

Name: _____

Quiz 12, Section 8.1, due on _____

(10 pts) Verify that the vector $\bar{X} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} e^t + \begin{pmatrix} 4 \\ -4 \end{pmatrix} t e^t$ is a solution to the system of equations $\bar{X}' = \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} \bar{X}$. Recall that 'verify' means to plug the solution into both sides of the system of ODEs and show the left side equals the right side. The purpose is to acquaint you with the structure of the solution to a system. Do not use the eigenvalue approach to solve the system.

$$\begin{aligned} \text{left: } \bar{X}' &= \begin{pmatrix} 1 \\ 3 \end{pmatrix} e^t + \begin{pmatrix} 4 \\ -4 \end{pmatrix} [e^t + t e^t] \\ &= \begin{pmatrix} 1 \\ 3 \end{pmatrix} e^t + \begin{pmatrix} 4 \\ -4 \end{pmatrix} e^t + \begin{pmatrix} 4 \\ -4 \end{pmatrix} t e^t \\ &= \begin{pmatrix} 5 \\ -1 \end{pmatrix} e^t + \begin{pmatrix} 4 \\ -4 \end{pmatrix} t e^t \end{aligned}$$

$$\begin{aligned} \text{right: } \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} \bar{X} &= \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \end{pmatrix} e^t + \begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 4 \\ -4 \end{pmatrix} t e^t \\ &= \begin{pmatrix} 2+3 \\ -1+0 \end{pmatrix} e^t + \begin{pmatrix} 8-4 \\ -4+0 \end{pmatrix} t e^t \\ &= \begin{pmatrix} 5 \\ -1 \end{pmatrix} e^t + \begin{pmatrix} 4 \\ -4 \end{pmatrix} t e^t \end{aligned}$$