

Thomas J. Pfaff

Problems Posed in Journals

**Math Horizons 185, September 2004:** Prove by combinatorial reasoning that

$$\sum_{k=1}^n k \binom{n+1}{k+1} = (n-1)2^n + 1.$$

**The College Math Journal 763, November 2003:** If a round cookie is inserted vertically into a shallow basin of melted chocolate and rolled back and forth along its edge, consider the boundary of the chocolate covered region on the cookie. We assume that the cookie is a disk of radius 1 placed initially on the  $x$ -axis with its center at  $(0, 1)$ , that the cookie is rolled along the  $x$ -axis a distance of  $\theta$  units to the left and right where  $0 < \theta < \frac{\pi}{2}$ , and that the depth of the chocolate is  $d$ , where  $0 < d < 1$ . When the cookie is rolled back to its initial position, the portion of the boundary of the chocolate covered region that is not on the edge of the cookie can be viewed as the graph of a function  $y = f(x)$ .

1. Determine the domain of  $f$  and find an explicit representation of  $f$  on its domain.
2. Find the area of the chocolate covered region on the cookie.

**The College Math Journal 737, November 2002:** Let  $K_n$  be the complete graph on  $n \geq 2$  vertices and  $P_i$  a path of length  $i$ . Prove or disprove:  $K_n$  can be partitioned into edge disjoint paths  $P_1, P_2, \dots, P_{n-1}$ , for  $n \geq 2$ .

**The College Math Journal 726, May 2002:** Evaluate

$$\lim_{n \rightarrow \infty} \frac{1}{n^2} \sum_{k=1}^n \csc(1/k).$$

**The  $\Pi ME$  Journal 1044, Fall 2002:** Evaluate the following limit:

$$\lim_{n \rightarrow \infty} \frac{n}{\ln n} \sum_{i=1}^{n-1} \frac{1}{ni - i^2}.$$