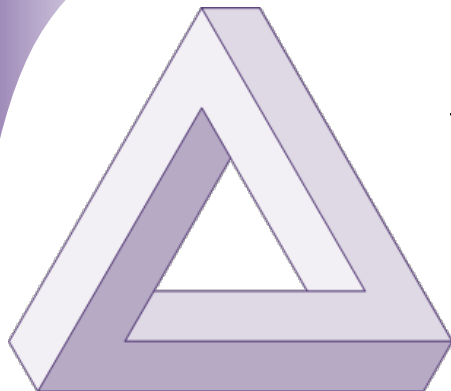


# TCU Math Newsletter



*A mistake is only an error, it becomes a mistake when you fail to correct it.*

*- John Lennon*

## **Presentations by Green Honors Chair Dr. Sommer Gentry on February 24 -26**

Dr. Sommer Gentry, Professor of Mathematics at the United States Naval Academy, will be visiting TCU as a Green Honors Chair on February 22-24. Dr. Gentry is also a Research Associate at Johns Hopkins University School of Medicine and a Senior Investigator at the U.S. Scientific Registry for Transplant Recipients.



On Monday, February 24, 3:30-4:30 pm, Dr. Gentry will present a lecture for students entitled "The Size of Infinity" in RJH 112. On the evening of February 24 at 6:30-8:00 pm, she will present a public lecture "Faster, Safer, Healthier with Operations Research" in PAL 130. On Tuesday, February 25 at 3:30- 5:00 pm Dr. Gentry will lead a career panel in RJH 112 followed by a workshop at 5:00-6:30 pm on "Superhuman Counting" in RJH 211. On the last day of her visit to TCU, Dr. Gentry will present the colloquium talk "Models that Matter; Making Organ Allocation Fair" in TUC 243 at 1:00-2:00 pm.

All TCU students, faculty, and staff and members of the public are invited to attend these events.

## **NSF Research Experience for Undergraduates Summer 2020 Programs**

The National Science Foundation (NSF) funds summer research opportunities for mathematics undergraduate students through 58 REU Sites across the country. Students are granted stipends and, in most cases, housing and a travel allowance.

A list of Mathematics REU sites where you can find details about the individual programs and the application processes can be found at

[http://www.nsf.gov/crssprgm/reu/list\\_result.jsp?unitid=5044](http://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5044).

## **2020 TCU Student Research Symposium (SRS) Workshops, Poster Software Demo, and Abstract Deadline**

TCU College of Science and Engineering undergraduate and graduate students are invited to display their research on a poster at the Student Research Symposium (SRS). The deadline for submitting an SRS poster abstract is Friday, February 28, 2020. The poster electronic submission deadline is March 29, 2020. There will be a poster software demo at 3-4 pm on February 14 in SWR 237. There will also be two workshops on how to make and print the posters at 3-4 pm in SWR 237 on February 21 and February 28. More information about SRS can be found at <https://srs.tcu.edu>.



## Solution to the November 2019 Problem of the Month

**Problem:** Let  $a_0 \leq b_0 \leq c_0$  be real numbers. From  $a_n \leq b_n \leq c_n$ , replace either  $a_n$  or  $c_n$  with the average of the three numbers and sort them obtaining three numbers satisfying  $a_{n+1} \leq b_{n+1} \leq c_{n+1}$ . Will the sequences  $(a_n), (b_n), (c_n)$  always converge?

**Solution:** Yes, all three must all converge to the same real number. First observe that  $c_{n+1} - a_{n+1} \leq c_n - a_n$ . Furthermore, if we replace the furthest number from  $b_n$ , we must have  $c_{n+1} - a_{n+1} \leq (c_n - a_n)/2$ . If we do this infinitely often, the width of the interval  $[a_n, c_n] \subset [a_{n-1}, c_{n-1}]$  goes to 0, proving the claim. If we replace the furthest from  $b_n$  only finitely often, we may assume we have reached an  $n$  where we never do. Replacing  $a_n, b_n, c_n$  with  $-c_n, -b_n, -a_n$  if necessary, we may assume  $b_n$  is closest to  $a_n$ , i.e.  $b_n \leq (a_n + c_n)/2$ , so that we replace  $a_n$ . We have

$$c_{n+1} = c_n, \quad a_{n+1} = b_n, \quad b_{n+1} = \frac{a_n + b_n + c_n}{3} \leq \frac{a_{n+1} + c_{n+1}}{2}.$$

We see that

$$c_{n+2} - a_{n+2} = c_n - \frac{a_n + b_n + c_n}{3} \leq \frac{2}{3}(c_n - a_n)$$

and the sequences  $(a_n), (b_n), (c_n)$  converge to the constant value taken on by the tail of  $(c_n)$ .

## February 2020 Problem of the Month

A wheel of radius 1 rolls straight down a  $45^\circ$  ramp until it first touches the horizontal surface. If it completes exactly one revolution, how far up the ramp was the point of initial contact?

Students and others are invited to submit solutions to Dr. George Gilbert by e-mail ([g.gilbert@tcu.edu](mailto: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.