

Show all work. 5 points each.

1. Verify the vector $\mathbf{X} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} e^{-5t}$ is a solution to

$$\frac{dx}{dt} = 3x - 4y$$

$$\frac{dy}{dt} = 4x - 7y$$

2. $\mathbf{K}_1 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$ $\mathbf{K}_2 = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$ are eigenvectors of the coefficient matrix of the system below. Find the eigenvalues and give a general solution.

$$\frac{dx}{dt} = x + 2y$$

$$\frac{dy}{dt} = 4x + 3y$$