

12.352

EE25BTECH11026-Harsha

Question:

The matrix form of the linear system

$$\frac{dx}{dt} = 3x - 5y$$

$$\frac{dy}{dt} = 4x + 8y$$

is

$$1) \frac{d}{dt} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & -5 \\ 4 & 8 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$2) \frac{d}{dt} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & 8 \\ 4 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$3) \frac{d}{dt} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 & -5 \\ 3 & 8 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

$$4) \frac{d}{dt} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 & 8 \\ 3 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Solution:

Let us solve the given question theoretically and then verify the solution computationally.

The given differential equations,

$$\frac{dx}{dt} = \begin{pmatrix} 3 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad (4.1)$$

$$\frac{dy}{dt} = \begin{pmatrix} 4 & 8 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad (4.2)$$

From (4.1) and (4.2),

$$\begin{pmatrix} \frac{dx}{dt} \\ \frac{dy}{dt} \end{pmatrix} = \begin{pmatrix} 3 & -5 \\ 4 & 8 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad (4.3)$$

$$\Rightarrow \frac{d}{dt} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & -5 \\ 4 & 8 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \quad (4.4)$$