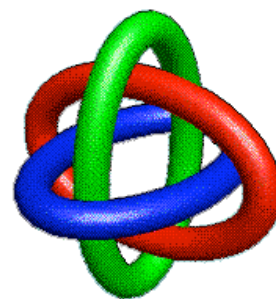


TCU MATH NEWSLETTER



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April 2008
Volume 16, Number 6

Everything of importance has been said before by somebody who did not discover it.

--- Alfred North Whitehead

TCU Calculus Bee Winners

The annual TCU Mathematics Department Calculus Bee was held on Tuesday, April 8. Twenty-two TCU undergraduates competed in the bee. The place winners this year were all mathematics majors. The first place winner was Darren Ong. Second place went to John Lagrone, and third place to Thanh Huynh.

Mathematics Majors Invited to Join Phi Beta Kappa

Three TCU mathematics majors were invited to join the prestigious national honor society Phi Beta Kappa. Thomas Sheffield, a junior, was invited along with seniors Anna Wilhelm and Libby Woolverton. They will be initiated into membership on May 9.

Keith Hayton Named Mathematics Senior Scholar

Keith Hayton was selected as the 2008 Mathematics Department Senior Scholar. The winner of this award is selected by the Mathematics Department Faculty. The award will be presented to Keith at the TCU Honors Banquet on April 17.

TCU Student Research Symposium on April 18

The fourth annual TCU Student Research Symposium will be held in the Tucker Technology Center on Friday, April 18. In the symposium, students from the TCU College of Science and Engineering present their research in poster displays throughout the building. The symposium will also include a keynote speaker, Andree Griffin, Manager of Geology for Fort Worth Basin XTO Energy. Ms. Griffin will present the talk *Urban Horizontal Drilling in the Barnett Shale* at 4:30 p.m. in Sid W. Richardson Lecture Hall 1.

Problems and Solutions

Solution to the March 2008 Problem of the Month

Problem: A 3-by-3 matrix has nonnegative real entries and columns summing to 2. Show that one can always choose 3 entries, with one entry from each row and one entry from each column, whose sum is between 1 and 3, inclusive. (Due to Bill Sands.)

Solution: Let a_{ij} be the ij th entry of the matrix. There are six ways to choose one entry from each row and each column, hence six possible sums. These six sums are not changed if we permute the rows or the columns of the matrix. Thus, we may assume the maximum sum is $a_{11} + a_{22} + a_{33}$ and that $a_{11} \geq a_{22} \geq a_{33}$. Furthermore,

$$a_{11} + a_{22} + a_{33} \geq [(a_{11} + a_{22} + a_{33}) + (a_{12} + a_{23} + a_{31}) + (a_{13} + a_{21} + a_{32})]/3 = 6/3 = 2.$$

The TCU Math Newsletter is published each month during the academic year.

Editor:
[Rhonda Hatcher](#)

Problem Editor:
[George Gilbert](#)

**Thought of the
Month
Editor:**
Robert Doran

Therefore, we are done unless $a_{11} + a_{22} + a_{33} > 3$. In fact, if $3 < a_{11} + a_{22} + a_{33} \leq 4$, then

$$2 \leq (a_{12} + a_{23} + a_{31}) + (a_{13} + a_{21} + a_{32}) < 3,$$

so that the larger of $a_{12} + a_{23} + a_{31}$ and $a_{13} + a_{21} + a_{32}$ is at least 1 and less than 3. If

$$a_{11} + a_{22} + a_{33} > 4,$$

then $4/3 < a_{11} \leq 2$, $a_{22} + a_{33} > 2$, and

$$4/3 < a_{11} + a_{23} + a_{32} \leq 2 + (2 - a_{22}) + (2 - a_{33}) < 4.$$

Arguing as above, one of $a_{11} + a_{23} + a_{32}$, $a_{12} + a_{21} + a_{33}$, and $a_{13} + a_{22} + a_{31}$ must be between 1 and 3.

The March Problem of the Month was solved by undergraduate Darren Ong.

April 2008 Problem of the Month

Find all values of b for which the parabola $y = x^2 + b$ is tangent to the unit circle.

Students and others are invited to submit solutions to Dr. George Gilbert by e-mail (g.gilbert@tcu.edu) or hard copy (Math Dept. Office or TCU Box 298900). Correct solutions submitted by persons who are not members of the TCU math faculty will be acknowledged in the next issue of the newsletter. Note that a correct solution is an answer and a justification of its correctness. The solution to the problem will be published in the next edition of the newsletter.