# Math 1600 Activity - Linear Transformations

- Complete this activity in groups of 4-5.

- Record your answers in one group workbook.

- Scrap paper, textbooks and/or lecture notes may be used as aids.

- **After completing each section, verify your group's answers with the TA before proceeding to the next section.**

- Please ensure that the name, student number, and lecture section of each group member is recorded in your workbook before handing it in at the end of tutorial.
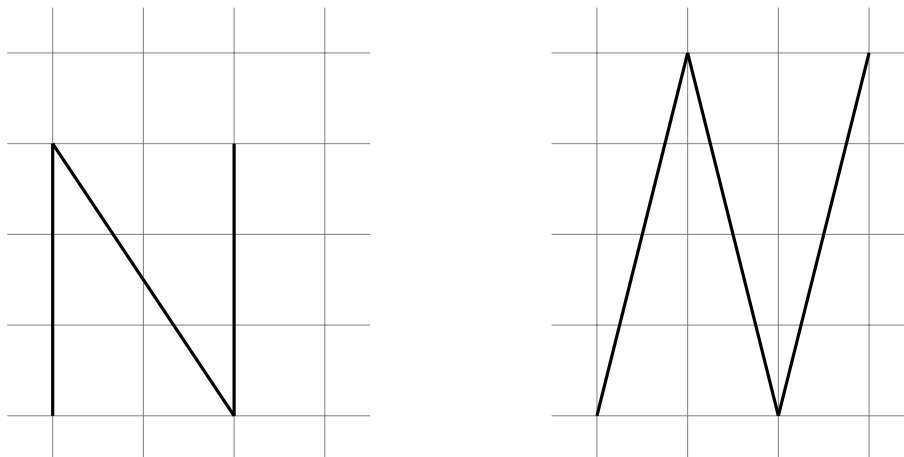
Suppose the "N" on the left is written in regular 12-point font and that the "N" on the right is written in *italics* in 16-point font.

Part A:

Let T be the transformation which takes the "N" on the left to the "N" on the right.

1. What is the domain of T?

2. What is the codomain of T?

3. Describe the action T has on the letter "N". Try to be as specific as possible.

Let A be a matrix which represents the transformation T. This means that for a vector $\mathbf{x}$ in the domain of T and a vector $\mathbf{y}$ in the codomain of T, $T(\mathbf{x}) = \mathbf{y}$ if and only if $A\mathbf{x} = \mathbf{y}$.

A pair of vectors $\{\mathbf{x}, \mathbf{y}\}$ is called an **input-output** pair for T if $T(\mathbf{x}) = \mathbf{y}$.

4. What is the size of A?

5. How many input-output pairs $\{\mathbf{x}, \mathbf{y}\}$ are required to determine A?

6. Using the graphs above, provide a sufficient set of input-output pairs.
   Hint: It may be useful to place the origin at the bottom left corner of the "N" and to draw $\mathbf{x}$ and $\mathbf{y}$ as position vectors from the origin to a point on the letter "N".

7. Use these input-output pairs to compute the matrix A.

Part B:

1. Determine the matrix B which transforms the italic 16-point "N" on the right back to the 12-point "N" on the left.

2. Describe the relationship between B and the matrix A from Part A.

3. Consider the collection of letters pictured below. Out of the four choices shown, which represents the image of this collection under the transformation T?