## Asymptotic Behavior of a Sum of Cosecants

Problem 05-001, by Hongwei Chen (Christopher Newport University, Newport News, VA). Prove that

$$
\sum_{k=1}^{n-1} \csc \left(\frac{k \pi}{n}\right)=\frac{2 n}{\pi}\left(\ln n+\gamma-\ln \left(\frac{\pi}{2}\right)\right)+O(1), \quad n \rightarrow \infty
$$

Remark. The exact sum

$$
\sum_{k=1}^{n-1} \sin \left(\frac{k \pi}{n}\right)=\cot \left(\frac{\pi}{2 n}\right)
$$

is well known. This motivated the proposer to investigate the corresponding sum of cosecants.

Status. The proposer has a solution. Other solutions are welcome.

