

- (c) (10 pts) For the Lienard system in (b), please show by LaSalle's invariant principle that

$$\lim_{t \rightarrow \infty} x(t) = \lim_{t \rightarrow \infty} y(t) = 0$$

if  $x^2(0) + y^2(0) < 3$ .

5. (a) (5 pts) State the Poincaré-Bendixson Theorem.

- (b) (10 pts) Show that, for all  $\alpha > 0$ , the system

$$\begin{aligned}x' &= y \\y' &= -x + (\alpha - x^2 - y^2)y\end{aligned}$$

has a unique stable limit cycle which is the  $\omega$ -limit set of every trajectory except the critical point at the origin.