

2-D & n-D Homogeneous Linear Systems (3.3, 6.3)

1. Determine whether $\mathbf{x}_1(t) = e^{-t} \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$, $\mathbf{x}_2(t) = e^{-t} \begin{pmatrix} 1 \\ -4 \\ 1 \end{pmatrix}$, and $\mathbf{x}_3(t) = e^{8t} \begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}$ form a fundamental set of solutions for $\mathbf{x}' = \begin{pmatrix} 3 & 2 & 4 \\ 2 & 0 & 2 \\ 4 & 2 & 3 \end{pmatrix} \mathbf{x}$

2. For each of the following systems, find the general solution, draw a phase portrait, and classify the fixed point. If an initial value is given, also solve the initial value problem.

a. $\mathbf{x}' = \begin{pmatrix} 6 & 14 \\ 21 & -1 \end{pmatrix} \mathbf{x}.$

b. $\mathbf{x}' = \begin{pmatrix} 4 & 4 \\ 1 & 7 \end{pmatrix} \mathbf{x}.$

c. $\mathbf{x}' = \begin{pmatrix} -10 & 7 \\ 0 & -3 \end{pmatrix} \mathbf{x}.$