Department of Mathematics May 2, 2008

UNDERGRADUATE MATHEMATICS SEMINAR

The next seminar will be this coming **Monday, May 5th,** with refreshments beginning at **4:00** in the Math Common Room, **Bailey 204**, and the lecture following at **4:15** in **Bailey 207**.

In this seminar, former Union College mathematics department member and current Professor of Mathematics and Computer Science at Widener University in Chester, PA, **Professor Janusz Lysco** will deliver the talk described below. If you are interested in joining Professor Lysco and others for dinner afterward, please gather in the Common Room after his talk.

TITLE: Aspects of Continuum Theory

ABSTRACT: We will discuss some aspects of continuum theory, with particular emphasis on continua that were discovered and studied by Polish mathematicians at the beginning of the last century. A continuum is a mathematical space that resembles the real number line in certain respects, but that can be quite different from the real numbers in some interesting ways.

Pieces From Theses: A View from Steve Cohen ('08)

Hello, I am senior Steve Cohen. During my four years with the math department here at Union College, I have learned many things, and discovered a new appreciation for advanced mathematics. In high school, I enjoyed math simply because it was one of the few subjects I was good at. However, now that I am in college and have taken many upper level math classes, I have a greater respect, appreciation, and get much more enjoyment out of the subject. The difference between high school and upper level college courses in my opinion is that in high school, you learn a formula and apply it to repetitive problems. In college, however, you derive your own formula and prove that it will work for every problem…forever!

Working on a thesis is no exception. Instead of having the teacher guide their students through a course, thesis was much more open-ended. I was able to pick what topic I wanted to study and how I wanted to study it. It was fun having this new sense of freedom. Further, it was very enjoyable to talk to my thesis advisor, Paul Friedman, about higher-level mathematics that one would probably see in graduate courses. The whole thesis experience was very enjoyable for me, and I feel I have matured an immeasurable amount as a mathematician as a consequence.

My thesis expanded upon a very old number theory question: Can a person with finite step-size reach infinity while walking on the number line and stepping only on primes? The answer to this question turns out to be no. To prove that this is impossible for a walker with step-size k, one need only provide a string of k consecutive composites. We can see that $(k + 1)! + 2$, $(k + 1)! + 3$, … $(k + 1)! + (k + 1)$ is, in fact, a string of k consecutive composites as desired.

To expand upon this problem, what if the walker is now in a plane instead of on a number line? The first thing one must do to answer this question is define how we will view the plane. Since we are talking about primes, we must have multiplication. Therefore, we will view the plane as the complex plane. That way, we have multiplication as desired. Next, we were talking about integers, so in the plane we will look at only the integer points of the complex plane, or Gaussian integers. Lastly, we must define what a prime Gaussian integer is. The first term of my thesis was dedicated to classifying which Gaussian integers are prime and to studying factorization in the (cont. p2)

Gaussian integers.

The last term of my thesis was dedicated to learning proofs of results that provide partial solutions to the following question: Can someone with a finite step-size walk to infinity while stepping only on Gaussian primes? This question was first asked by Basil Gordon in 1962 and remains unsolved. I explored a proof of a theorem by Gethner, Wagon, and Wick that stated if we restrict the walker to any line on the plane, he will not be able to reach infinity. Next, I learned proofs by Loh that stated we can confine the walker to a sector of the plane, and not just a line, and show that he still will not be able to reach infinity. Loh then had another theorem that stated a set of the union of a bunch of these sectors can be found such that no walk to infinity is possible on the set. It can then be shown that this set is arbitrarily close to the entire plane.

While I did not answer Gordon's question, I did learn of proofs that provide evidence that the answer is no. Also, it was very enjoyable studying upper-level mathematics and how mathematicians approach problems when the original question is quite complex.

Putnam Exam and MCM Results Are in!

As the faithful newsletter might remember, this past December six Union students sat for a national collegiate mathematics competition known as the Putnam Exam. (See the February 15th issue of the newsletter for participant Susan Beckhardt's commentary on the contest.) The Putnam Exam consists of twelve 10-point problems. In all, 3753 students took this *challenging* exam, and the median score was … 2 points! The Union squad did exceptionally well, especially **Susan Beckhardt** and **Richie Bonventre**, both of whom scored in the top 25% of all participants. Congratulations team!

In February, **Shawn Bartok, Richie Bonventre,** and **Steven Neier** worked as a team in this year's Mathematical Contest in Modeling (MCM), competing against over 1100 teams from around the world. (See the March 7th issue of the newsletter for Steven Neier's commentary on the contest.) Over a long weekend, they devised a model for the impact of the melting of the polar cap on the Florida coast. Their solution was judged to be one of the **TOP 15** of the more than 500 that addressed this problem, earning the designation of "Meritorious". Well done!!

Problem of the Newsletter: May 2, 2008

Congratulations to **Schuyler Smith** for his solution to last week's problem, with a special "thank you" to **Susan Beckhardt** for baking the cookies in last week's problem. You can view a winning solution on the bulletin boards in Bailey Hall.

Here is this week's problem: Given circles of radius R1 and R2 connected by tangential segments as in the picture, find the total length of the segments and the two major arcs they subtend. Express your answer in terms of A, the sum of the radii.

Professor Friedman will accept solutions until 12:00 noon Thursday, May 8th. Email your solution to him (friedmap@union.edu) or put it in his mailbox in the Math Department's office.

REMINDERS!

- JUNIOR MATH MAJORS: Your Mathematics Thesis Application Form on which you list your preferred thesis topics is **due today!**
- Academic advising for fall term course selection begins next week, and petitioning begins next weekend, May 10th.