1. Suppose \( A = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \) and \( B = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix} \).

(a) Let \( T \) be the transformation with standard matrix \( AB \). What 2D transformation is performed by \( T \) when it acts on the homogeneous coordinates of a point \((x, y)\)?

(b) Let \( L \) be the transformation with standard matrix \( BA \). What 2D transformation is performed by \( T \) when it acts on the homogeneous coordinates of a point \((x, y)\)?

(c) Is the transformation performed by \( T \) the same as the transformation performed by \( L \)? Justify your answer.

2. For each of the following, determine if \( v \) is an eigenvector of \( A \). If so, find the eigenvalue.

(a) \( v = \begin{bmatrix} 4 \\ 3 \\ 1 \end{bmatrix}, A = \begin{bmatrix} 3 & 7 & 9 \\ -4 & -5 & 1 \\ 2 & 4 & 4 \end{bmatrix} \)

(b) \( v = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}, A = \begin{bmatrix} 3 & 6 & 7 \\ 3 & 3 & 7 \\ 5 & 6 & 5 \end{bmatrix} \)

3. For each of the following, find a basis for the eigenspace corresponding to the listed eigenvalue.

(a) \( A = \begin{bmatrix} 4 & -2 \\ -3 & 9 \end{bmatrix} \), \( \lambda = 10 \)

(b) \( A = \begin{bmatrix} 4 & 2 & 3 \\ -1 & 1 & -3 \\ 2 & 4 & 9 \end{bmatrix} \), \( \lambda = 3 \)

4. Suppose the 2 \( \times \) 2 matrix \( A \) has an eigenvalue \( \lambda = -1 \) with associated eigenvector \( x = \begin{bmatrix} 3 \\ 4 \end{bmatrix} \). What is \( A^{45}x \)?

5. Let \( A \) be the standard matrix for the linear transformation that reflects vectors in \( \mathbb{R}^2 \) across the line \( 2x_2 = 3x_1 \). Without finding the matrix \( A \), find both eigenvalues of \( A \) and describe their eigenspaces.