# Linear Transformations

For each matrix, determine:

1. The product of the matrix times each vector: $\mathbf{u} = \begin{bmatrix}1\\0\end{bmatrix}$, $\mathbf{v} = \begin{bmatrix}0\\1\end{bmatrix}$, and $\mathbf{x} = \begin{bmatrix}1\\1\end{bmatrix}$.
2. Draw the vectors and the matrix vector products on one of the provided axis.
3. Based on the change observed, label the transformation as one of the following:

- Reflection over $x$-axis.
- Reflection over $y$-axis.
- Reflection over $y = -x$
- Reflection over the origin.
- Horizontal contraction
- Vertical expansion
- Rotation by angle $\frac{3\pi}{2}$
- Rotation by angle $\frac{\pi}{2}$
- Horizontal shear
- Vertical shear
- Projection onto $x$-axis
- Projection onto $y$-axis

- $A = \begin{bmatrix}0 & 1\\-1 & 0\end{bmatrix}$
- $B = \begin{bmatrix}-1 & 0\\0 & 1\end{bmatrix}$
- $C = \begin{bmatrix}\frac{1}{2} & 0\\0 & 1\end{bmatrix}$
- $D = \begin{bmatrix}1 & 2\\0 & 1\end{bmatrix}$
- $E = \begin{bmatrix}1 & 0\\0 & 0\end{bmatrix}$
- $F = \begin{bmatrix}1 & 0\\0 & -1\end{bmatrix}$
- $G = \begin{bmatrix}0 & -1\\-1 & 0\end{bmatrix}$
- $H = \begin{bmatrix}0 & 0\\0 & 1\end{bmatrix}$
- $J = \begin{bmatrix}1 & 0\\-2 & 1\end{bmatrix}$
- $K = \begin{bmatrix}1 & 0\\0 & 2\end{bmatrix}$
- $L = \begin{bmatrix}0 & -1\\1 & 0\end{bmatrix}$
- $M = \begin{bmatrix}-1 & 0\\0 & -1\end{bmatrix}$