Syllabus. Math 145. Introduction to Chaos, *aka Intro to (Nonlinear) Dynamics.*
class meets: Tu Th 10-11:40. Eng. Bldg 2. room 192 (outside patio entrance)
Prof.: Richard Montgomery. off:4120 McHenry.
office hours: (tentative) Tu 8-10 AM, Th 5-6 PM
class web site: http://people.ucsc.edu/ rmont/classes/chao/2013/index.html
TA: Yusuf Goren yusuf.goren@gmail.com . Yusuf will cover lectures 2, 3, 4

EVALUATIONS:
20 percent: homework [HW], quizes, class participation
30 percent: midterm . (week 5) on 1 and 2D mappings; maybe a bit on Mandelbrot's set
50 percent: final . on flows (ODEs), and some on mappings
TEXTS:
[1] An Introduction to Chaotic Dynamical Systems, 2nd Ed. , R. Devaney and son, (2003)

[2] Nonlinear Dynamics And Chaos: With Applications ... , S. Strogatz

[3] not required. 'Chaos and Fractals'. Proc. of Symp. in Applied Math. v. 39, AMS pub.

MATHEMATICAL PREREQUISITES.

Beginning Calculus. By looking at a graph, can you see where the derivative is zero? Greater than 1? *Some linear algebra:* Do you know what a two-by-two matrix is? Can you diagonalize one? Do you know how matrices define maps? *Some differential equations:* Can you solve $dy/dt = -y$? $d^2y/dt^2 = -y$?. *Some understanding of the Complex number field:* What point of the xy plane does the complex number $1 + 2i$ represent? How do you write it in polar coordinates? Can you draw $(1 + i), (1 + i)^2, (1 + i)^3, (1 + i)^4, \ldots$?

Tentative schedule. *Note: Montgomery does class 1. Yusuf Goren does classes 2, 3, and 4. Montgomery does the remainder.*

week 1. 1D map families, focusing on the quadratic family
week 2. 1D maps ct'd.
week 3. May's paper (*). Wrap up 1D maps. Begin 2D maps.
week 4. 2D maps ct'd. Mandelbrot's paper (*).
week 5. review. midterm: Thurs. Feb 7.
week 6. ODEs =flows. Fixed points. Linearization. Classifiying 1D flows.
week 7. 2D flows. Limit cycles. Homoclinic and heteroclicing saddle points. Poincare return map. Poincare-Bendixson statement. Dictionary between flows and invertible maps
week 8. A 3D flow. Lorenz's paper (*).
week 9. Stable-Unstable manifold theorem. Homoclinic tangle. Forced pendulum.
week 10. Synthesis. Review. Last day of class: Mar 14.
Final: Thursday, March 21 12:003:00 p.m.

(*) Notes on reading and discussion. At the first class everyone get a number j, $j = 1, 2, 3, 4, 5$. Each paper will be divided into 5 parts. During the discussion part of class groups will convene to discuss with each group having at least one person with each of the 5 numbers j.