

PROBLEMS OF THE MONTH FOR UH MĀNOA UNDERGRADUATES
PROBLEMS FOR SEPTEMBER 2008

Let

$$p(x) = \sum_{k=0}^n a_k x^k$$

denote a non-constant polynomial, where the coefficients satisfy the inequality

$$0 < a_0 < a_1 < \dots < a_n.$$

Problem A. Prove that any real zero of $p(x)$ lies in the open interval $(-1, 0)$.

Problem B. Show that

$$\frac{1}{2\pi i} \int_C \frac{p'(w)}{p(w)} dw = n,$$

where C is the positively oriented unit circle ($|w| = 1$) traversed exactly once.

RULES

The following rules may be changed or clarified from month to month:

1. Any regular undergraduate currently enrolled at UH Manoa is eligible to compete.

2. Write a complete solution with all details to either problem or both.

3. Submit your solution(s) by email before the end of the above month to Pavel Guerzhoy at pavel@math.hawaii.edu

For the subject line of your email use "problem of the month" and send your email *via your UH email address*. Either write your solution within the body of your email or within attachment(s) in the form of readable pdf files or images of your work in jpg format (e.g., scanned or digitally photographed).

4. Solutions will be judged by a committee of professors according to a combination of criteria: accuracy, attention to details, chronological order of submission, and neatness, but not necessarily in that order.

5. Before the end of the 10-th day of the month that follows, the winner(s) will be announced on the Math Department web site. Moreover, if there is at least one good answer to a problem the winner(s) for that problem will collectively receive a total of least \$20 to be distributed among them depending on the criteria in 4 above, as soon as the checks can be extracted from the Hanf Fund at the UH Foundation, a process that may take several weeks.