

## Chapter 2 Section 2

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The letter L can be represented by the vectors  $(0, 2)$  and  $(1, 0)$ .



The following problems ask for a linear transformation of the letter L. In the following problems, give the matrix of the transformation and plot the result.

**Problem 1.** Scale  $L$  by a factor of  $\frac{1}{2}$

**Solution.** The matrix of the transformation is

$$\begin{bmatrix} 0.5 & 0.0 \\ 0.0 & 0.5 \end{bmatrix}$$

*After the scaling, the  $L$  looks like this*



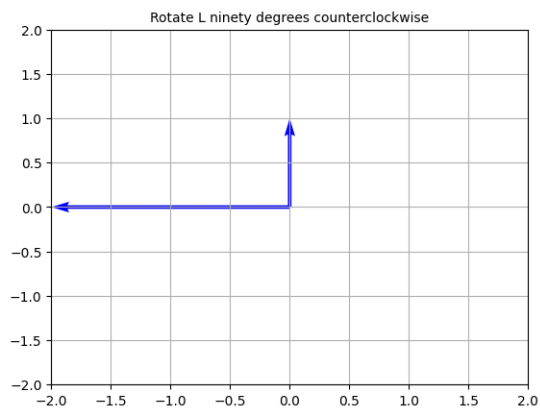
*Note that in creating this shape, we scaled both vectors that make up the L.*

**Problem 2.** *Rotate L ninety degrees counterclockwise*

**Solution.** *The matrix of the transformation is*

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

*After the rotation, the L looks like this*

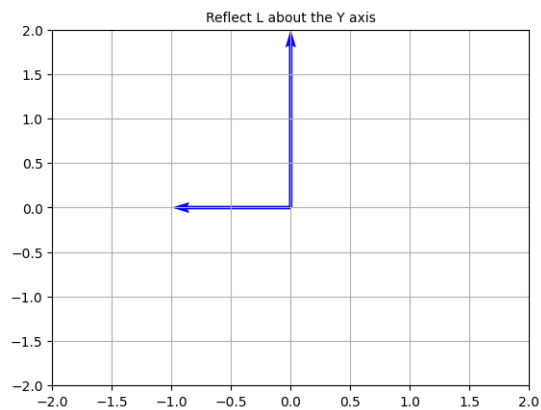


**Problem 3.** *Reflect L about the Y axis*

**Solution.** *The matrix of the transformation is*

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

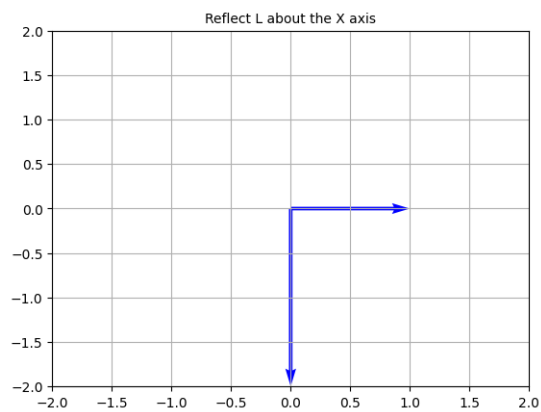
*The plot looks like this*



**Problem 4.** *Reflect  $L$  about the  $X$  axis*

**Solution.** *The matrix of the transformation is*

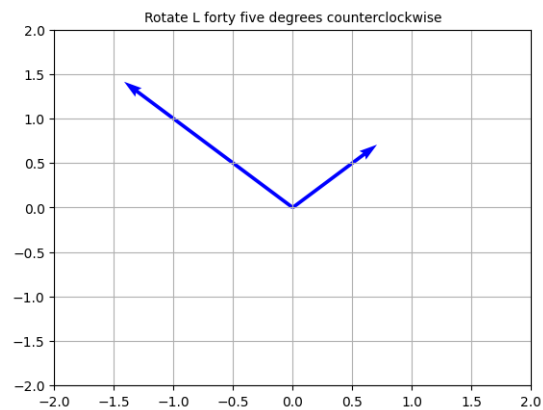
$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$



**Problem 5.** *Rotate  $L$  forty five degrees counterclockwise*

**Solution.** *The matrix of the transformation is*

$$\begin{bmatrix} \cos(\frac{\pi}{4}) & -1 * \sin(\frac{\pi}{4}) \\ \sin(\frac{\pi}{4}) & \cos(\frac{\pi}{4}) \end{bmatrix}$$



**Problem 6.** Find the orthogonal projection of  $L$  onto the  $x$ -axis

**Solution.** The matrix of the transformation is

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



**Problem 7.** Find the orthogonal projection of  $L$  onto the  $y$ -axis

**Solution.** The matrix of the transformation is

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

