Department of Mathematics September 26, 2008

UNDERGRADUATE MATHEMATICS SEMINAR

The next seminar of this term will be this coming **TUESDAY, September 30nd.** Refreshments will be served at **4:30** in the **Math Common Room**, **Bailey 204**, with the seminar beginning at **4:45** in **Bailey 207**.

In the seminar, **Professor V. Frederick Rickey** from the Department of Mathematical Sciences at the **United States Military Academy** will be delivering the following talk.

TITLE: Professor Ferdinand Hassler of West Point and Union College

ABSTRACT: Ferdinand Hassler (1770-1843) was a remarkable individual. He learned surveying in his native Switzerland before coming to the United States with his remarkable library. He taught mathematics at the United States Military Academy from 1807 to 1809 and while teaching started to write the first analytic trigonometry book published in the U.S. Then he taught at Union College for a year. From 1815 to 1817 and also from 1832 to 1843 he was Superintendent of the U.S. Coast Survey. His scientific work was very important in the development of the United States. In addition to his scientific accomplishments, he was a colorful and idiosyncratic individual. In closing we will identify his great-great-grandson.

Record-Setting Largest-Known Prime Discovered!
$100,000 Prize to Be Awarded

The Great Internet Mersenne Prime Search (GIMPS) announced that the 45th and 46th known "Mersenne Primes" were discovered on August 23rd and September 6th, respectively, of this year. Verification of these discoveries has been completed just recently.

From www.mersenne.org: "On August 23rd, a UCLA computer discovered the 45th known Mersenne prime, $2^{43,112,609}$-1, a mammoth 12,978,189 digit number! The prime number qualifies for the Electronic Frontier Foundation's $100,000 award for discovery of the first 10-million-digit prime number. Congratulations to Edson Smith, who was responsible for installing and maintaining the GIMPS software on the UCLA Mathematics Department's computers.

"On September 6th, the 46th known Mersenne prime, $2^{37,156,667}$-1, a 11,185,272 digit number was found by Hans-Michael Elvenich in Langenfeld near Cologne, Germany! This was the first Mersenne prime to be discovered out of order since Colquitt and Welsh discovered $2^{110,503}$-1 in 1988.

"The nearly decade long quest for the EFF award came down to a close race to the finish - with just two weeks separating the discovery of the two primes.

"As promised, GIMPS will give $50,000 of the EFF award to the UCLA Mathematics Department for discovering the first 10 million digit prime. $25,000 will go to charity, and most of the remainder will go to discoverers of the previous six Mersenne primes."

The software used to find these numbers is **free to download**, available at www.mersenne.org. Perhaps you will win the next prize offered by the EFF: **$150,000 for the first 100-million digit.**

Who Was Mersenne? What is a Mersenne Prime? Here's a Primer!

Marin Mersenne (1588-1648) was a French monk and number theorist. According to Howard Eves' "Introduction to the History of Mathematics", "[H]e maintained a constant correspondence with the greatest mathematicians of his day and served admirably, in those pre-journal times, as a clearinghouse from mathematical ideas. He edited the works of many of the Greek mathematicians and wrote on a variety of subjects."

Marin Mersenne

A Mersenne number is one of the form $M_k = 2^k - 1$ for some integer k. Mersenne numbers that are prime are called *Mersenne primes.* For example, 2^3-1=7 is a Mersenne prime, and 2^4-1=15 is a Mersenne number, though not a Mersenne prime. THIS WEEK's PON asks you to show that if k is composite then M_k is also composite. Thus, in the search for Mersenne primes, it is enough to consider only those M_k with k prime. Mersenne primes are then denoted M_p where p is prime.

It is believed that Mersenne primes were first studied due to their link to *perfect numbers*, that is, numbers that are equal to the sum of their proper divisors. Theorems of Euclid and Euler show that even perfect numbers are in *one-to-one correspondence* with Mersenne primes (with $M_p(M_p+1)/2$ being perfect). Therefore, the discovery of the 45th and 46th known Mersenne primes also means that we now know of the existence of exactly 46 even perfect numbers. (NB: There are no known odd perfect numbers!)

If you want to see all the digits of the 45th (the larger of the two recently discovered) Mersenne prime, $2^{43,112,609}$-1, go to http://prime.isthe.com/chongo/tech/math/prime/m43112609/prime-c.html and follow the links there.

Back Issues of the Math Newsletter Are Available Online Through the Math Department's Website:

www.math.union.edu

Calculus Midterm Approaching?

- Free tutoring! The Math Department offers a free tutoring service for students enrolled in its calculus courses through Math 115. The Calculus Help Center is open five nights a week, Sunday through Thursday, from 7:30pm to 10:00pm in the seminar room of Sorum House.

Problem of the Newsletter

Unfortunately, no one submitted a correct solution to last week's problem. We will leave it as an open problem, and will (likely) post a solution to it at the end of this term.

Here is this week's problem: As in the article above, show that if k is composite then $M_k = 2^k - 1$ is also composite. Additionally, try to prove that $2^{43,112,609}$-1 does, in fact, have 12,978,189 digits.

Solutions to this problem should be submitted to Professor Friedman by Noon on Thursday, October 2nd, either by email (to friedmap@union.edu) or to his mailbox in the Math Department office on the second floor of Bailey Hall.