

# TCU Math Newsletter

*If a 'religion' is defined to be a system of ideas that contains unprovable statements, then Gödel taught us that mathematics is not only a religion, it is the only religion that can prove itself to be one.*

- John Barrow

## **Presentations by Green Honors Chair Dr. Ken Ono on February 22-24**

Dr. Ken Ono, the Asa Griggs Candler Professor of Mathematics at Emory University, will be visiting TCU as a Green Honors Chair on February 22-24. Dr. Ono is a distinguished number theorist and speaker who has been invited to speak to audiences all over North America, Asia and Europe.

On Wednesday, February 22, 3:30-4:20 pm, Dr. Ono will give a Math Club mini-talk and chat in TUC 244 with pizza. On Thursday, February 23, he will present the colloquium talk "Can't you just feel the Moonshine?" in TUC 352 at 3:30-4:30 pm, and he will present the public lecture "Gems of Ramanujan and their Lasting Impact on Mathematics" in Sid Richardson Lecture Hall 3 at 7:30-9:00 pm. His final talk at TCU, "Zeta polynomials for modular forms," will be February 24, 3:30-4:30 pm in TUC 244.

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

## **Budapest Semesters in Mathematics**

Applications for Fall 2017 and Spring 2018 semesters of Budapest Semesters in Mathematics Education (BSME) are now being accepted. The deadlines are April 1 and November 1, respectively. The applications are reviewed on a rolling basis. Students are encouraged to apply early using the website [bsmeducation.com](http://bsmeducation.com).

## **TCU Career and Intern Expo on February 8**

All TCU students and alumni are invited to attend the TCU Career and Intern Expo on February 8, 2017 from 4:00 to 7:00 pm in the Campus Rec Center. Top employers hiring for internships and full time positions in a wide range of industries will be at the Expo.

Advanced registration is not required. Students should bring their TCU IDs to the check-in the day of the event, and are encouraged to dress professionally and bring copies of their résumés. Visit [careers.tcu.edu](http://careers.tcu.edu) for a list of employers attending.

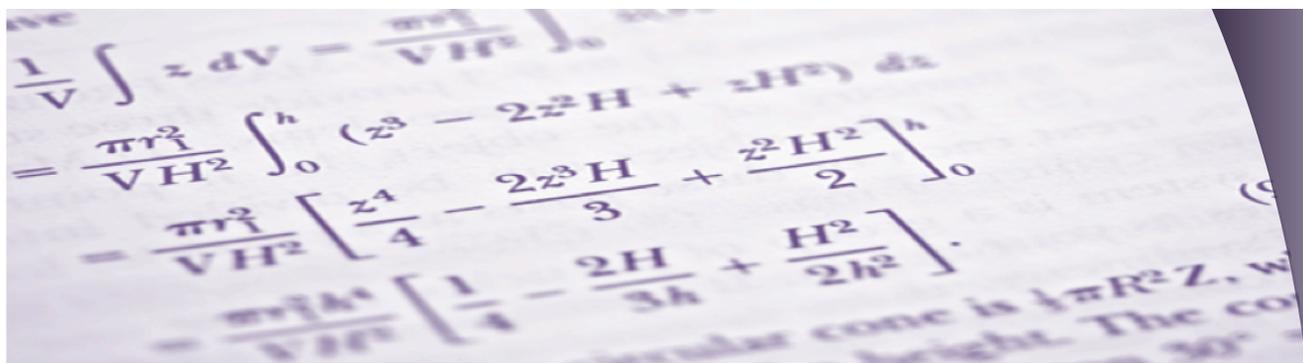
## **NSF Research Experience for Undergraduates Summer Programs**

The National Science Foundation (NSF) funds summer research opportunities for mathematics undergraduate students through 59 REU Sites across the country. Students are granted stipends and, in most cases, housing and a travel allowance.

A list of REU sites in the Mathematical Sciences 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)

The application deadlines vary for the different sites, but many of the deadlines are in February.



## Solution to the November 2016 Problem of the Month

**Problem:** Given a positive integer  $k$ , show that there is a positive integer  $n$  such that

$$(\sqrt{2} - 1)^k = \sqrt{n+1} - \sqrt{n}.$$

**Solution:** Solving for  $\sqrt{n+1}$  and squaring, we obtain

$$n + 1 = n + 2\sqrt{n}(\sqrt{2} - 1)^k + (\sqrt{2} - 1)^{2k}.$$

Cancel the  $n$  and solve for  $\sqrt{n}$  to find

$$\sqrt{n} = \frac{1 - (\sqrt{2} - 1)^{2k}}{2(\sqrt{2} - 1)^k} = \frac{(\sqrt{2} + 1)^k - (\sqrt{2} - 1)^k}{2} = \sum_{j=0}^{\lfloor k-1/2 \rfloor} \binom{k}{2j+1} 2^{(k-1-2j)/2}.$$

We see that  $\sqrt{n}$  is a positive integer when  $k$  is odd and  $\sqrt{2}$  times a positive integer when  $k$  is even. In either case, we see that  $n$  is a positive integer.

This month's problem was solved by undergraduate Think Doan, Brad Beadle ('96), Peter and Roger Bevan, and Qi An.

## February 2017 Problem of the Month

Let  $p(x)$  be a real polynomial of degree 2. Show that, for  $n$  a sufficiently large positive integer,

$$\frac{d^n}{dx^n} (p(x)e^x)$$

has two real roots.

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.