

## SSM 553 - Nonlinear Systems - Spring 2009

Homework Set 3

due: Tuesday, March 3

1. A gradient vector field on  $\mathbb{R}^n$  is of the form

$$\dot{x} = -\frac{\partial V}{\partial x}(x)$$

where  $V : \mathbb{R}^n \rightarrow \mathbb{R}, x \mapsto V(x)$ , is a continuously differentiable function. Show that a gradient vector field cannot have periodic orbits.

Hint: Consider  $V$  along trajectories of the system.

Also, from the textbook, Nonlinear Systems by Hassan Khalil, third edition, do the following problems from Chapter 3

2. Problem 3.1, parts (1)-(6), pg. 105
3. Problem 3.4, pg. 105
4. Problem 3.5, pg. 105