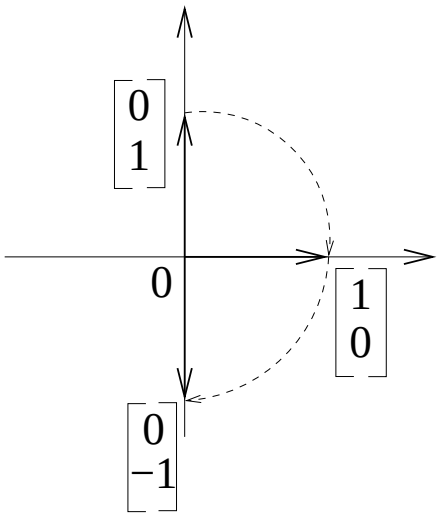
1. Describe the linear transformation with the matrix $A = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ geometrically.

Solution. Since the matrix is 2×2, it defines a linear transformation $\mathbf{R}^2 \longrightarrow \mathbf{R}^2$. Let us see where do the basis vectors go when we apply the transformation:

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



Hence we observe that the transformation is the rotation of the plane clockwise through an angle of 90°.

Answer. The transformation is the rotation of the plane clockwise through an angle of 90°.