Atanas Delevski
ECE 515 HW #4
4/6/2020

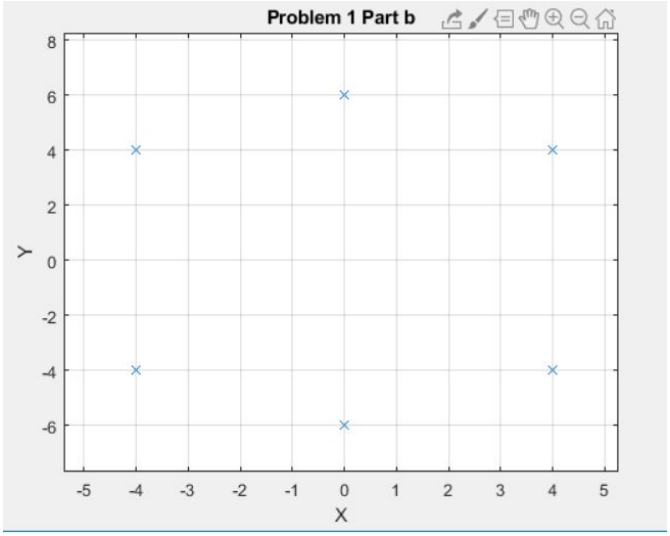
Problem 1

Part A:

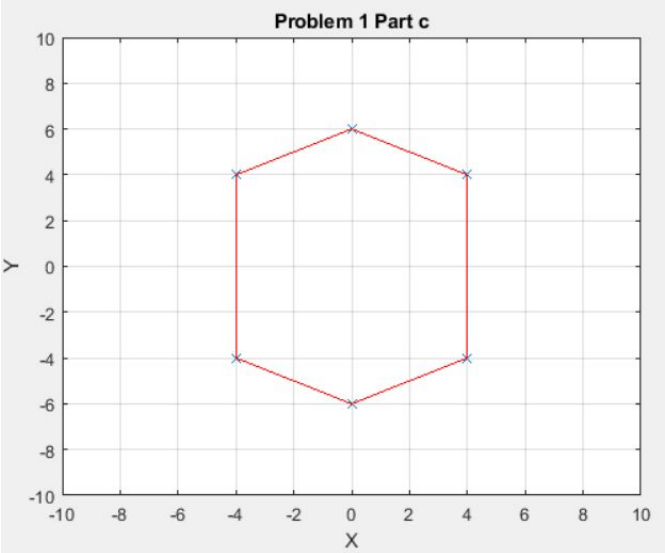
The following point in (x,y) coordinates are:

A = 0 6
B = 4 4
C = 4 -4
D = 0 -6
E = -4 -4
F = -4 4

Part B:



Part C:



Problem 2

Part A:

For the rotation and translation aspects of our matrix, we will have to multiply by cos and sin in the 4 upper left values of the matrix and then provide the translation vector in the upper right 2 values in this fashion:

$$\begin{pmatrix} \cos\theta_1 & -\sin\theta_1 & x_t \\ \sin\theta_1 & \cos\theta_1 & y_t \\ 0 & 0 & 1 \end{pmatrix}$$

Then, we have to take care of the shear. Shearing is a manipulation of scaling, and in this case we only scale the 'sin' values of our matrix. We simply put a 0.5 in front of those 'sin's. Like this:

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[   cosd(30)        -0.5*sind(30)    4;
 0.5*sind(30)         cosd(30)       5;
       0                 0          1]
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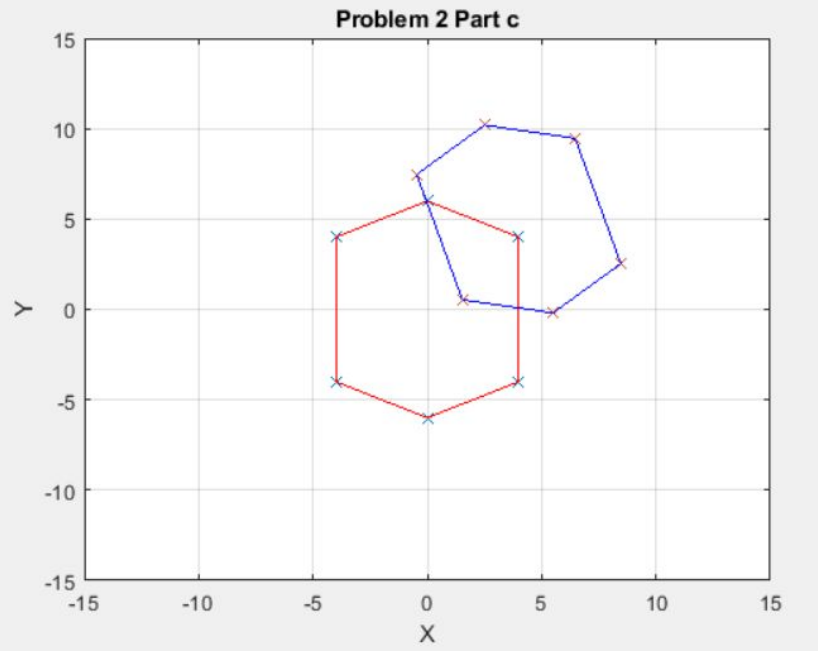
Part B:

I used Matlab's hom2cart function for this portion of the problem for convenience. If we wanted to convert them manually, we would simply divide the primary coordinate by the third coordinate.

Part C:

(For reference, I included the original hexagon in red, and the new one in blue)



Problem 3:

Part A:

To find the intersection of two lines using homogeneous coordinates, you simply just need to turn the line equations into 1x3 vectors and then take their cross product.

The first vector would be [-0.5 -1 6] and the second would be [1 0 -4]. Then we take the cross product and we get [4 4 1].

This means that our lines intersect at the point (4,4) in Cartesian space.