Math 441 Analysis and Dynamics of Differential Equations Written Assignment 5

Read your lecture notes, chapter 7 and section 8.2. Submit the following problems.

Topics: Two dimensional flows: α and ω limit sets, Poincare Bendixson Theorem, no chaos in two dimensions, limit cycles, Hopf bifurcations.

- 1. (Poincare Bendixson theorem) Prove the lemmas leading up to Poincare- Bendixson theorem, which we did not prove in class.
- 2. (Phase portrait) 7.1.3, 7.1.4.
- 3. (Coordinate change) 7.1.5
- 4. (Wave form) 7.1.4

- 5. (Existence, uniqueness and stability of a limit cycle) 7.1.8
- 6. (Gradient system, phase portrait) 7.2.2, 7.2.6 (a), 7.2.8
- 7. (Liapunov function) 7.2.10
- 8. (Dulac's criterion) 7.2.18.
- 9. (Lienard systems) 7.4.2
- 10. (Hopf Bifurcation) 8.2.2, 8.2.3, 8.2.4