

# Goodseal Gazette

Carleton College  
Northfield MN 55057

The newsletter for the Carleton mathematics and statistics community

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Editors: Max Bearak and Deanna Haunsperger; Problems of the Week: Mark Krusemeyer; Subscriptions and Web: Sue Jandro

## Two Talks You Don't Want to Miss!

### *How Can Mathematics Predict the Transmission of HIV?*

**S**teve Pankavich, US Naval Academy,  
Tuesday, January 31, 4-5 pm in CMC 206.

*Recently, mathematics has been used in interesting and surprising ways by medical researchers to study viruses, such as HIV. In this talk, we will use information about how HIV replicates in order to model the growth or decay of a virus population within the human body. Then, with the help of some Calculus and Linear Algebra, we will be able to exactly determine what conditions lead to the HIV virus dying out and what conditions allow the virus to persist.*

### *Prime Divisors and Recurrence Sequences*

**R**afe Jones, Holy Cross College,  
Thursday, February 2, 4-5 pm in CMC 206.

*In the middle ages, Leonardo Fibonacci got inspired by growing rabbit populations (or idealized versions thereof) and popularized the sequence that now bears his name:*

1, 1, 2, 3, 5, 8, 13, 21,...

*This sequence obeys the recurrence relation*

$$F_n = F_{n-1} + F_{n-2}$$

*where the  $n^{\text{th}}$  Fibonacci number  $F_n$  represents the rabbit population at the  $n^{\text{th}}$  generation. A recurrence sequence is one given by a recursive*

*formula such as this, and I will discuss many examples.*

*A question whose answer has eluded mathematicians throughout the centuries since Fibonacci lived is: for how many  $n$  is  $F_n$  prime? I have discovered a truly marvelous answer, which this abstract is too narrow to contain. OK, so that's not really true (apologies to Pierre de Fermat). However, I will give some results that measure "how prime" the terms are for various recurrence sequences, including some non-linear examples coming from dynamics. More precisely, I'll consider the set of primes dividing at least one term of the sequence; if this set is sparse in the set of all primes, then in some sense the terms are close to being prime. If time permits, I'll speak more broadly about the field of arithmetic dynamics, and state the best-known conjecture in the field.*

### *Kolenkow Reitz Fund For Undergraduate Research*

**C**reated by a donor, and honoring Carleton former professors Kolenkow and Reitz, the fund supports student research. Up to ten students in the natural sciences and mathematics will be supported summer break 2012, with each student receiving funds not to exceed \$4200. If interested, submit an application by Feb 16 identifying a sponsor at another institution, a brief description of research plans with your specific role, and a budget paragraph justifying requested funds. Decisions about funding will be made before Spring Break. More information and the online application form can be found at: <http://serc.carleton.edu/cismi/KolenkowReitz.html>.

*Summer Research/Classes:  
Deadlines Approaching!*

**Institution:** Institute for Computational and Experimental Research in Mathematics (ICERM – Brown University, Providence, RI)

**Research field:** Open questions in geometry and dynamical systems of geometric origin

**Dates:** June 18 – August 10, 2012

**Benefits:** \$3000 stipend, all travel, room and board reimbursed

**Website and deadline:** Application is due by February 10<sup>th</sup>, and can be found at <http://www.mathprograms.org/db/ICERM>

**Institution:** Park City Mathematics Insitutute (Park City, UT)

**Research field:** Geometric Group Theory

**Dates:** July 1 -21, 2012

**Benefits:** Two courses worth of credit; financial aid is available.

**Website and deadline:** Application is due January 31<sup>st</sup>, and can be found at <http://pcmi.ias.edu>.

**Institution:** Valparaiso University – Valparaiso Experience in Research by Undergraduate Mathematicians (VERUM)

**Research field:** Quandles and Generalized Colorings of Knots; Vertical Transmission in Two-Sex Epidemic Models with Reproduction Isolation; Generalized Pattern Avoidance in Trees

**Dates:** May 30 – July 31, 2012

**Benefits:** \$4050 stipend and partial travel reimbursements to Valparaiso and the Joint Meetings in San Diego next January

**Website and deadline:** Application is due Feb. 27<sup>th</sup> and can be found at [valpo.edu/mcs/verum](http://valpo.edu/mcs/verum).

**Institution:** Oregon State University

**Research field:** Pure and applied mathematics

**Dates:** June 25 – August 17, 2012

**Benefits:** \$4390 stipend, travel and housing allowance, and tuition and fees for 12-credit senior level course

**Website and deadline:** Application is due Feb. 22<sup>nd</sup>, and can be found at [www.math.oregonstate.edu/~math\\_reu/](http://www.math.oregonstate.edu/~math_reu/)

*The Tour Goes On...*

Next week (Friday, February 3, 3:30 PM, CMC 206), Stephen Kennedy will speak on “The Problem with Apportionment.” (Bob Dobrow's topic this week is “Random Walk, Gambler’s Ruin, and the Cover Time Problem.”)

**PROBLEMS OF THE WEEK**

1. What is the least positive integer  $n$  such that the decimal expansion of  $\frac{1}{n}$  is eventually periodic with (smallest) period 12,
- if  $n$  is not required to be a prime and
  - if  $n$  is required to be a prime?
- (For example, for  $\frac{1}{7}$ , the decimal expansion

$$\frac{1}{7} = 0.\overline{142857} = 0.142857142857\dots$$

is periodic with period 6.)

2. Find

$$\lim_{n \rightarrow \infty} \int_0^{\infty} \frac{n \cos(\sqrt[4]{x/n^2})}{1 + n^2 x^2} dx .$$

(Warning: Don’t take anything about the limit and the integral sign for granted.)

It’s a pleasure to report a good week for solutions (and for snow). Last week’s first problem was solved by Dylan Peifer; the second problem was solved both by Dylan and by Justin Troyka. John Snyder (in Oconomowoc) also solved both problems. Dylan and Justin should each stop by CMC 217 some time to pick up a B.B.O.P. item. Keep up the good work, problem solvers!

- Mark Krusemeyer