Homework #8
Due: Tuesday, November 20, 2007

1. (18 pt; 3pts each) Calculate e^{At} for the following matrices

$$\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 2 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad \begin{bmatrix} -3 & 1 & 7 \\ 0 & 4 & -1 \\ 0 & 0 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 1 & 1 \\ -1 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & -1 & 2 \\ 0 & 1 & 0 \\ 1 & 1 & -1 \end{bmatrix} \quad \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix}$$

2. (12 pt) Let A be a real matrix. Show that the differential equation $\dot{x} = Ax$ has the form $\dot{x} = -\nabla F(x)$ where $F : R^d \to R$ has continuous first partial derivatives, called a *gradient system*, if and only if A is a symmetric matrix.

Total: 30 pts