

PROBLEM OF THE MONTH #2

NOVEMBER 2021

Directions: Write a complete solution to the problem below showing all work. Your paper must have your name, W#, and Southeastern email address. Solutions are to be sent as a SINGLE PDF FILE to the submission address talwissubmissions@selu.edu, with the subject heading of the email as Problem of the Month #2, November 2021, by 11:59 p.m., **Tuesday, November 30**. No late papers will be accepted.

All papers with a correct solution will be entered in a drawing for a great prize! Anyone can submit solutions, but only currently enrolled students are eligible for prizes.

Questions concerning the problem of the month should be sent to either Dr. Tilak de Alwis (tdealwis@selu.edu), or Dr. Dennis Merino (dmerino@selu.edu)

PROBLEM: *Tangent and Cotangent*

(a) Use any graphing utility to draw a large graph of $f(x) = \frac{1}{\cot x - \cot 2x}$ for $-\pi/4 \leq x \leq \pi/4$.

Does this function have any discontinuities in the given closed interval? If so, name the type of discontinuity, and justify the answer mathematically.

(b) Find the exact value of $\int_0^{\pi/4} \frac{1}{\cot x - \cot 2x} dx$ by hand.

(c) Find the exact value of $\sum_{k=0}^{100} [\tan(2^{k+1}) + \cot(2^{k+2})]$ by hand. Provide the simplified answer in a closed-form format.

Note: Partial answers might still be considered. So all submissions are welcome!