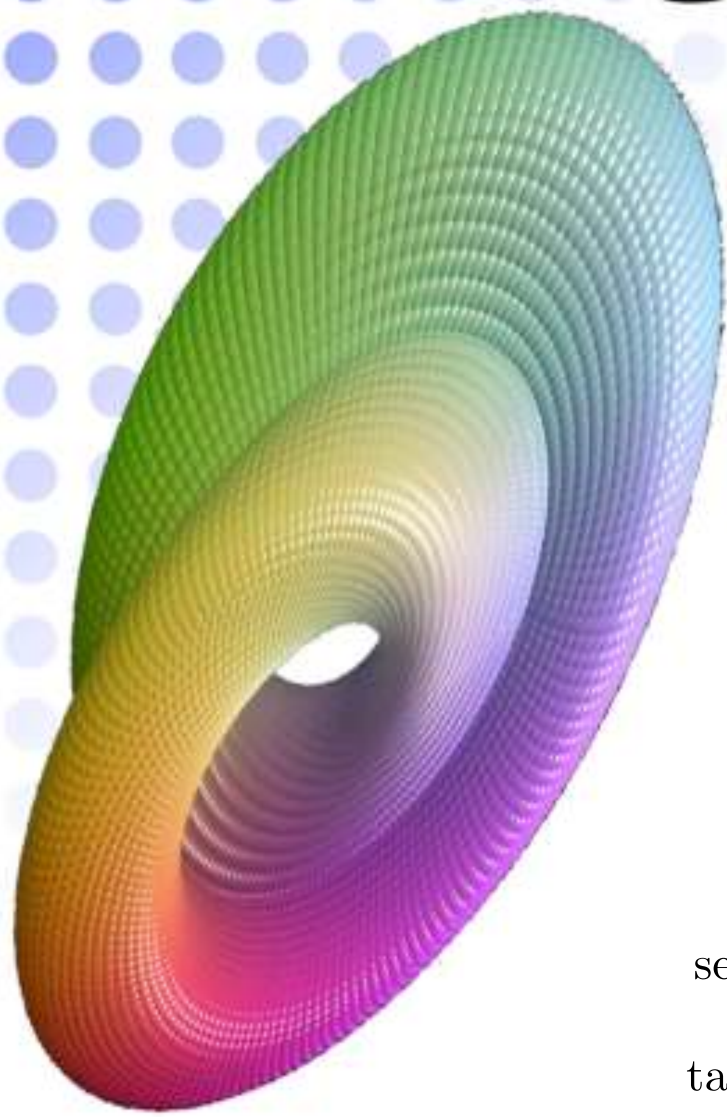
Michigan Math Club

Thursday at 4pm in the Nesbitt Room

Free Pizza and Pop



The Taylor series of $\sec(x)$ and $\tan(x)$

Steven Karp • 21 February 2019

In a calculus class, one learns elegant formulas for the Taylor series about $x = 0$ for functions such as e^x, $\frac{1}{1-x}$, $\sin(x)$, $\cos(x)$, $\ln(1+x)$, ...

In this talk, we will explore the series:

$$\sec(x) = 1 + \frac{1}{2}x^2 + \frac{5}{24}x^4 + \frac{61}{720}x^6 + \cdots,$$
$$\tan(x) = x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \frac{17}{315}x^7 + \cdots.$$

They are related to combinatorial objects called 'up-down permutations'. I will also discuss connections to ox plowing, 'maximal morsifications' of functions, and Euler's famous formula

$$1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \cdots = \frac{\pi^2}{6}.$$

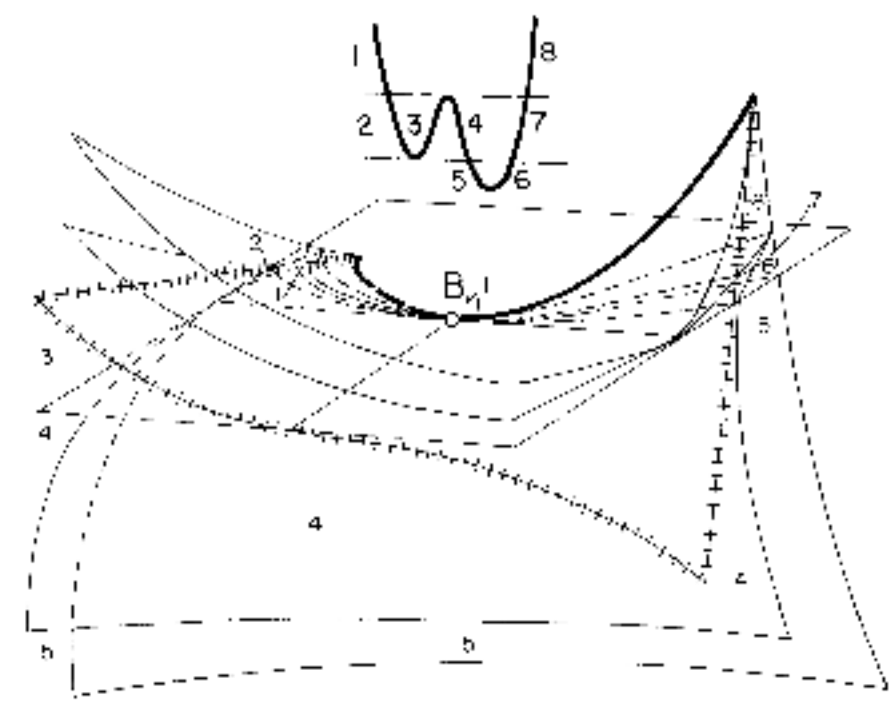


Image source: Arnold, *Bernoulli-Euler updown numbers associated with function singularities, their combinatorics and arithmetics*