**Project 1: Period-3 Implies Chaos**

In 1975, T.Y. Li and J.A. Yorke published an extremely influential paper entitled, “Period three implies chaos.” Beyond the mathematics, perhaps its most last contribution is that this catchy title coined the term, “chaos” for what might have formerly been called sporadic aperiodic nonlinear oscillations. The term “chaos” was a lot more sexy, and it stuck, even though there was an error in the original paper, which was subsequently corrected.

This project tasks you to understand the mathematics of this influential work.

1. Go to the library, and photo-copy the following two papers:


The librarians will be happy to help you find these. These papers are to be stapled to your project.

2. Find the main theorems in these papers, highlight them (in yellow for example), and then copy the theorem down by hand on a separate sheet of paper.

Now you will prove these theorems.

3. Fill in all of the requested arguments demanded in Challenge 1, pages 32-35. Drawing lots of pictures will help.

4. On a new sheet of paper, placed in front of #3 above, state specifically what the arguments in Challenge 1 established.

5. Do problems T3.9 and T3.10 on page 127.

6. On a new sheet of paper, placed in front of #5, state specifically what the arguments in T3.9 and T3.10 establish.

7. Have you proven the theorem stated in #2 above?

8. Discuss verifying a period-3 orbit in a more experimental setting.

**NOTE** – if it strikes your fancy and you would prefer to do slightly harder Challenge 3 in ASY about the more general Sarkovsky’s theorem instead of Challenge 1 about the more famous Period-3 implies chaos, then by all means this is fine. You only need to do one of the two.