Step-1

Consider the following matrix:

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

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

$$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

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

Step-2

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

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

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

Step-3

Calculate the following:

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

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

$$= B$$

Now, calculate the derivative of e^{Bt}

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

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

$$= B$$

$$= B \cdot e^{Bt}$$

Step-4

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