

Practice Problems.

SODE's

(1) Solve the initial value problem:

$$\dot{X} = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ 0 & -1 & 2 \end{bmatrix} \quad X(0) = \begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix}$$

(2) Find e^{At} for $A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$.

(3) (a) Transform the third order linear equation

$$y''' - y'' + 4y' - 4y = 0$$

into a system of linear differential equations of order 1. Write in matrix form.

(b) Find the general solution of the following linear system:

$$\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 4 & -4 & 1 \end{bmatrix} X = \dot{X} \quad (X: \mathbb{R} \rightarrow \mathbb{R}^3)$$

4) a 3×3 system of linear differential equations of order one,

$$A x = \dot{x}$$

has general solution

$$c_1 (e^t, 0, 0) + c_2 (e^{2t}, -e^{2t}, 0) + c_3 (te^{2t}, te^{2t}, e^{2t})$$

(a) Find e^{At} .

(b) Find A .