Step-1

Consider the following matrix:

$$B = \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix}$$

$$\begin{aligned} B \cdot B &= \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix} \\ &= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \end{aligned}$$

Find e^{Bt} and then check the derivative is Be^{Bt}.

Step-2

Substitute B in the expansion of e^{Bt}.

$$\begin{aligned} e^{Bt} &= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 0 & -t \\ 0 & 0 \end{bmatrix} \\ &= \begin{bmatrix} 1 & -t \\ 0 & 1 \end{bmatrix} \end{aligned}$$

Step-3

Calculate the following:

$$\begin{aligned} B \cdot e^{Bt} &= \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} 1 & -t \\ 0 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix} \\ &= B \end{aligned}$$

Now, calculate the derivative of e^{Bt}

$$\begin{aligned} \frac{d}{dt} e^{Bt} &= \begin{bmatrix} 1 & -t \\ 0 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 0 & -1 \\ 0 & 0 \end{bmatrix} \\ &= B \\ &= B \cdot e^{Bt} \end{aligned}$$

Step-4

Therefore, derivative of e^{Bt} is $\boxed{Be^{Bt}}$