

PROBLEMS AND SOLUTIONS

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This section contains problems intended to challenge students and teachers of college mathematics. We urge you to participate actively *both* by submitting solutions and by proposing problems that are new and interesting. To promote variety, the editors welcome problem proposals that span the entire undergraduate curriculum.

Proposed problems should be sent to **Curtis Cooper**, either by email (preferred) as a pdf, \TeX , or Word attachment or by mail to the address provided above. Whenever possible, a proposed problem should be accompanied by a solution, appropriate references, and any other material that would be helpful to the editors. Proposers should submit problems only if the proposed problem is not under consideration by another journal.

Solutions to the problems in this issue should be sent to **Chip Curtis**, either by email as a pdf, \TeX , or Word attachment (preferred) or by mail to the address provided above, no later than June 15, 2017.

PROBLEMS

1091. *Proposed by Ovidiu Furdui, Technical University of Cluj-Napoca, Cluj-Napoca, Romania.*

Let $A \in \mathcal{M}_2(\mathbb{Z})$, the set of two by two integer matrices. Prove that $\sin A \in \mathcal{M}_2(\mathbb{Z})$ if and only if A^2 is the zero matrix.

1092. *Proposed by Mehtaab Sawhney (student), Commack High School, Commack, NY.*

Prove that for any positive constant α that

$$\sum_{cyc} \ln(1 - x^{\alpha+1}y) + \sum_{cyc} \ln(1 - x^{\alpha+1}z) \geq \sum_{cyc} \ln(1 - x^{\alpha+2}) + \sum_{cyc} \ln(1 - x^{\alpha}yz)$$

given that $0 < x, y, z < 1$.

1093. *Proposed by Greg Oman, University of Colorado, Colorado Springs, CO.*

Let V be the real vector space of all countably infinite sequences of real numbers (with the usual component-wise addition and scalar multiplication), and let W be the subspace of V consisting of all sequences $\{a_n\}$ such that $\sum_{n=1}^{\infty} a_n$ converges. Prove that there exists a linearly independent subset X of W of size 2^{\aleph_0} all of whose members are *conditionally* convergent and sum to 0.

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