

The Mackinac Gazette

Greetings from the Department Chair

Welcome to the third edition of the Grand Valley State University Department of Mathematics Newsletter. As has been the case for the last several years, the department has welcomed new faculty to tenure track positions: Filiz Dogru, Karen Heidenreich (who has been with us for the last three years as a teaching post-doc), and Paul Yu. We have also seen some resignations and retirements: Alverna Champion, Ernie Palmer, and Phil Pratt.

In other faculty news, John Golden and Clark Wells have been promoted to Associate Professors with tenure; Jane Mays was also awarded tenure. David Austin, Carl Arendsen, and John Golden were on sabbatical leaves in the fall, while Clark Wells is on leave this winter.

As we have done for three of the last four summers, the department hosted a Research Experiences for Undergraduates (REU) program funded by the National Science Foundation. Ed Aboufadel, Steven Schlicker, Matt Boelkins, and Clark

Wells worked collaboratively with eight sophomore and junior mathematics students on research problems in mathematics. The students who participated were Chris Bay (Truman State), Lindsey Bromenshenkel (Bemidji State), Justin Hogg (Pittsburgh), Amber Lembcke (Concordia), Jen Miller (Bucknell), Julie Olsen (Elmhurst), Ben Vugteveen (GVSU), and Jesse Windle (Nebraska). We divided into four research groups: Julie and Jesse worked with Ed on using wavelets to break captchas; Chris and Amber worked with Steve to investigate the geometry of the Hausdorff metric; Lindsey and Justin conducted work with Clark in Lie Theory and its relations to rotations in 3-dimensional space; and Jen, Ben, and Matt investigated how certain properties of polynomial functions depend on the distribution of the polynomial's zeros.

By the end of the program, the students had produced a lengthy research paper and given two major presentations. The first of the

presentations took place at the Michigan REU conference at Central Michigan University, along with REU participants from programs at Hope College and CMU. At the end of the summer, six of our REU students gave presentations at MathFest, the MAA's annual summer national mathematics conference, which was held in Boulder, Colorado.

Our REU students have even won several awards, providing wonderful recognition for GVSU. Chris Bay had his MathFest talk recognized as a "Best Presentation" (one of 9 such awards out of 53 presentations) at MathFest. Chris also presented a poster at the Annual Joint Meetings of the American Mathematical Society and the MAA, held in January in Phoenix, and won an award for his poster at this conference (one of 33 awards out of 108 entries). Lisa Driskell, one of our REU students from the summer of 2002, recently won the annual Greg Mellen Memorial Cryptology Scholarship for her article based on her work (with Ed) on wavelets and steganography (the science of hiding messages in images). The article will appear in the April 2004 issue of *Cryptologia*.

I want to thank David Austin, Matt Boelkins, and Paul Fishback for their fine work in creating this newsletter. I hope you will use this newsletter as a reminder to stay in contact with us. If you have the opportunity to return to campus, please stop by and visit your old faculty friends and take advantage of the many opportunities that are available at Grand Valley State University.

Steven Schlicker
Chair, Department of Mathematics



Is this a captcha? Professor Ed Aboufadel with students Jesse Windle and Julie Olsen.

New Faculty

The Department of Mathematics is pleased to welcome four outstanding new faculty members this year.

Filiz Dogru

A new Assistant Professor, Filiz Dogru comes to Grand Valley after earning an undergraduate degree at Ankara University in Turkey and a Ph.D. from The Pennsylvania State University. Her research interests are in hyperbolic geometry and dynamical systems. In particular, she is working to understand the trajectories followed by billiard balls in the hyperbolic plane. When asked what drew her to Grand Valley, Filiz says, "When I was in grad school, I always mentioned to my friends that I wanted to work in a friendly, but not small, department with an excellent teaching reputation. I also wanted to have the opportunity and support from the department to grow in mathematics. At that time, my friends told me it was a dream, but I believe I found that mathematics department at GVSU. I am extremely happy to be here. When I first came to the USA, I knew only two words of the language: yes and no. Today I am proud of myself to be part of such a great department at GVSU. I love what I am doing."



Filiz Dogru

Karen Heidenreich

This year, Karen Heidenreich joined the Department of Mathematics as an Assistant Professor after working here for three years in a post-doctoral Visiting Assistant Professorship. After earning her bachelor's degree from the University of Northern Iowa and her Ph.D. from Notre Dame, Karen came to Grand Valley to "experience teaching at a school that emphasizes undergraduate education." Karen's research interests lie within the field of algebra and focus on a study of the highest weight representations of infinite dimensional Lie algebras. During her time at Grand Valley, Karen has served as an active advisor to the Math and Stats Club.



Karen Heidenreich

Nathan Wodarz

This is Nathan Wodarz' first year of a three-year post-doctoral Visiting Assistant Professorship. The aim of this position is to give mentoring and teaching experience to recent Ph.D.'s who have a strong interest in teaching but may not have worked in a rich teaching environment as a graduate student. Nathan comes to us after earning both his bachelor's degree and Ph.D. at the University of Minnesota. His scholarly interests are in homotopy theory, a branch of algebraic topology. Of his interest in Grand Valley, Nathan says, "I really liked the concept of a school that didn't shortchange either teaching or research. I felt uncomfortable teaching last year at a school that put a large emphasis on research. On the other hand, I wouldn't want to go to a school which expected me to teach to the detriment of research either. Grand Valley offered a nice medium."



Nathan Wodarz

Paul Yu

Paul Yu, a new Assistant Professor, comes to the Department of Mathematics from Illinois State University, where he is expecting to complete his Ph.D. in the coming year. He also holds a bachelor's degree from the University of Illinois at Champaign-Urbana. Paul's scholarly interests lie in mathematics education, especially semiotic applications to learning theory. In addition, he is interested in dynamic geometry software and curricula at the K-12 levels. Finally, he is intrigued by the relationship he sees between mathematics and art. Paul was attracted to Grand Valley for its "commitment to teaching with strong support for research and service." Not finding his first-year faculty position stressful enough, Paul and his wife recently welcomed a new child over spring break.



Paul Yu

A Solution to the Poincaré Conjecture May Be Near

Remember all the hours you spent working on your Math 210 proof portfolio in the hopes of earning a respectable grade? The Clay Mathematics Institute has published a portfolio of seven mathematics problems for the mathematical community. Rather than offering a good grade, however, the institute offers \$1 million for the solution of just one of these problems. Recent work of Grigori Perelman, a Russian mathematician working at the Steklov Institute of Mathematics, seems to give a solution to one of these problems, the so-called Poincaré conjecture, a problem in topology first posed in 1904.

The Poincaré conjecture deals with the structure of three-dimensional space. To understand what it says, let's first think about a two-dimensional analogy. Imagine that we take a piece of string tied in a loop with a slip-knot and arrange it on the surface of a basketball. No matter how the string is laid out, we can make the loop disappear by pulling it through the slip-knot. Because it possesses this property, the surface of the basketball is called "simply connected."

However, if we perform the same experiment on the surface of a bagel, this is no longer true. For instance, if the string winds around the hole in the bagel, the loop will never disappear when pulled on. In fact, an old theorem in topology tells us that the surface of the basketball, known to topologists as the two-dimensional sphere, is the only surface that is simply connected. The Poincaré conjecture says, plainly enough, that the three-dimensional sphere, the set of points in four-dimensional space that are a constant distance from the origin, is the only simply connected three-dimensional space. This conjecture is, in many respects, the beginning point of any study of three-dimensional spaces.

Though the statement of the Poincaré conjecture is simple enough, a proof has eluded mathematicians for the past hundred years in spite of intensive efforts by many talented mathematicians. In the late 1970's, William Thurston of Princeton University made an exceptionally bold conjecture about the geometry of all three-dimensional spaces. It was immediately recognized that if Thurston's conjecture were true, then

the Poincaré conjecture must be true as well.

Perelman's work is exciting for it seems to give a proof of Thurston's much more general conjecture. Several teams of mathematicians from around the world are working to determine whether Perelman's proof contains any flaws, and at this time, it is too early to state definitively that the proof is correct. However, Perelman's ideas have been called "highly original and of deep insight" by experts and are already being used to investigate related areas of mathematics.

Perelman completed his papers while working in relative seclusion and entered the spotlight only last year when he gave a few talks on his work in the United States. Curiously, the publicity-shy Perelman seems uninterested in submitting his papers for publication, a requirement if he is to lay claim to the prize money offered by the Clay Institute. You may read more about the Clay Mathematics Institute and its list of seven problems at www.claymath.org.

Grand Valley Mathematics Department Hosts Three Major Conferences

The Michigan Undergraduate Mathematics Conference

On Saturday, October 25, 2003, more than 140 students and faculty from 19 universities across the state and surrounding region gathered at GVSU's DeVos Center in Grand Rapids for the 6th Annual Michigan Undergraduate Math Conference. Approximately 100 of the attendees were students, 27 of whom gave presentations on scholarly work they'd done in summer research programs or special class projects.

In addition, there were multiple presentations on graduate programs, REUs, and career opportunities in mathematics. Dr. Suzanne Lenhart of the University of Tennessee and Oak Ridge National Lab gave a keynote address on her research in applied mathematics involving differential equations and optimal control.

Of particular note are three talks given by GVSU students **Kristina Lund**, **Micah TerHaar**, and **Benjamin Vugteveen**, who conducted research in the summer of 2003 with, respectively, Professors Will Dickinson, Jon Hodge, and Matt Boelkins.

More information about the conference can be found at <http://www.gvsu.edu/math/mumc.html>.

Math in Action 2004

Another great installment of the Mathematics Department's annual Math In Action Conference was hosted on Thursday, February 26, 2004. This event provides sessions where K-12 educators and pre-service math teachers experience an active learning environment through a variety of means. With 22 small group sessions on different topics, we drew a large range of interested mathematics teachers and were delighted that over 220 people were in attendance.

Many current and former GVSU students participated. Alumnus Shanna Scholten Greer, '03, (West Ottawa High School) led a session called "Can you Fathom It?" on the use of the program *Fathom* in the classroom. For the third year in a row, Tara Maynard, '97, (Creekside Middle School) presented, this time on "Spinners - What Can They Teach Us?" In addition, we were pleased to have Professor Deborah Ball, an internationally known mathematics education researcher from the University of Michigan, give two outstanding addresses on the teaching and learning of mathematics.

This event has become a popular gathering for Grand Valley faculty and alumni who are involved in mathematics education. We invite and

encourage those of you who work as teachers in the area to join us in 2005. Should you be interested in participating in or leading a session, contact Marge Friar at 616-331-2304 or friarm@gvsu.edu.

Conversations Among Colleagues

On Saturday, March 20, 2004, the first *Conversations Among Colleagues* conference was held in the DeVos Center of Grand Valley State University. Participants and speakers represented most of the universities in Michigan and many of the two- and four-year colleges. Speakers shared their respective mathematical education research, curricular work, and/or state standards and the implications each of these hold for preparing teachers of mathematics.

Michigan State University has agreed to sponsor the conference in 2005, and *Conversations Among Colleagues* is expected to continue annually. This year's conference was organized by Char Beckmann of GVSU and a joint committee of members of the Michigan Mathematics Teacher Educators (MMTE), Michigan Council of Teachers of Mathematics (MCTM), and the Michigan Section of the MAA. The event was sponsored by these and several other organizations.

The themes of *Conversations* will also continue to be addressed through sessions to be held in conjunction with the Michigan MAA Section meeting, May 7-8, 2004 at Oakland University (program is available online at www.michmaa.org), the University of Michigan Mathematics Education Leadership Conference, May 21, 2004 at the U of M School of Education (contact Teresa McMahan at teresam@umich.edu for information), and the MCTM Annual Conference at the Marriott Renaissance Center in Detroit, October 29-30, 2004. Interested speakers for the MCTM conference can find the speaker proposal online at www.mictm.org.



Left to right: Benjamin Vugteveen, Micah TerHaar, and Kristina Lund.

John Skukalek Wins University Niemeyer and Department Outstanding Graduate Awards

John Skukalek of Grand Rapids has captured not only the Outstanding Graduate Award, the mathematics department's highest honor for graduating seniors, but also the greatest honor bestowed upon undergraduates university-wide. The Glenn A. Niemeyer Award is given annually to just two Grand Valley students in recognition of their outstanding academic work, as well as for the ways they have enriched their peers' lives.

John has taken nearly every mathematics course our department offers; in addition, he spent the fall semester of 2003 at the prestigious MASS (Mathematics Advanced Study Semester) Program at Penn State. He intends to pursue a Ph.D. in graduate school starting this coming fall, and is currently choosing from among several outstanding programs.

During his time at GVSU, John has most enjoyed being able to interact

with professors who not only share his interest in mathematics, but also truly care about the quality of his learning. His favorite class was point-set topology with Professor Dickinson, for the subject helped him think more abstractly while "viewing different mathematical ideas through a single lens." He also liked the way the class challenged him to balance intuitive understanding with rigorous reasoning.

John hopes to one day be a college professor himself, engaged in both teaching and research, and aspires to write (understandable) math books for undergraduates. He leaves us this year with some pointed advice for fellow mathematics majors, posed in a sequence of (true) if-then statements: "If you are majoring in math and find yourself not enjoying your math courses, you might want to consider changing your major. If you're going



John Skukalek

to succeed as a math major you simply have to make it a personal concern of yours to ponder over ideas until you understand them. If you don't find math beautiful, you won't really learn it." And finally: "Memorize the quadratic formula before taking a class with Professor Fishback."

Student Awards 2004

On Monday, April 12, the department will honor its most outstanding students at its annual awards banquet. Here is a summary of the students who will be recognized:

Department Senior Awards: in recognition of outstanding overall work in the mathematics major.

Eric Andrews, Fruitport
Nicholas A. Brown, Grand Haven
Marcie Brink, West Olive
Heather Duffield, Caledonia
Nathan Immekus, Dryden
Nathan Meyer, Allegan
Kyle Meyers, Jenison
Laura Roede, Grand Rapids
John Skukalek, Grand Rapids

Outstanding Sophomore Award: to encourage continued study in mathematics and in recognition of outstanding work to date.

Nathanial Burch, Grand Rapids
Micah TerHaar, Wyoming

Department Scholarships: to support students financially through the Mathematics Endowment fund. These scholarships are awarded based on grade point average, letters of recommendation, a personal essay, and extracurricular mathematical activities.

Rebecca Bergeon, Jenison
Nathanial Burch, Grand Rapids
Janelle Lautzenheiser, Mason
Megan Llamas, Hazel Park
Kristina Lund, Highland
Tarah McCarthy, Grand Rapids
Christopher J. Smith, Grandville
Lisa Toth, Grand Haven

Miriam Schaefer Scholarship: awarded by the Michigan Council of Teachers of Mathematics to only five students statewide, for support of Michigan residents studying to be mathematics teachers at Michigan universities.

Joshua Brandsen, Hudsonville
Amanda Forslund, Marne

In addition, the department will this year induct thirty-eight students into the GVSU chapter of *Pi Mu Epsilon*, the national mathematics honor society.

Faculty in Focus

Originally from Hancock, Michigan, in the Upper Peninsula, **Amy Stone** completed her bachelor's degree at Michigan Tech and attended graduate school at Western Michigan University. When offered a graduate fellowship that required no teaching, Amy declined it since she wanted teaching always to be an important part of her professional life. After finishing her degree at Western in 1999, she came to Grand Valley where she is currently an affiliate faculty member. In contrast to her experiences at Tech and Western, where she describes the faculty as being primarily focused on research, Grand Valley attracted Amy with its belief that "undergraduates are important here."

Since joining the faculty, Amy has taught a wide variety of courses, from the remedial course Math 097 to the graduate level Math 645. She describes Math 201, the first course in the calculus sequence, as her "favorite class by far" since most of her students have not seen the material before in high school and the course contains the first really new ideas students see in college level mathematics. Also, she finds the students to be more keenly interested since it is often the first course they are taking in their major.

Amy likes to take advantage of this interest by creating engaging questions and interesting applications. For instance, the portfolio problems she creates allow students to investigate applications in considerably more depth. A recent portfolio featured an optimization problem whose main character was circumnavigating the globe in a lawn chair suspended by Hefty bags filled with helium. In Math 225, the introductory discrete mathematics course for computer science students, Amy introduces some ideas from logic using the classic scene "She's a witch" from the film *Monty Python and the Holy Grail*. Students typically recite the lines along with the movie characters.

Outside of her professional life, Amy describes herself as a "huge movie fan," preferring action and comedies to drama. She especially likes James Bond movies and gives Pierce Brosnan an enthusiastic review for his turn as the dashing spy. Lately, she is also investing more time in her creative writing.

Ed Aboufadel came to Grand Valley in 1995 after earning his bachelor's degree from Michigan State University and Ph.D. from Rutgers. Ed chose Grand Valley since he wished to be part of an institution that is committed to and encourages excellent teaching and recognizes the value of the use of technology in teaching mathematics. Currently an Associate Professor, he sums up his position with this assessment: "I feel like I'm average here and that's a good thing."

Ed especially enjoys teaching Math 203, the third course in the calculus sequence, for it is a course that benefits tremendously from the use of computers and the ability they give to visualize objects that are difficult to imagine otherwise. Another favorite course is Math 465, Automata and the Theory of Computation, because it is outside his area of expertise and thus challenges him to continually assimilate new ideas.

Learning new things is a challenge that Ed always finds particularly rewarding. While attending a conference in the early 90's, Ed became interested in the new subject of wavelets after hearing a talk on the F.B.I.'s use of wavelets in fingerprint analysis. After working for two or three years to learn the subject, Ed began introducing them as a substantive topic in Math 327, Linear Algebra II. The next year, his colleague Steve Schlicker began using and expanding on the materials Ed had created. It soon became clear that they had the raw materials for a book. The result is their successful "Discovering Wavelets," a text unique for its goal of introducing wavelets to an undergraduate audience.

During the past few summer REU programs, Ed has pursued his interest in wavelets with talented undergraduates from across the country. A recent idea of his is to use wavelets to break "captchas," pictures of words that have been distorted so that they may be read by humans but not computer programs (see www.captcha.net). Many online services use captchas to prevent malicious programmers from creating programs that, say, create multiple email accounts from which to send spam. Of course, it is useful to understand the weaknesses of using captchas in this way so Ed's group wrote a successful program, utilizing wavelets, that can read Holiday Inn's captchas more than 80% of the time and gimp-y-r, a benchmark set of captchas created at Carnegie Mellon, 43% of the time. This work illustrates Ed's curiosity and his desire to find things in the world around us that have a mathematical explanation.



Amy Stone



Ed Aboufadel

Longtime Department Member Phil Pratt Retires

Along with Alverna Champion and Ernie Palmer, Phil Pratt elected to retire this year. Phil had completed over 32 years of service to Grand Valley, including 8 years as chair of the Department of Mathematics and Statistics.

Phil attended Michigan State University for both his undergraduate and graduate degrees. In the fall of 1970, while still working on his dissertation, he began teaching at GVSU; he completed his Ph.D. in the spring of 1971. While Phil's graduate training was in complex analysis, he later gained expertise in newly emerging computer technology. In addition to being a leader in the development of new courses in computer science at Grand Valley, he began writing texts for a wide range of classes in this discipline: to date Phil has published approximately 50 books!

Phil says that he always enjoyed teaching a wide range of courses, but Math 325 (Discrete Mathematics for Computer Science) was probably his favorite. When asked about the best part of his Grand Valley career, Phil cites the many students he enjoyed working with, but particularly emphasizes "the wonderful faculty and staff that I had the chance to work with throughout my 30+ years."

In retirement he will continue working on a variety of book projects, as well as devote more time to his endeavors as a concert organist. Now residing in Florida, he and his wife Judy enjoy living in close proximity to their daughter, son-in-law, and grandchildren.

Alumnus in Focus: Nick Ceglarek '96, G'99

Few students have accomplished as much at Grand Valley (and after graduation) in the same short time as Nicholas Ceglarek. As an undergraduate, he played football for five years and distinguished himself an Academic All-Conference quarterback, a GVSU Scholar-Athlete of the Year, and even a Rhodes scholar candidate. As a mathematics major, he excelled in the classroom and also completed an undergraduate research project with Professor Fishback. Along with one other student, they studied the Fundamental Theorem of Calculus as it applied to some especially complicated functions.

Nick graduated magna cum laude in 1996 with a bachelor's degree in mathematics, secondary teaching certification, and minors in statistics and psychology. According to Nick, his experience at Grand Valley was "tremendous" and "every professor and class benefited [his] life in a positive way." While many different professors impressed him, he reports that in mathematics and statistics, instructors such as Drs. Jinn, Hong, Sundstrom, Hevia, and Fishback were particularly influential.

Upon receiving his undergraduate degree, Nick was hired as a high school mathematics teacher by the Rockford Public Schools. He quickly established himself and was soon teaching a wide range of courses, including algebra, geometry, and advanced placement calculus. Nick says the experience was "extraordinary" and that the "best part of teaching is the ability to positively impact the lives of children."

While teaching in Rockford, Nick continued his education at Grand Valley, earning a master's degree in educational leadership in 1999. About that time, a position as assistant principal and district assessment coordinator arose, one that took advantage of his expertise in both statistics and assessment. While he would miss some of the one-on-one impact with students in his own classes, Nick saw this as a chance to reach an even greater number of students through "building a school climate of respect, developing programs, and serving students and staff."

A few years later (at just 29 years of age), he had the good fortune to be offered his current job as the superintendent of Baldwin Community schools, a position that emphasizes assessment and school improvement. While his job has many challenges, Nick says he is especially thankful for the mentoring role his mother plays in his life, for she is also a superintendent (in another district), and provides advice and guidance throughout his life and career.

Nick says that his education has prepared him exceptionally well for his current position. "Grand Valley instilled and fostered a way of thinking, not just establishing a knowledge base." Moreover, a "mathematics degree helps strengthen an analytical approach to leadership. When a situation occurs, a logical progression of thought follows. The process fostered in many mathematics classes assists me in my daily operations." He also speaks fondly of how his athletic and academic experiences developed his understanding of teamwork and collaboration with others.

Even amidst the busy times of his current job, Nick has continued his education. He is just 9 dissertation credits shy of earning his doctorate in educational leadership through a joint EMU/GVSU program and should finish the program in 2005. Nick stands as a shining example of one who has taken advantage of so much of what Grand Valley offers and who, consequently, has made a significant impact on the world around him.



Nick Ceglarek with students

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**A newsletter for alumni, students, faculty, and friends of the
Grand Valley State University Department of Mathematics**



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