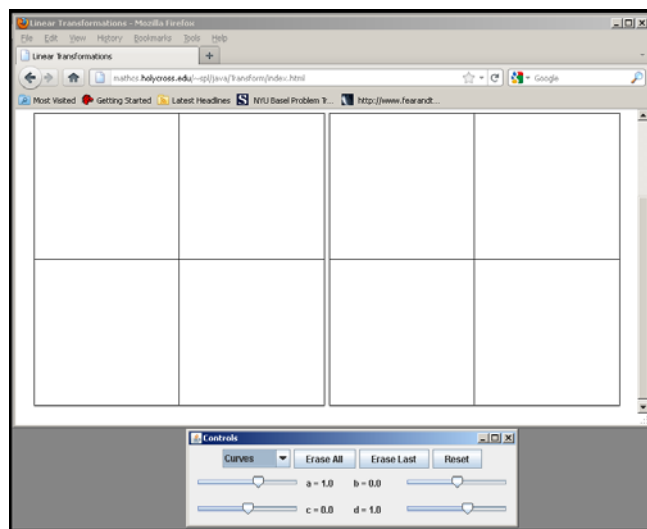


Linear Algebra Computer Lab 2 Webpage Instructions

1. Go to <http://mathcs.holycross.edu/%7Eespl/java/Transform/index.html> or to the class webpage and use the link there. The class webpage is accessible from dankalman.net.
2. When the webpage has completely loaded, you should see two windows. Use the mouse to arrange them as in the figure at right. Size the firefox window as shown, and then position the controls window directly below that.



3. **Defining a matrix:** The slider bars allow you to set the four entries of a 2×2 matrix. When the window first opens the matrix is

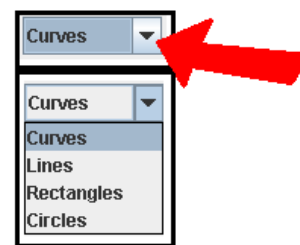
$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

Use the slider bars to change the matrix to

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} -1 & 0 \\ 0 & .5 \end{bmatrix}$$

Do that now. **Hint:** if fine adjustments of the slider bars are difficult with the mouse, try using the left and right arrow keys on the keyboard.

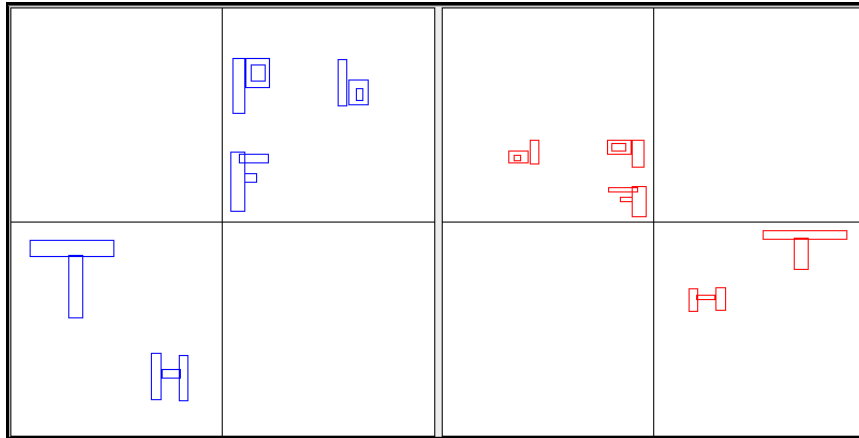
4. **Using the Drawing Controls:** On the control panel you can choose several options for drawing in the graph window by using the drop down menu as shown at right. If you select *Curves*, clicking and dragging the mouse in the left graph window will create a drawing in both windows. By selecting *Lines*, *Rectangles*, or *Circles*, you can drag the mouse in the left window to draw objects of each type in *both* windows. Experiment with that now.



5. **What's the point?** When you draw an object in the graph on the left, you are highlighting a set of points in the plane. If you think of a highlighted point (x,y) as a column vector $\begin{bmatrix} x \\ y \end{bmatrix}$, we can multiply by the matrix A to obtain a transformed point. That one is highlighted in the window on the right. By observing how a shapes and their

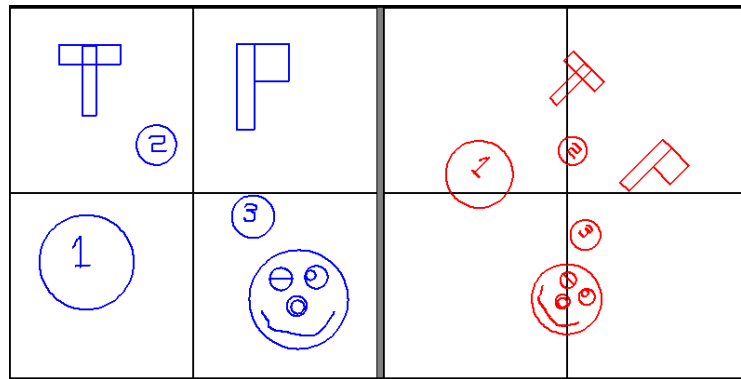
transformations, you can discover the geometric behavior of a given matrix.

Using the circle and rectangle drawing features, in particular, can show you what is going on. In the figure below, rectangles were used to create some familiar



letter shapes. They suggest the following description of the transformation: Each figure is reflected across the y axis and then vertically compressed toward the x axis. That is the kind of description you are trying to find for each type of matrix you study in this lab.

Circles are useful for checking if a transformation stretches an image different amounts in different directions. The example above pretty clearly compresses an image vertically. In the figure below the circles show that the transformation does not stretch or shrink a figure significantly more in one direction than another.



- Keeping a record of your work.** You may like to keep a microsoft word document open as you do the lab, to record your work. You can make create pictures in the word document of the control window to show what matrix is being used, and of the graph window to show the shapes you created. Here is how: click on the window you want to put into your document. Then on the keyboard hold down the *alt* key and press the *print screen* key once. Then click on the word document and paste the image into your document. You can either type *ctrl - V* or use the paste command on the edit menu. Save your word document frequently. At the end of the lab, either save it on a network drive, a memory stick, or email it to yourself.