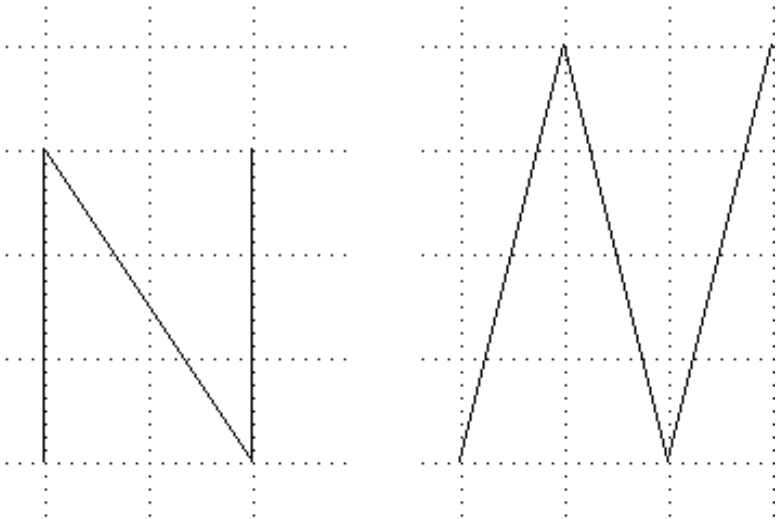
THE ITALICIZING N PROBLEM

Name _____ Group Members _____



Suppose the "N" on the left is written in regular 12-point font. Find a matrix A that will transform N into the letter on the right, which is written in 'italics' in 16-point font.

$A =$

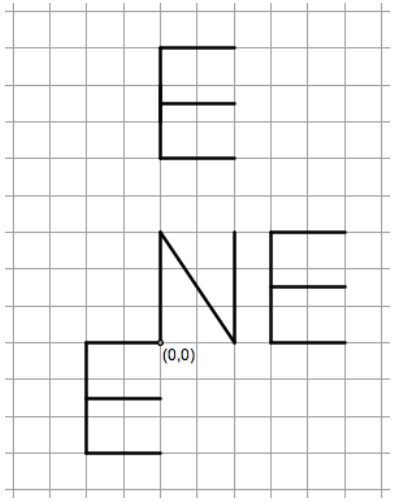
Work with a small group and write out your solution and approach. Make a list of any assumptions you notice your group making, or any questions for further pursuit that come to mind.

BEYOND THE N

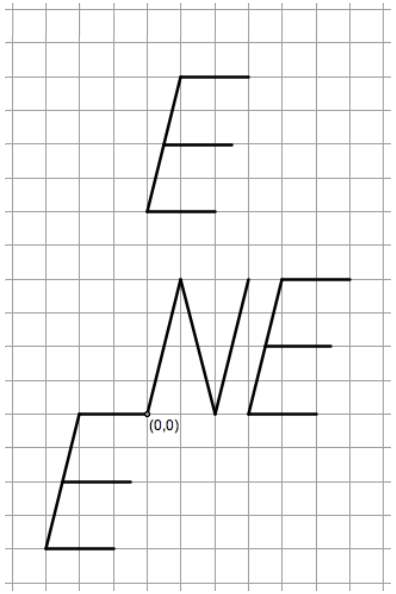
Name: _____

After class, a few students were wondering how letters places in other locations in the plane would be transformed under $A = \begin{bmatrix} 1 & 1/3 \\ 0 & 4/3 \end{bmatrix}$. If an "E" is placed around the "N," the students argued over four different possible results for the transformed E's. Which choice below is correct, and why? If none of the four options are correct, what would the correct option be, and why?

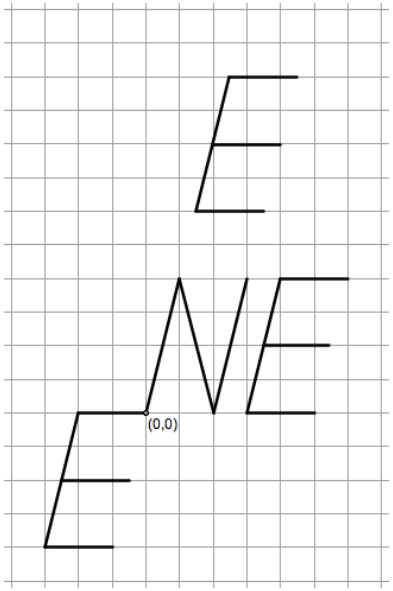
Original:



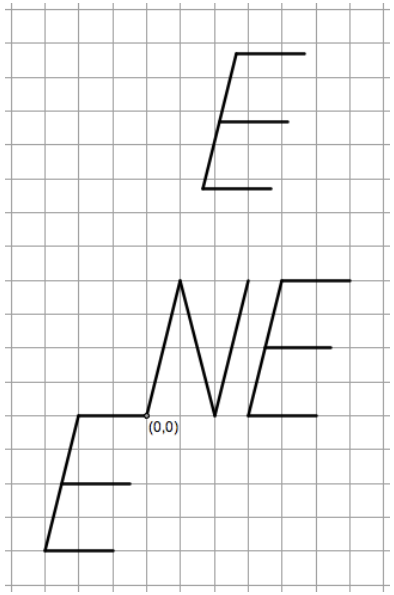
Choice A:



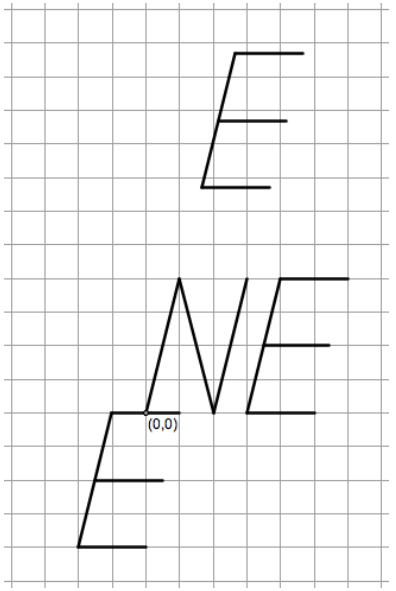
Choice B:



Choice C:

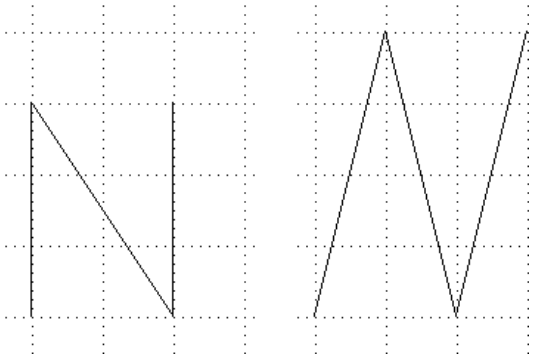


Choice D:



PAT AND JAMIE

Name _____ Group Members _____



Suppose the "N" on the left is written in regular 12-point font. Find a matrix A that will transform N into the letter on the right, which is written in italics in 16-point font.

Last semester, two linear algebra students—Pat and Jamie—described their approach to the Italicizing N Task in the following way:

"In order to find the matrix A, we are going to find a matrix that makes the "N" taller (from 12-point to 16-point), find a matrix that italicizes the taller "N," and the combination of those will be the desired matrix A."

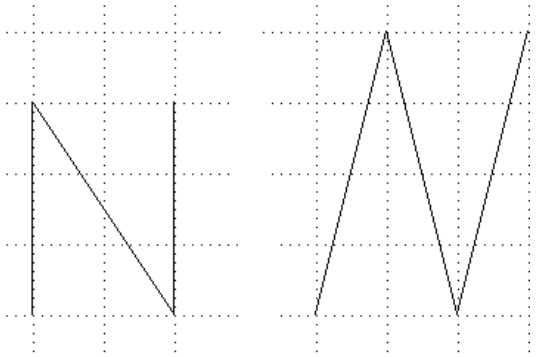
1. Do you think their approach allowed them to find a matrix A? Does it seem sensible? If so, do you think it was the same matrix A we found this semester?

2. Try Pat and Jamie's approach. You should either: (a) come up with a matrix A by using their approach, or (b) be able to explicitly explain why this approach does not work.

   Use your group's whiteboard as a space to work together on this problem.

GETTING BACK TO THE N

Name _____ Group Members _____



Suppose the "N" on the left is written in regular 12-point font. Find a matrix *A* that will transform N into the letter on the right, which is written in italics in 16-point font.

Last semester, two linear algebra students—Pat and Jamie—described their approach to the Italicizing N Task in the following way:

"In order to find the matrix *A*, we are going to find a matrix that makes the "N" taller (from 12-point to 16-point), find a matrix that italicizes the taller "N," and the combination of those will be the desired matrix *A*."

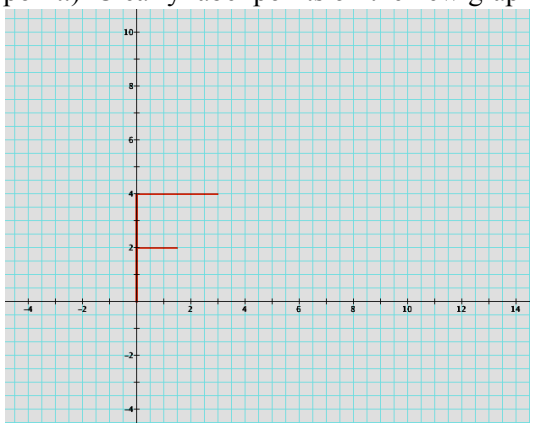
Consider the following new task:

Find a matrix *C* the will transform the letter on the right back into the letter on the left.

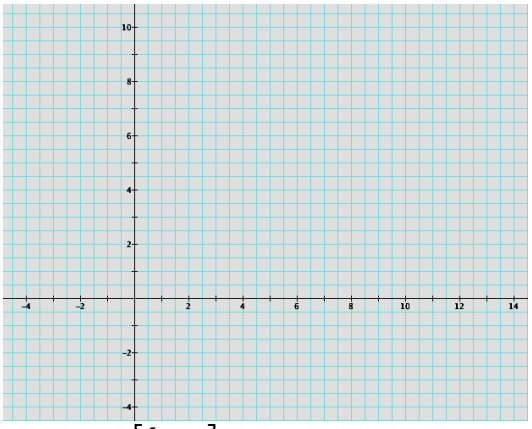
1. Find *C* using either your method or one of your classmates' methods for finding *A*.
2. Find *C* using Pat and Jamie's method for finding *A*.

Geometric interpretation of a matrix times a vector.

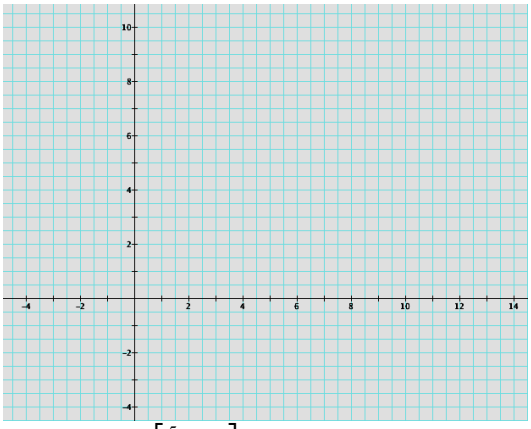
Consider the capital letter F as drawn on the upper left graph below. Some important points on the F occur at (0,0), (0,2), (0,4), (3,4) and (1.5,2). For each of the matrices listed, draw the image of the F when each point of the original F is multiplied by that matrix (e.g., for matrix **A** and point **x**, multiply **Ax** to find the new point.) Clearly label points on the new graphs.



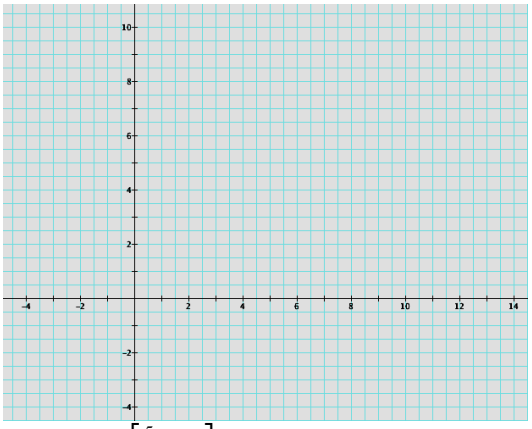
Original



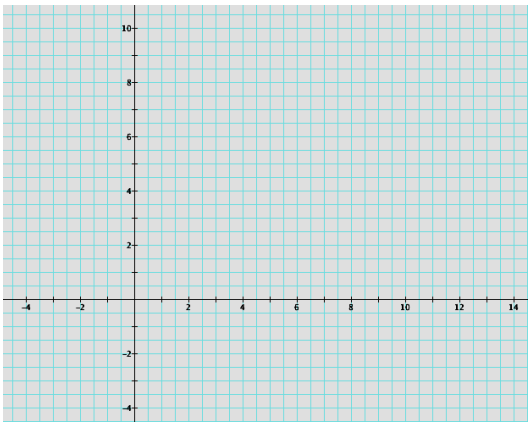
$$\mathbf{A} = \begin{bmatrix} \frac{5}{3} & 0 \\ 0 & 2 \end{bmatrix}$$



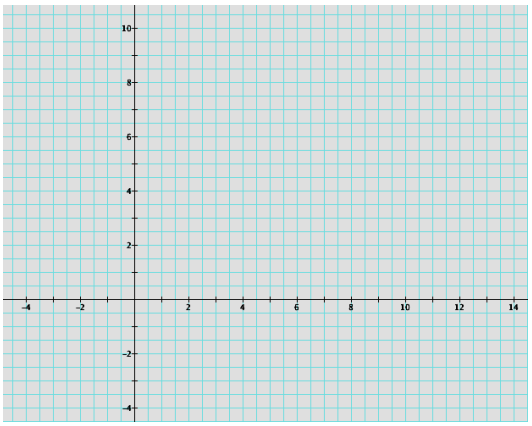
$$\mathbf{B} = \begin{bmatrix} \frac{5}{3} & 1 \\ 0 & 2 \end{bmatrix}$$



$$\mathbf{C} = \begin{bmatrix} \frac{5}{3} & 0 \\ 1 & 2 \end{bmatrix}$$



$$\mathbf{D} = \begin{bmatrix} \frac{5}{3} & 0 \\ 0 & -1 \end{bmatrix}$$



$$\mathbf{E} = \begin{bmatrix} \frac{5}{3} & 0 \\ 0 & 0 \end{bmatrix}$$

Generalizations.

$$\mathbf{M} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

For what values of a, b, c. d, will each of the following occur:

1. A stretch of 2 in the x direction and a stretch of 3 in the y direction.

2. A reflection across the x-axis.

3. A reflection across the line y = x.

4. A collapse on the y-axis.

5. A rotation of 180 degrees.

6. A rotation counterclockwise of 90 degrees.