce within 40 years and 75% of second marriages failing, knowing the relationship dynamics that increase or decrease the probability of couples remaining together is important before one pops “the question” (or answers it).

We investigate the procedure Gottman used to create his model: videotaping extended conversations of couples, scoring and coding the positive and negative interactions, and plotting these interactions as functions of turns of speech. The resulting functions were then classified, based upon the slopes of the functions, into five interaction styles. We examine the use of these styles (and null clines) to predict the longevity of these human relationships.

An Investigation of the Isoperimetric Inequality

Moriah E Wright
Youngstown State University
mewright@student.ysu.edu

Abstract #41: The classical isoperimetric problem dates back to ancient times. The problem can be simply stated as follows: Of all closed curves in the plane of fixed perimeter, which one encloses the maximal area? The solution to the isoperimetric problem is usually given in the form of the isoperimetric inequality. We will give a proof of the isoperimetric inequality as given by Erhard Schmidt which uses the arc length formula, Green's Theorem, and the Cauchy-Schwartz Inequality.

Calculus Applets Made Easy (Part 2)

Carl Spitznagel
John Carroll University
spitz@jcu.edu

Abstract #10: Using the free software package GeoGebra, it is easy to quickly create demonstrations for calculus and other courses. These demonstrations can also be converted to Java applets for use on the internet. Although related to the talk labeled "Part 1," attendance at that talk is not necessary for understanding this one.

Is Deal or No Deal Cheating Its Contestants?

Daniel R Shifflet
Bowling Green State University
drshiff@bgsu.edu

Abstract #12: The popular game show Deal or No Deal became a hit the instant it debuted on television nearly five years ago. Since then, hundreds of contestants have played for the opportunity to win huge cash prizes. Some did, some did not, and some narrowly missed out on their fortune by quitting the game too early. Or did they? Simple statistical analysis suggests that the rules applied to some contestants differ greatly from others. Is this true? If so, is it cheating, or just another part of the game?

Nearly Normal Tridiagonal Matrices

Ben Mackey
Kent State University
bmackey3@kent.edu

Abstract #18: The behavior of normal matrices is very well studied. In particular, normal matrices can be completely characterized by their singular value decompositions. In this talk, we define a matrix to be nearly normal if its commutant with its Hermitian adjoint has rank 2. In the case of tridiagonal matrices, we explore the eigenvalues and eigenvectors of these matrices and prove a result concerning their singular value decompositions analogous to what we know about normal matrices.

[Saturday 11:25 – 11:40]

Cyclogons: Rolling with Polygons

Andrew D Rowe
Ashland University
arowe@ashland.edu

Abstract #37: A cycloid is the curve defined by a point on the circumference of a circle which rolls around another circle. A cyclogon is a related curve created when an n-sided polygon rolls around an m-sided polygon with a trace point on the n-sided polygon. This talk will look at finding the area under the curve without using calculus and how the ratio of n/m and the ratio of the side lengths of the n-gon to the m-gon affect the curve.

Approximation of Irrational Numbers with Rational Numbers Using Farey Sequences

Ian Morrison
Cleveland State University
homonculi@gmail.com

Abstract #49: How closely can any rational number p/q approximate an irrational number "theta"? Given an error bound for this approximation, how large must q be before "theta"-p/q is guaranteed to be within the error value? Using Farey sequences and the integral lattice, I will reconstruct a proof of Hurwitz's Theorem which gives an exact value for the difference between "theta" and p/q as a function of q.

A New Take on Cauchy's Determinant Theorem of 1841

Stuart Clary & Dale H. Mugler
The University of Akron
clary@uakron.edu

Abstract #6: Let M be a matrix of rank 2 with no entry equal to zero, and let R be the matrix whose entries are the reciprocals of the corresponding entries of M. We show how to express the determinant of R in terms of the entries of M and the 2-by-2 sub-determinants of M. Our formula generalizes a famous formula published by Cauchy in 1841.

The Stitz Zeager Open Source Precalculus Project

Carl Stitz & Jeff Zeager
Lakeland Community College
cstitz@lakelandcc.edu

Abstract #9: Carl and Jeff decided to take sabbatical and write a free, open source pre-calculus textbook. It's been a year and we'd like to show you what we have.

On a generalization of Brockett's double bracket equation

Alessandro Arsie
University of Toledo
alessandro.arsie@utoledo.edu

Abstract #20: I will present a generalization of Brockett's double bracket equation that applies to possibly non-symmetric matrices and discuss its sorting and diagonalization properties. I will also present a new technique to study the convergence of such a system based on the idea of height functions, proving that diagonalization of the initial data can be performed also in the case of degenerate spectrum. Simulations will be presented and hypothetical connections with classes of integrable systems discussed. These results have been obtained in joint works with Christian Ebenbauer (University of Stuttgart, Germany).

Notes

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The Ohio Section of the Mathematical Association of America would like to thank the faculty, staff, and students of the Kent State University Mathematics Department for their efforts in hosting this meeting. Special thanks go to Laura Dykes for her tireless work as local arrangements liaison.

Announcement of Fall 2010 Section Meeting

The Ohio Section of the Mathematical Association of America will hold its annual Fall meeting on **October 22-23, 2010** at Ursuline College in Cleveland OH. The invited speakers for that meeting are: Michael Henle, Barbara Ashton, Dave Sobecki and John Stillwell. More details, including submission information for contributed talks from faculty and students, will be forthcoming in the Fall edition of the Ohio Section newsletter and also on the Ohio Section web site, **www.maa.org/ohio.**