

Score:

Name:

**HW4 - Due 02/27/2008**  
**ODE - spring 2008**

1) By using polar coordinates, prove that the system

$$\begin{cases} y' = y + x - y(x^2 + y^2) \\ x' = x - y - x(x^2 + y^2) \end{cases} \quad (1)$$

has a unique periodic solution.

2) Consider the following system in  $\mathbb{R}^2$  written in polar coordinates

$$\begin{cases} r' = r(1 - r) \\ \theta' = \sin^2(\theta/2) \end{cases} \quad (2)$$

determine the attraction properties of  $(0, 0)$  and  $(1, 0)$ .

3) Find all periodic solutions of

$$s^{(4)} + 2s'' + s = 0$$