As usual, I hope you finish this in class, if not it is due Wednesday. We are interested in solving the initial value problem \( x'(t) = Ax(t), \quad x(0) = x_0 \) where

\[
A = \begin{bmatrix} 1 & 2 & -1 \\ 1 & 0 & 1 \\ 4 & -4 & 5 \end{bmatrix}, \quad \text{and} \quad x_0 = \begin{bmatrix} -8 \\ 6 \\ 22 \end{bmatrix}.
\]

1. Verify \( x_1 = \begin{bmatrix} -e^t \\ e^t \\ 2e^t \end{bmatrix} \) solves \( x'(t) = Ax(t) \).

2. Verify \( x_2 = \begin{bmatrix} -2e^{2t} \\ e^{2t} \\ 4e^{2t} \end{bmatrix} \) solves \( x'(t) = Ax(t) \).

3. Verify \( x_3 = \begin{bmatrix} -e^{3t} \\ e^{3t} \\ 4e^{3t} \end{bmatrix} \) solves \( x'(t) = Ax(t) \).

4. Show \( W[x_1, x_2, x_3] \neq 0 \).
5. Find a fundamental matrix $X(t)$ for $x'(t) = Ax(t)$ and then evaluate $X(0)$.

6. Use row reduction to determine $X^{-1}(0)$.

7. You will show in the Section 9.4 #28 that $x(t) = X(t)X^{-1}(0)x_0$ is the solution to the given initial value problem. Using the pieces you have computed, perform this multiplication and express $x(t)$ as a vector function.