A Rotation Matrix

First we note that

$$K^2 = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} = -I$$

$$K^3 = K^2 K = -K, K^4 = K^2 K^2 = I, K^5 = K^4 K = K, \text{ etc.}$$

Therefore

$$\begin{aligned} e^{\theta K} &= I + \theta K + \frac{1}{2!}\theta^2 K^2 + \frac{1}{3!}\theta^3 K^3 + \frac{1}{4!}\theta^4 K^4 + \frac{1}{5!}\theta^5 K^5 + \cdots \\ &= I + \theta K + \frac{1}{2!}\theta^2(-I) + \frac{1}{3!}\theta^3(-K) + \frac{1}{4!}\theta^4(I) + \frac{1}{5!}\theta^5(K) + \cdots \\ &= \left(I - \frac{1}{2!}\theta^2 + \frac{1}{4!}\theta^4 - \cdots \right) I + \left(\theta - \frac{1}{3!}\theta^3 + \frac{1}{5!}\theta^5 - \cdots \right) K \\ &= (\cos\theta)\, I + (\sin\theta)\, K = \begin{bmatrix} \cos\theta & 0 \\ 0 & \cos\theta \end{bmatrix} + \begin{bmatrix} 0 & -\sin\theta \\ \sin\theta & 0 \end{bmatrix} \\ &= \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \quad \text{(i.e. a } \theta \text{ radians rotation of the plane)} \end{aligned}$$