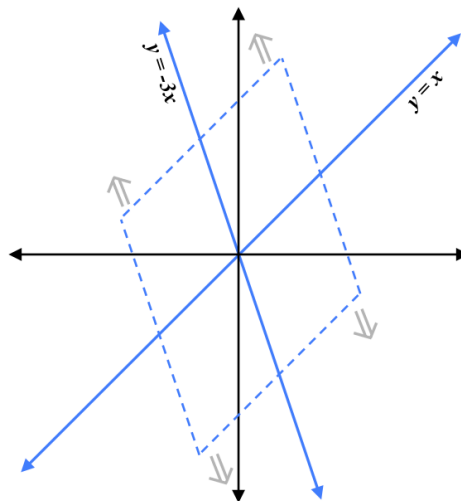# The Stretching Problem

Imagine a linear transformation $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ that has the following properties:

In the direction along the line $y = -3x$, the transformation stretches all points by a factor of two.

In the direction along the line $y = x$, the transformation keeps all points fixed.

1. Use the space on the right to sketch what should happen to the image shown on the left when it is stretched according to the transformation described above. You may use a combination of intuition or calculations, as well as any additional sketches below or on your group's whiteboard.
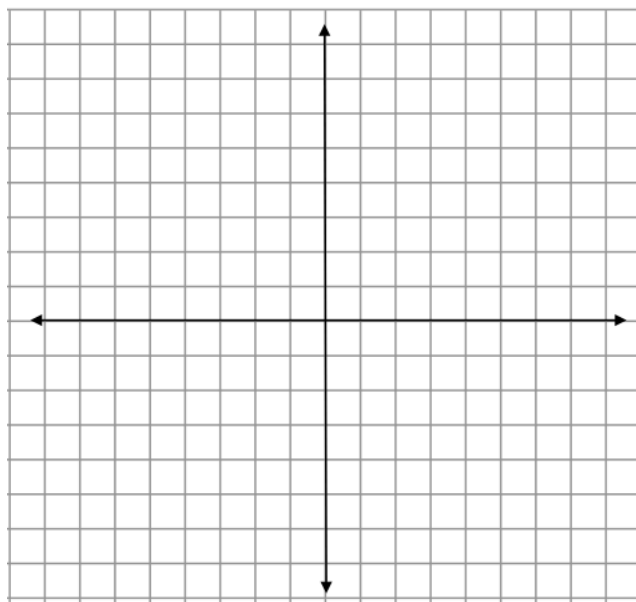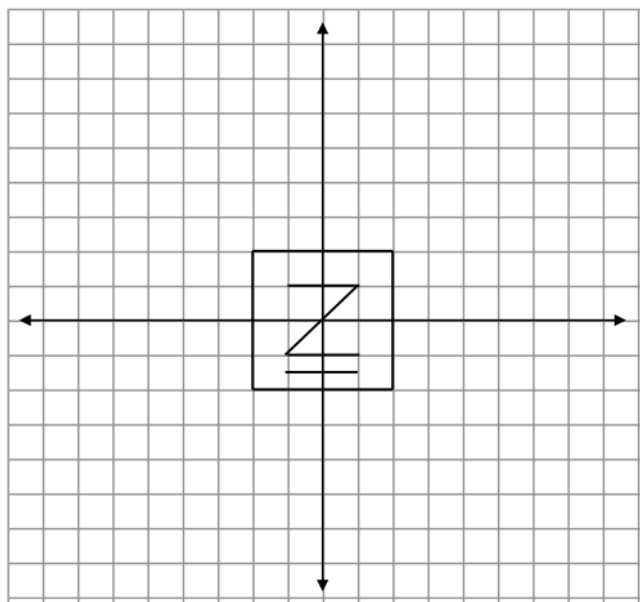
2. Determine what will happen to $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$ and to $\begin{bmatrix} -2 \\ 2 \end{bmatrix}$ under this transformation. Use an initial estimate from your sketch in problem 1. Then try to do a calculation that will determine these locations more precisely.

3. Determine a matrix that allows you to calculate what happens under the transformation to any point on the plane. Use it to check your sketch or improve its accuracy.