12.352

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

Theoretical Solution

The given differential equations,

$$\frac{dx}{dt} = \begin{pmatrix} 3 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \tag{1}$$

$$\frac{dy}{dt} = \begin{pmatrix} 4 & 8 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} \tag{2}$$

From (1) and (2),

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

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