L'Augarithms

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Mathematics Colloquium Spring Lineup

Colloquia are typically held Wednesdays 3:40—4:40 in Oren 113.Highly sought-after refreshments are served.

Jan.	19	Infinite Secrets: The Genius of Archimedes
Feb.	2	Ken Kaminsky, Augsburg College
	16	Loren Larson, St. Olaf College
	23	Nancy Steblay, Augsburg College
Mar.	2	Jiang-Ping Chen, St. Cloud State
	23	Alicia Johnson, Macalester College
Apr. →	6	Doug Dokken, University of St. Thomas[1]
	20	Talks by Students
	26	Special colloquium by Kevin Sanft ('02)[2]

[1]This week's colloquium

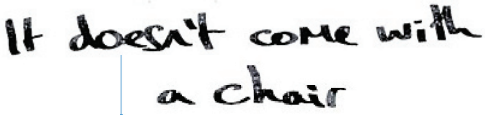
Investigation of Power Laws Associated with Strong Tornados

by Professor Doug Dokken, University of St. Thomas

(*Continued on other side*)

Best School Humor

This came under the heading: How to fail a test with dignity: *Joanna works in an office. Her computer is a stand-alone system What is a stand-alone computer system?*



Best Church Bulletin Humor

The following announcement appeared in a church bulletin, or was announced at a church service:

The Priest will preach his farewell message after which the choir will sing "Break Forth Into Joy."

The Caption Contest

The caption contest has ended, many fine captions having been submitted. But the Caption Contest Judging Committee (CCJC) is deadlocked, and had reached a final decision at the time this *L'Augarithms* was put to bed. We hope to be able announce the winner in our next issue. The CCJC has been sequestered until such time as they can come to a decision. In the meantime, adjuncts will be covering their classes.

Problem of the week...

There were no solvers of the POTW from vol. 24.10. The correct minimum surface area was 700 ft^2 which fit in a 5 x 10 x 20 foot box.

A diagonal in a convex polygon is a line joining two non-adjacent vertices. Take an n-sided convex polygon and draw all possible diagonals. Suppose that in doing so no three diagonals ever intersect at a common interior point. How many different regions are the interior of the polygon?

❖ Reprinted with permission from Bradley U's old 'POTW' page <http://hilltop.bradley.edu/%7Edelgado/potw/potw.html>

Puzzle of the week...

Erik Grindal and **Adolfo Jochim** solved PZOTW from vol 24.10. They found that the second car overtook the first after 1 hour and 40 minutes, 150 miles from Hamburg. Now, the new PZOTW:

Is it possible to hold on to both ends of a single length of unknotted rope and tie a knot in the rope without letting go of either end? Please resolve the question one way or the other.

❖Submit POTW & POZTW solutions to kaminsky @augsburg.edu, or under Ken's door at SCI 137E, or in the puzzles and problems box just outside of Su's office.

L'Augarithms
The approximately bi-weekly newsletter
of the
Department of Mathematics
at Augsburg College
Editor.....Kenneth Kaminsky
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[1]Investigation of Power Laws Associated with Strong Tornados

by Prof. Doug Dokken, Univ. of St. Thomas

Doug Dokken

Case studies ([1], [6]) have indicated that there may be values of exponent b of the radius r in the formula $\zeta \propto r^{-b}$ described below) that are strongly correlated with thresholds of tornadic activity. For tornadic thunderstorms one can estimate the relationship between vorticity and the length scale using Doppler radar data. In a recent study, Cai [1] defines the pseudovorticity by ζ = DV/L, where DV is the difference between the maximum and minimum radial velocity of the mesocyclone and L is the distance between them. Cai filtered the radar data and interpolated the data to the several to scales from 0.3km to 9.6km. Let ε be a scale the data is filtered to. From the interpolated data he obtained data points $(\ln(\varepsilon), \ln(\zeta))$, plotted the points, and found the best linear fit. Cai's study comparing mobile Doppler radar data from tornadic and non-tornadic storms indicates that steeper slopes (smaller negative values) are indicative of tornadic storms. As those mesocyclones that produced tornados become stronger, approaching tornadogenesis, the slope of the line decreased (became steeper). Cai found the threshold for strong tornados was slope m = -1.6. For tornadic mesocyclones, this suggests a power law of the form, $\zeta \propto r^{-b}$, where r is the radius of the vortex. It has been observed that the exponent can be thought of as a measure of a fractal dimension associated with the vortex. For high-resolution mobile Doppler radar data, there has been some attempt to interpret this as a giving a power law for the drop off of the velocity as a function of radius of the vortex. Recent studies of radar data [4] and numerical simulations [5] have produced arching vortex lines in the rear flank of supercell storms. As more and more vortex lines are produced in this region, viscous interactions between neighboring vortex lines would lead to mergers and an increase in the dimension of the vortex [2]. This should also lead to a strengthening of the vortex and increase in the vorticity as well. We give a heuristic argument to support the power law for strong tornados, $\zeta \propto r^{-1.6}$.

[1] H. Cai, Monthly Weather Review 133 (2005), 2535–2551.

[2] A. J. Chorin, Vorticity and Turbulence, Springer, New York (1994)

[3] D.C. Dowel and H.B. Bluestein, 2002: The 8 of June 1995 McLean Storm. Part II: Cyclic Tornado formation, maintenance and dissipation. Mon. Wea. Rev.,130, 2649-2670.

[4]Markowski, P. M., J. M. Straka, E. N. Rasmussen, R. P. Davies-Jones, Y. Richardson, and J. Trapp, 2008: Vortex lines within low-level mesocyclones obtained from pseudo-dual-Doppler radar observations. Monthly Weather Review, 136, 3513–3535.

[5]Straka, J. M., E. N. Rasmussen, R. P. Davies-Jones, and P. M. Markowski, 2007: An observational and idealized numerical examination of low-level counter-rotating vortices toward the rear flank of supercells. Electronic Journal of Severe Storms Meteorology, 2(8), 1–22.

[6] Wurman, J., and S. Gill, 2000: Finescale radar observations of the Dimmitt, Texas (2 June 1995), tornado. Mon. Wea. Rev., 128, 2135-2164.

St. Thomas takes Math Jeopardy title

On April 1st, Augsburg hosted the first annual **Math Jeopardy Contest**. Teams from Augsburg, St. Thomas, and Macalester competed in a thrilling three-way match with St. Thomas coming from behind to take the prize. Augsburg held the lead through the first round and into the second round, when St. Thomas suddenly caught fire. All three teams made laudable showings, and all were in the running when double jeopardy ended and it was time for final jeopardy. Here is the final jeopardy question :

Jill's father looked at the money on the table. "You've quite a lot there," he remarked. "I found two dollars on the sidewalk," the girl explained. Her father laughed. "You were lucky. Now you've got five times as much as you'd have had if you lost two bucks." How much did Jill have before her lucky fine?

The standings at the end of Double Jeopardy stood at St. Thomas: 5,400; Augsburg: 4,500; and Macalester: 3,800 points. In Final Jeopardy, Macalester bet all their points, but missed the question, while both Augsburg and St. Thomas answered the question correctly. With their lead going in, and a larger bet, St. Thomas took the day.

See pictures of Math Jeopardy at the department website:

<augsburg.edu/math/>