PROBLEMS

Problems, solutions, and any comments on the problems or solutions should be sent to Curtis Cooper, Department of Mathematics and Computer Science, Central Missouri State University, Warrensburg, MO 64093 (email: ccooper@cmsuvmb.cmsu.edu).

Problems which are new or interesting old problems which are not well-known may be submitted. They may range from challenging high school math problems to problems from advanced undergraduate or graduate mathematics courses. It is hoped that a wide variety of topics and difficulty levels will encourage a number of readers to actively participate in problems and solutions. An asterisk ($*$) after a number indicates a problem submitted without a solution.

Problems and solutions should be typed or neatly printed on separate sheets of paper. They should include the name of the contributor and the affiliation. Solutions to problems in this issue should be mailed no later than March 15, 1995, although solutions received after that date will also be considered until the time when a solution is published.

69. *Proposed by Mohammad K. Azarian, University of Evansville, Evansville, Indiana.*

Let G be a group such that whenever $g_1, g_2, g_3 \in G$ and $g_1 g_2 = g_3 g_1$, then $g_2 = g_3$. Show that:

(a) If G has two elements of order 2, then G must contain the Klein four group.

(b) The set $H = \{g \mid g^k = 1, \text{where } k \text{ is some integer}\}$ is a subgroup of G.

70. *Proposed by Herta T. Freitag, Roanoke, Virginia.*

The perfect number 28 can be expressed as $1^3 + 3^3$. Another perfect number, $496 = 1^3 + 3^3 + 5^3 + 7^3$. Generalize to give the conditions, if any, under which perfect numbers can be expressed as sums of consecutive odd cubes, and give this representation.

71. *Proposed by Ronnie Gupton, Larry Hoehn, and Jim Ridenhour, Austin Peay State University, Clarksville, Tennessee.*

Provide a non-calculus solution to the following problem on page 530 of James Stewart's *Calculus* (2nd ed.), Brooks/Cole Publishing Company, 1991.

"A cow is tied to a silo with radius r by a rope just long enough to reach the opposite side of the silo. Find the area available for grazing by the cow."

72. *J. Sriskandarajah, University of Wisconsin Center-Richland, Richland Center, Wisconsin.*

Show that one more than four times the product of two consecutive odd numbered pentagonal numbers is a square.