TCU Math Newsletter

It is my experience that proofs involving matrices can be shortened by 50% if one throws the matrices out.

> – Emil Artin,
>   A leading mathematician
>   of the twentieth century
>   (from his book Geometric Algebra, p. 14)

Calculus Bee on Monday, April 9

The annual TCU Mathematics Department Calculus Bee will be held on Monday, April 9 at 3:30 pm in Tucker Technology Center 245. The material covered is Calculus I and II, but not beyond the material that current Calculus II students have had. There will be refreshments for contestants in TUC 300 between 3:00 pm and 3:30 pm. All TCU undergraduates are eligible to compete. TCU bookstore gift cards will be awarded to the top three finishers, with $75 for first place, $50 for second place, and $25 for third place.

TCU Colloquium Series Talk on April 13

Professor Brian Rainies of Baylor University will present the next talk in Frank Stones Colloquium Series. The talk, "Chain Transitivity and Ramsey Shadowing," will be on Friday, April 13 at 3:30-4:30 pm in TUC 245. Students, faculty, and members of the community are invited to attend the talk and enjoy refreshments served in TUC 300 during the half hour before the talk.

Math Majors Honored

Thinh Doan has been named the 2018 TCU Mathematics Department Senior Scholar. The winner of the award is determined by a vote of the Mathematics Department Faculty.

Math majors Luke Beasley, Peter Doré, Clare McGrady, Talha Mushtaq, Kelli Pedersen, and Thu Pham will be initiated into the mathematics honor society Pi Mu Epsilon later this month. Math majors Harrison Chao, Thinh Doan, Lindsey Elliott, Linh Nguyen, Luke Reddick, and Gunnar Roadfeldt were previously inducted.

Senior math majors Thinh Doan and Linh Nguyen and junior math major Wellington Owen will be initiated into membership in Phi Beta Kappa this May. Math majors Dylan Barth and Gunnar Roadfeldt and math minor Hannah Richstein were initiated into Phi Beta Kappa last year as juniors.

Congratulations to all of these students on their achievements.

Math Majors to Education Investment Fund Story

TCU undergraduate math majors Dominic Micheli, Kelli Pedersen, and Stephen Olivier have been named fund managers for the Educational Investment Fund (EIF). The EIF is $1.4 million portfolio managed by a very select group of TCU graduate and undergraduate students.
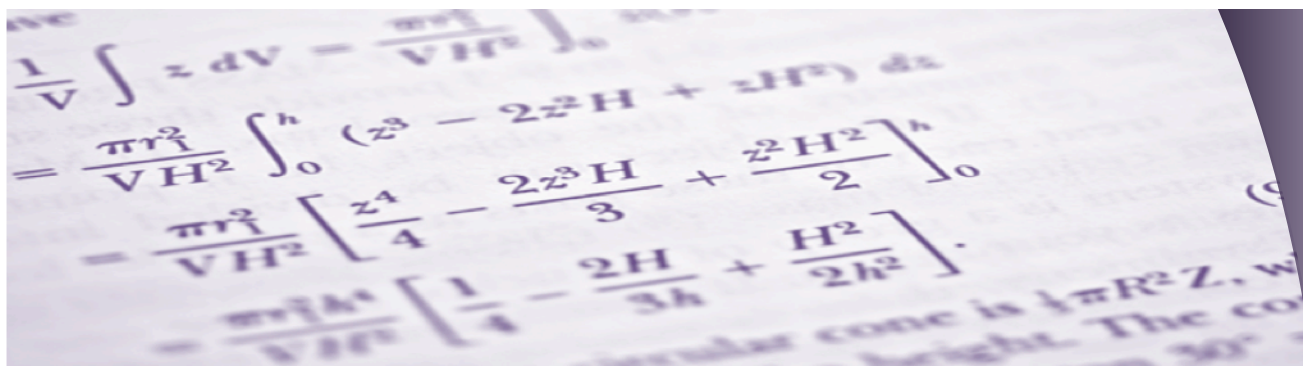
Solution to the March 2018 Problem of the Month

Problem: Consider the sequences defined by $a_0 = 1$, $a_{n+1} = 2a_n + 1$, for integers $n \geq 0$, and b_0 real, $b_{n+1} = 2b_n - 1$, for integers $n \geq 0$. For what values of b_0 will $b_n > a_n$ hold for all nonnegative integers n?

Solution: The inequality holds for all n if and only if $b_0 \geq 3$.

We have
$$a_{n+1} + 1 = 2(a_n + 1) = \cdots = 2^{n+1}(a_0 + 1) = 2^{n+2},$$
so $a_n = 2^{n+1} - 1$. Similarly,
$$b_{n+1} - 1 = 2(b_n - 1) = \cdots = 2^{n+1}(b_0 - 1),$$
and $b_n = (b_0 - 1)2^n + 1$. Therefore, $b_n > a_n$ if and only if
$$(b_0 - 3)2^n + 2 > 0.$$
Inequality for large n implies $b_0 \geq 3$, in which case the inequality clearly holds for all n.

This month's problem was solved by Brad Beadle ('96), Roger and Peter Bevan, and the SUNY Fredonia Math Club.

April 2018 Problem of the Month

Because April is the month of our Calculus Bee, we have a calculus problem, albeit one that is too involved for the Bee. For what $b > 0$ is $xb^{-1/x} - x + 1 > 0$ for all $x > 0$?

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.