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# ***TCU Math News Letter***

**Volume 8, Number 5 February 2000**

*Truth is stranger than fiction; fiction has to make sense.*

--- Leo Rosten

[Editor: Dr. Rhonda Hatcher](#) and [Archive of Newsletters](#)

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## **Student Assistants Needed for MathCounts on February 19**

The MathCounts contest for middle school students will be held at TCU on Saturday, February 19, 2000 from 9:00 a.m. to 1:00 p.m. Undergraduate student assistants are needed to help with the contest. Although the work is voluntary, lunch will be provided along with a free T-shirt. Students interested in helping should contact Dr. Roy Combrink in Winton Scott Hall 162 or by email at [r.combrink@tcu.edu](mailto:r.combrink@tcu.edu) or phone at 257-6341

## **Two New Mathematics Journals for Undergraduate Publications**

Rose-Hulman Institute of Technology will publish the first issue of the Rose-Hulman Undergraduate Mathematics Journal in March 2000. The journal is devoted entirely to papers written by undergraduates on topics related to mathematics. The journal welcomes articles containing new results, new and interesting proofs of old results, historical developments of a theorem or area of mathematics, relationships between areas of mathematics and/or other fields of study, or interesting applications of mathematics. Papers submitted for publication must be accompanied by a letter from a mathematician who knows the student's work. For more information visit the web site at [www.rose-hulman.edu/mathjournal/](http://www.rose-hulman.edu/mathjournal/).

Morehead State University has announced a new electronic journal. The Morehead Electronic Journal of Applications in Mathematics (MEJAM) is an interdisciplinary journal which publishes the work of undergraduate students. The goal of MEJAM is to provide a refereed outlet for undergraduates in any discipline to publish quality papers and see the results quickly. MEJAM accepts papers which are outside the realm of the typical undergraduate curriculum and which emphasize the applications of mathematics while maintaining significant mathematical interest. Papers may be historical, expository, or completely original in nature but must adhere to strict academic standards and must emphasize some aspect of the applications of mathematics. Papers from all disciplines will be considered for publication. More information about the journal can be found at the web site <http://www.morehead-st.edu/colleges/science/math/mejam>. If you have any questions about MEJAM, contact the senior editor, R. Duane Skaggs, at [d.skaggs@morehead-st.edu](mailto:d.skaggs@morehead-st.edu).

## **Master of Arts in Teaching Degree Program at TCU to Begin in Fall 2000**

The Mathematics Department at Texas Christian University will begin to offer a Master of Arts in Teaching

(MAT) degree program in mathematics. The MAT program is designed to prepare highly qualified teachers of mathematics at the secondary and two-year college levels. The degree plan includes 24 hours of graduate mathematics courses together with 12 hours of graduate education courses.

Review of mathematics graduate applications for the fall semester of 2000 will begin in March 2000. For further information and application materials, contact Dr. Robert Doran in the Mathematics Department office or by email at [r.doran@tcu.edu](mailto:r.doran@tcu.edu) or phone at 257-7335. More detailed information can also be found at [www.math.tcu.edu/math/](http://www.math.tcu.edu/math/).

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## Solution to the December 1999/January 2000 Problem of the Month

**Problem:** Find the maximum volume of a right cone inscribed in a sphere of radius 1. (By inscribed, we mean that the vertex and circumference of the base of the cone are on the surface of the sphere.)

**Solution** The maximum volume is  $32\pi/81$ .

Let  $r$  be the radius and  $h$  be the height of the cone. The maximum volume will occur when  $h \geq 1$ , so we see that  $(h-1)^2 + r^2 = 1^2$  or  $h = 1 + \sqrt{1-r^2}$ . Thus, the volume of the cone is  $V = \frac{1}{3}\pi r^2 \left(1 + \sqrt{1-r^2}\right)$  where  $0 \leq r \leq 1$ . Differentiation yields

$$V' = \frac{2}{3}\pi r \left(1 + \sqrt{1-r^2}\right) + \frac{1}{3}\pi r^2 \left(\frac{-r}{\sqrt{1-r^2}}\right) = \frac{1}{3}\pi r \left(\frac{2\sqrt{1-r^2} + 2 - 3r^2}{\sqrt{1-r^2}}\right).$$

Critical points in the interior of the domain satisfy  $2\sqrt{1-r^2} + 2 - 3r^2 = 0$ . Either moving the radical to one side and then squaring both sides or writing the equation in the form  $3\left(\sqrt{1-r^2}\right)^2 + 2\sqrt{1-r^2} - 1 = 0$ , we find the only relevant critical point is  $r = 2\sqrt{2}/3$ .

Finally, comparing  $V(0) = 0$ ,  $V(2\sqrt{2}/3) = 32\pi/81$  and  $V(1) = \pi/3$ , we see that the maximum volume is  $32\pi/81$ .

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## Problem of the Month

This month's problem comes from Russia's 1997 national high school contest. Show that the numbers from 1 to 16 can be written in a line, but not in a circle, so that the sum of any two adjacent numbers is a perfect square.

Students and others are invited to submit solutions to Dr. George Gilbert (Math Dept. Office or P.O. 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.

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The TCU Math Newsletter will be published each month during the academic year. Dr. Hatcher: Editor; Dr. Gilbert: Problem Editor; Dr. Doran: Thought of the Month Editor. Items which you would like to have included should be sent to Dr. Hatcher (Math Dept. Office or P.O. 298900).