

# INTENSIVE LECTURE SERIES in Mathematics, Keio



Speaker: **Prof. James A. Yorke**  
(University of Maryland)

Date: **June 18, 2007 (Monday)**

Time: **15:00 - 16:00**

Place: **12-209, 2nd Floor, Bldg. 12**  
**Faculty of Science and Technology**  
**Yagami Campus, KEIO University**

**Title:** Surprising patterns emerge when "bisecting" proofs of theorems

Theorem and proof are conjoined twins but I have always had a secret preference for proof, or rather for those kernels of proofs that recur.

I have been developing an art form in which the goal is to take a proof of any theorem and reorganize it into two parts. Reduce it to two tasks or lemmas to be proved. Of course those parts might in turn be similarly bisected, hopefully not ad infinitum. I was led to this goal by remembering classes that presented complicated proofs requiring many disparate facts to be proved, making it impossible for me to wrap my mind around the collective entity and see it as a unity. For example I encountered the Poincare-Bendixson Theorem in college, to my considerable confusion.

I often find this "bisection" task quite difficult, but when I succeed, I sometimes unearth connections with proofs of other theorems. Here I will report on three eerily connected results.

- 1) The Poincare-Bendixson Theorem
- 2) Degree theory in  $R^n$  made constructive
- 3) Why period doubling cascades exist in one-parameter families of maps.