

# TCU Math Newsletter

*Not everything that can be counted counts, and not  
everything that counts can be counted*  
- Albert Einstein

## **Colloquium Talk on November 14**

Professor Ravi Shankar of the University of Oklahoma will present the next talk in Frank Stones Colloquium Series at 3:30 pm on Tuesday, November 14 in TUC 352. The title of his talk is "New Metrics of Non-Negative Sectional Curvature on a Family of 2-Connected, 7-manifolds." TCU students 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.

## **Information about Mathematics BS and BA Degrees Available on the TCU Math Department Web Page**

TCU students declaring a BS mathematics major in Fall 2017 or later will be choosing from one of two tracks toward the degree. One of the tracks is more applied than the other. Students who declared a BS mathematics major before Fall 2017 can choose to do one of these tracks toward the BS degree or they can complete the degree under the old requirements. More information about the BS degree and also the BA mathematics major requirements can be found under the current undergraduate students tab on the TCU Mathematics Department web page at <https://mathematics.tcu.edu>

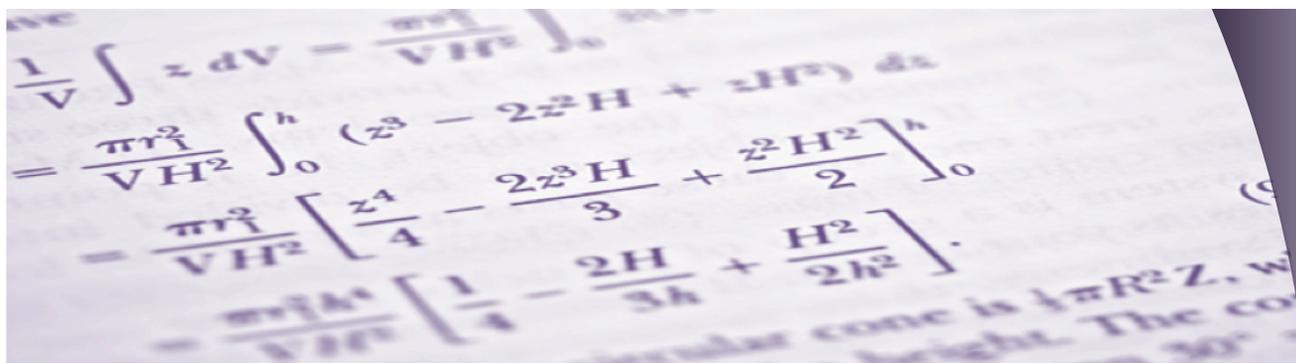
## **Budapest Semesters in Mathematics Education**

Budapest Semesters in Mathematics Education (BSME) is a semester-long study abroad program in Budapest, Hungary designed for undergraduates and recent graduates interested in the learning and teaching of secondary mathematics. At BSME, students explore the Hungarian approach, in which a strong and explicit emphasis is placed on problem solving, mathematical creativity, and communication.

BSME welcomes students who are (1) currently pursuing secondary mathematics teaching license at their home institutions, (2) planning to pursue other paths to mathematics licensure, or (3) simply curious about learning and teaching of mathematics. And BSME courses are designed so that credits will be transferable to American colleges and universities.

BSME is currently accepting applications for Spring 2018, Fall 2018, and Spring 2019 semesters and Summer 2018. Admission is rolling, with the Spring 2018 applications due November 1. More information, including the online application, can be found at <https://bsmeducation.com>

The summer session is a new 6-week program called Summer@BSME. The application deadline for this new summer session is March 1, however, it is expected to fill up quickly so early application is encouraged.



## Solution to the October 2017 Problem of the Month

**Problem:** Let  $p$  be a prime number. Prove that there are integers  $k$  and  $n$  such that  $k^2 + n^2 + 1$  is divisible by  $p$ .

**Solution:** Observing that  $1^2 + 0^2 + 1$  is divisible by 2, we may proceed assuming  $p$  is odd.

If  $a^2 - b^2 = (a - b)(a + b)$  is divisible by  $p$ , then at least one of  $a - b$  and  $a + b$  is divisible by  $p$ . It follows that  $0^2, 1^2, \dots, \left(\frac{p-1}{2}\right)^2$  have distinct remainders upon division by  $p$ . Thus, each of the sets  $\{k^2\}$  and  $\{-n^2 - 1\}$  have at least (in fact, one can show exactly)  $(p + 1)/2$  of the  $p$  possible remainders of division by  $p$ . It follows by the pigeonhole principle that some  $k^2$  and  $-n^2 - 1$  have the same remainder, in which case  $k^2 + n^2 + 1$  is divisible by  $p$ .

This month's problem was solved by Brad Beadle ('96), Qi An, and Chance Moore.

## November 2017 Problem of the Month

One learns in Calculus II that

$$1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \frac{1}{7} - \frac{1}{8} + \dots = \ln 2.$$

What is the value of the rearrangement

$$1 + \frac{1}{3} - \frac{1}{2} + \frac{1}{5} + \frac{1}{7} - \frac{1}{4} + \frac{1}{9} + \frac{1}{11} - \frac{1}{6} + \frac{1}{13} + \frac{1}{15} - \frac{1}{8} + \dots ?$$

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.