Differential Equations Seminar: Week 11 Exercises

1. Use a Lyapunov function to determine the stability of the origin for the system

$$\begin{aligned} x' &= -x - 5y\\ y' &= 3x - y^3 \end{aligned}$$

2. Use a Lyapunov function to determine the stability of the origin for the system

$$\begin{aligned} x' &= -x - y^3 \\ y' &= x - y \end{aligned}$$

3. Use a Lyapunov function to determine the stability of the origin for the system

$$\begin{aligned} x' &= -x - y^2\\ y' &= -\frac{1}{2}y + 2xy \end{aligned}$$

4. Use a Lyapunov function to determine the stability of the origin for the system

$$\begin{aligned} x' &= y\\ y' &= -4x - cy \end{aligned}$$

where c > 0.