

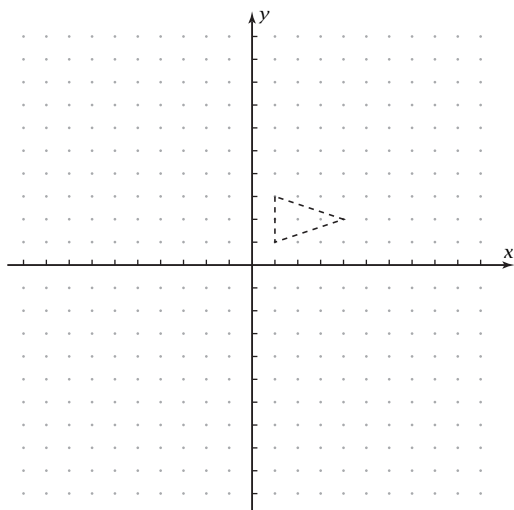
Exploration 11-3a: Matrix Images and Transformations

Date: _____

Objective: Transform an image by multiplying by a matrix.

1. Matrix $[M]$ describes the triangle shown here. What do the columns represent?

$$[M] = \begin{bmatrix} 1 & 4 & 1 \\ 1 & 2 & 3 \end{bmatrix}$$



2. Matrix $[A]$ is a **transformation matrix**. Multiply $[A][M]$ and write the answer here.

$$[A] = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

3. Explain why you can't multiply $[M][A]$.
4. The figure corresponding to the answer in Problem 2 is called the **image** of $[M]$ for the transformation $[A]$. Plot the image on the given figure.
5. How would you describe the transformation defined by matrix $[A]$?
6. The original triangle whose matrix is $[M]$ is called the **pre-image**. Why is this its name?

7. Matrix $[B]$ is another transformation matrix.

$$[B] = \begin{bmatrix} \cos 90^\circ & \cos 180^\circ \\ \sin 90^\circ & \sin 180^\circ \end{bmatrix}$$

Apply the transformation by calculating $[B][M]$. Plot the result on the given figure.

8. Matrix $[B]$ in Problem 7 **rotates** the pre-image by 90° counterclockwise. Write a matrix $[C]$ that you think will rotate the pre-image by 40° counterclockwise. To do this, you should realize that the angle in the second column is 90° more than the angle in the first column. Apply the transformation by calculating $[C][M]$. Write the answer with elements rounded to one decimal place.
9. Plot the image from Problem 8 on the given figure. Extend one side of the pre-image and the corresponding side of the image and measure the angle with a protractor. Did the transformation really rotate the pre-image by 40° ?
10. Write a transformation matrix $[D]$ that both **dilates** by a factor of 2 and rotates by 240° . Calculate $[D][M]$. Write the image matrix with elements rounded to one decimal place, and plot the image on the given figure.
11. What did you learn as a result of doing this Exploration that you did not know before?