TCU Math News Letter

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The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man.

--- George Bernard Shaw

Editor: Dr. Rhonda Hatcher and Archive of Newsletters

TCU Lectureship Talk on November 6

Professor Robin Forman will be the next speaker in the 2001-2002 TCU Research Lectureship Series. His talk "An Introduction to Discrete Morse Theory," will be given at 4 p.m. on Tuesday, November 6 in Winton Scott Hall 145, and refreshments will be served in Winton Scott Hall 171 at 3:30 p.m. before the talk.

This talk will be the last talk in the lecture series for the fall semester. There are five speakers scheduled for the spring semester, beginning with Professor Nathaniel Dean of Rice University on Tuesday, January 22, 2002.

Parabola Meeting on Tuesday, November 6

Professor Robin Forman of Rice University will speak at the next meeting of Parabola, the TCU undergraduate mathematics club. Professor Forman's talk is entitled "How Many Equilibria Are There? (An Introduction to Morse theory)" In the talk he will investigate a way of counting the equilibria of a dynamical system. The lecture will be accessible to anyone who is currently taken or already took Differential Equations or Calculus III. The talk will begin at 12:30 p.m. in Winton Scott Hall 171. Beginning at 12:15 p.m., a pizza lunch will be served to those attending the talk. All TCU students, faculty, and other interested members of the community are invited to attend the lunch and the talk.

Summer Opportunities for Math Majors on the MAA Web Page

The Mathematical Association of America web page includes a listing of summer research and job opportunities for mathematics students. The main web page address is www.maa.org and the special summer opportunities list is at www.maa.org/students/reustuff/pages/smrpage.html. It is not too early to start thinking about applying for these because most require faculty recommendations and some have early deadlines. Students interested in joining the Mathematical Association of America should contact Professor Ken Richardson in Winton Scott Hall 139 or at (817) 257-6128 or by email at k.richardson@tcu.edu.

Christmas Buffet

The TCU Mathematics Department will hold its annual Christmas Buffet from 11:00 a.m. to 1:00 p.m. on Thursday, December 6 in Winton Scott Hall 171. All TCU mathematics majors, graders, faculty, and other friends of the department are invited to come.

If you would like to join us, please come to the Math Department office in Winton Scott Hall 112 to sign up.

Solution to the October 2001 Problem of the Month

Problem: .. *There is no generalization of the quadratic formula that solves polynomial equations of degree 5 and higher, such as* $x^5 - 5x^4 + 8x^3 - 6x^2 + 3x + 3 = 0$. *However, for this month's problem, you are also given that there are two solutions to this particular equation whose sum is 2. Find all real solutions (exactly, not in the form of a numerical approximation).*

Solution: If roots r_1 and r_2 sum to 2, then $(x - r_1)(x - r_2) = x^2 - 2x + p$, with $p = r_1 r_2$, must be a factor of $x^5 - 5x^4 + 8x^3 - 6x^2 + 3x + 3$. By long division, we find

$$x^5 - 5x^4 + 8x^3 - 6x^2 + 3x + 3$$
$$= (x^3 - 3x^2 + (2 - p)x + (p - 2))(x^2 - 2x + p) + (p^2 - 1)x + (-p^2 + 2p + 3).$$

Because the remainder, $(p^2 - 1)x + (-p^2 + 2p + 3)$, must be 0, we see that $p^2 - 1 = 0$, implying $p = -1$ or 1, and that $-p^2 + 2p + 3 = 0$, implying $p = -1$ or 3. Thus, $p = -1$ and the other factor is $x^3 - 3x^2 + 3x - 3$. By the quadratic formula r_1 and r_2 are $1 + \sqrt{2}$ and $1 - \sqrt{2}$. The cubic factor may be rewritten as $(x-1)^3 - 2$, revealing the third real solution $1 + \sqrt[3]{2}$.

Problem of the Month

This month's problem originally appeared as problem 5.1.1 in the journal Function. Three poor woodcutters, stranded in the bitter winter seek shelter in an abandoned cottage. "I," said the first, "have 5 logs of wood to help keep us warm." "And I," said the second, "have 3." "Alas," said the third, "I have no wood, but I have 8 kopeks to repay you for allowing you to share your fire."

How should the 8 kopeks be distributed between the first two woodcutters?

(Remember that math majors will earn 10 points in the Bucks for Books lottery for a correct solution. For details and other ways to earn points, refer to the September 2000 Newsletter or visit the web page www.math.tcu.edu/math/BucksForBooks.html)

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.

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).