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427J Quiz

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1. What is the general solution to

$$\frac{d}{dt} \vec{x} = \begin{bmatrix} 0 & 1 \\ -3 & 4 \end{bmatrix} \vec{x}?$$

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$$\begin{bmatrix} x_1' \\ x_2' \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} x_2 \\ -3x_1 + 4x_2 \end{bmatrix}$$

$$\begin{array}{l|l} x_1' = x_2 & \text{Let} \\ x_2' = -3x_1 + 4x_2 & y = x_1, y' = x_1' = x_2 \end{array} \quad \left. \begin{array}{l} y'' = -3y + 4y' \end{array} \right\}$$

$$\rightarrow y'' - 4y' + 3y = 0$$

$$\rightarrow r^2 - 4r + 3 = 0$$

$$(r-3)(r-1) = 0$$

$$\rightarrow r = \{3, 1\}$$

$$y = e^t v e^{3t} \rightarrow x_1 = e^t v e^{3t}$$

$$\vec{x}^1 = \begin{bmatrix} e^t \\ e^t \end{bmatrix} \quad \vec{x}^2 = \begin{bmatrix} e^{3t} \\ 3e^{3t} \end{bmatrix}$$

$$\therefore \text{Gen. sol} = \vec{x} = C_1 \begin{bmatrix} e^t \\ e^t \end{bmatrix} + C_2 \begin{bmatrix} e^{3t} \\ 3e^{3t} \end{bmatrix}$$