MA573 - Fall 2022 Homework 11 - Due December 9th

Hirsh-Smale-Devaney Problems

Chapter 9: 4, 6, 7(c,e), 16 (for this one try to explain intuitively why this result is true, you do not need to rigorously prove it)

Chapter 10: 2, Note: There are some really nice exercises in the rest of this chapter. While they won't be assigned, try some if you're interested!!!

Non-textbook Problem(s):

Problem 1: Consider

$$x' = \mu x - y + xy^2$$
$$y' = x + \mu y + y^3$$

with parameter $\mu \in \mathbb{R}$. Using linearized analysis around the origin show that a Hopf bifurcation occurs at the origin as μ is varied. Then, use numerical investigation and/or phase plane analysis to determine whether the bifurcation is *super-critical* or *sub-critical*, that is does a stable limit-cycle bifurcate out of the origin as the equilibrium goes unstable? or does an unstable limit-cycle collapse onto the origin, rendering the origin unstable?