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 as a pdf, TEX, or Word attachment (preferred) 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 **Shing So**, either by email as a pdf, TEX, or Word attachment (preferred) or by mail to the address provided above, no later than August 15, 2012.

PROBLEMS

976. *Proposed by D. M. Bătinetu-Giurgiu, Matei Basarab National College, Bucharest, Romania and Neculai Stanciu, George Emil Palade Secondary School, Buzău, Romania.*

For any triangle, let s, r, and R denote its semiperimeter, inradius, and circumradius. Show that

$$(2x+y)s^2 + r(y-2x)(4R+r) \geq 9\sqrt[3]{4xy^2s^2R^2r^2},$$

for any $x, y > 0$.

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

Let X be a set and $f\colon X \to X$ be a function. A subset Y of X is said to be closed under f provided that whenever $y \in Y$, $f(y) \in Y$. Prove or disprove: There exists an uncountable set X and a function $f\colon X \to X$ with the following property:

(*) for any subsets Y and Z of X which are closed under f, either $Y \subseteq Z$ or $Z \subseteq Y$.

978. *Proposed by Michel Bataille, Rouen, France.*

Let $H_n = 1 + \frac{1}{2} + \cdots + \frac{1}{n}$ be the nth harmonic number. Evaluate

http://dx.doi.org/10.4169/college.math.j.43.3.257