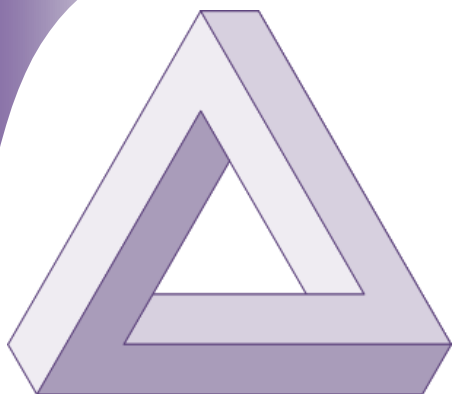


TCU Math Newsletter



He or she who asks a question is a fool for five minutes; he or she who does not ask a question remains a fool forever.

Confucius



William Lowell
PUTNAM
Mathematical Competition

This year's Putnam Mathematical Competition, delayed from its usual date on the first Saturday in December, will be held on Saturday, February 20, on an unofficial basis, meaning no prizes or national recognition for the top contestants, but the same problems that would have formed this year's contest. Students will register online, download the problem set and upload solutions through an online platform, and have their papers graded by regular Putnam graders. Those interested should register individually. The registration link is at <https://www.maa.org/math-competitions/putnam-competition>. Questions? Check out the link and, if you have further questions, contact Dr. Gilbert at g.gilbert@tcu.edu.

NSF Research Experience for Undergraduates Summer 2021 Programs

The National Science Foundation (NSF) funds summer research opportunities for mathematics undergraduate students through REU Sites across the country. Students are granted stipends and, in most cases, housing and a travel allowance. Depending on the COVID-19 situation, some programs may be offered in a virtual format. The application deadlines vary, but some are in February 2021.



A list of Mathematics REU sites where you can find details and learn about the individual programs and the application processes can be found at https://www.nsf.gov/crssprgm/reu/list_result.jsp?unitid=5044. Another REU program that mathematics students may be interested in is the NSF REU in Data Science at Worcester Polytechnic Institute. Information about this REU can be found at <https://www.wpi.edu/academics/departments/data-science/reu-program>.

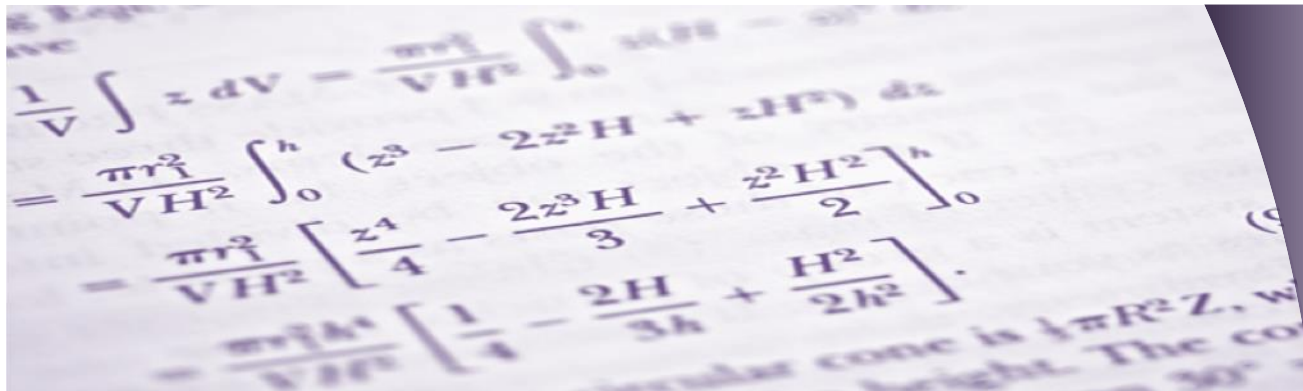
Budapest Semesters in Mathematics Education Online Program



Budapest Semesters in Mathematics Education (BSME) is normally a study abroad program in Budapest, Hungary intended for students interested in the teaching of mathematics at the secondary school level. Due to the COVID-19 situation, BSME will run an online program for the Summer 2021 session. The session will run from June 14 to July 16.

At BSME, students learn about the Hungarian approach which emphasizes problem solving, mathematical creativity, and communication. The courses are designed so that credits will be transferable to American colleges and universities. BSME is currently accepting applications for Summer 2021. The due date for applications is May 24, 2021, but applications are reviewed on a rolling basis, so students are encouraged to apply early.

More information, including the online application, can be found at <https://bsmeducation.com/summer-online-overview/>.



Solution to the November 2020 Problem of the Month

Problem: (due to Robert Doran) Let z and w be complex numbers such that $|z - 1| = r < 1$ and $|w - 1| = s < 1$. Prove that the real part of zw is at least $1 - r - s - rs$.

Solution: Write $z - 1 = re^{i\alpha}$ and $w - 1 = se^{i\beta}$. Then

$$zw = 1 + re^{i\alpha} + se^{i\beta} + rse^{i(\alpha+\beta)}.$$

Its real part is

$$1 + r \cos \alpha + s \cos \beta + rs \cos(\alpha + \beta) \geq 1 - r - s - rs.$$

The Problem of Month was solved by Brad Beadle ('96).

(The greatest real number c such that the real part of zw must be at least $1 - r - s + crs$ is $c = 1/2$. The key here is to show that the worst case is $r, s \rightarrow 1$ and $\alpha = \beta = 2\pi/3$.)

February 2021 Problem of the Month

This month's problem appeared in Peter Winkler's Mind-Benders for the Quarantined. It requires more computation than is usual for our problems, but nothing excessive. Find all 10-digit numbers $d_1d_2d_3d_4d_5d_6d_7d_8d_9d_{10}$ with each of 0, 1, ..., 9 appearing exactly once and such that $d_1 \cdots d_i$ is divisible by i for every i .

Students and others are invited to submit solutions to Dr. George Gilbert by e-mail (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.