

## Problem 25

In each of Problems 25 and 26, verify that the given matrix satisfies the given differential equation.

$$\mathbf{\Psi}' = \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} \mathbf{\Psi}, \quad \mathbf{\Psi}(t) = \begin{pmatrix} e^{-3t} & e^{2t} \\ -4e^{-3t} & e^{2t} \end{pmatrix}$$

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### Solution

Check to see that the given matrix satisfies the ODE.

$$\begin{aligned} \begin{pmatrix} e^{-3t} & e^{2t} \\ -4e^{-3t} & e^{2t} \end{pmatrix}' &\stackrel{?}{=} \begin{pmatrix} 1 & 1 \\ 4 & -2 \end{pmatrix} \begin{pmatrix} e^{-3t} & e^{2t} \\ -4e^{-3t} & e^{2t} \end{pmatrix} \\ \begin{pmatrix} (-3)e^{-3t} & (2)e^{2t} \\ -4(-3)e^{-3t} & (2)e^{2t} \end{pmatrix} &\stackrel{?}{=} \begin{pmatrix} e^{-3t} - 4e^{-3t} & e^{2t} + e^{2t} \\ 4e^{-3t} + 8e^{-3t} & 4e^{2t} - 2e^{2t} \end{pmatrix} \\ \begin{pmatrix} -3e^{-3t} & 2e^{2t} \\ 12e^{-3t} & 2e^{2t} \end{pmatrix} &= \begin{pmatrix} -3e^{-3t} & 2e^{2t} \\ 12e^{-3t} & 2e^{2t} \end{pmatrix} \end{aligned}$$

Because the left and right sides are the same, the given matrix for  $\mathbf{\Psi}(t)$  is indeed a solution.