Chemistry 5850 Fall 2005 Assignment 8

Due: Monday, Nov. 14.

Weight of this assignment: 29 marks

1. Characterize the behavior of the solutions of the non-autonomous differential equation

$$\dot{x} = -x\frac{\sin t}{t},$$

   as completely as you can. [10 marks]

2. Consider the differential equations

$$\begin{aligned} \dot{r} &= -ar, \\ \dot{\theta} &= \omega. \end{aligned}$$

   In these equations, r and θ represent the polar coordinates of a point in the plane.

   (a) Carry out a scale transformation to reduce the number of parameters appearing in these equations. [2 marks]

   (b) Describe the nature of the solutions of these equations for $a > 0$. [2 marks]

   (c) Now suppose that $a = a(t) = \sin(\Omega t)$. Using any appropriate methods, characterize the behavior of this time-dependent model as a function of Ω. [15 marks]