Homework # 1
Due September 25 at the beginning of class

Please collaborate on ideas, but write up individually. If still stuck, come to office hours or email me. Unless labeled A, B, etc, problems are from Alligood-Sauer-Yorke. Remember to show your working/reasoning. Answers that appear without explanation will not receive a high score! Some of your time this week is devoted to getting started with Matlab. For help, always start with our course website http://math.dartmouth.edu/m53f13/resources.html, then ask friends or myself

- A Install Matlab on your personal machine, e.g.from http://caligari.dartmouth.edu/downloads/matlab Susan Schwarz can help with installation. Instead you could work at computer labs where Matlab is already installed. Make sure you follow the commands in the file intro53.m, and look through other introductions linked on our course site.
- T1.3
- T1.4 Please make sure you give a geometric description.
- T1.5 Hint: Use all information you already have about the fixed points of f.
- B [see Computer Expt 1.2] Download the incomplete Matlab code iter_hw1.m and finish it so that it iterates the map $f(x) = ax(1-x)$ with $a = 3.5$. I already included code to produce cobweb and iteration plots. Hand in printouts of these two plots for this map, for the initial condition $x_0 = 0.7$.
  - a) Try several different initial conditions and draw some conclusion about the basin of the observed orbit (what is its period?)
  - b) Try initial condition $x_0 = (a-1)/a = 0.714285714285714\ldots$ and explain what is happening.
- T1.8 You can look at the back of the text for a hint, but then you must explain where the solution comes from.
- T1.11
- 1.1
- 1.2
- 1.4
- 1.9 Hint: It is helpful to sketch the function.
- 1.15 It is rather mind-blowing that this chaotic map has such a formula! We will explore more later. [Hint: use the answer to guess a formula relating an angle $_n$ to x_n. Find the absurdly simple update rule for $_n$. The answer for 1.15 in the book is the solution to a different question.
- p.31 Computer Expt 1.4: use the code above to investigate sensitive dependence as asked for. At a baseline you can keep rerunning this code and comparing by eye. You need only report results for separations 0.001 and 10^{-15}. **BONUS**: improve the code to compare two runs (using two colors) with separation 10^{-15} on the same iteration graph. Choose nice axis range, and hand in a printed plot.