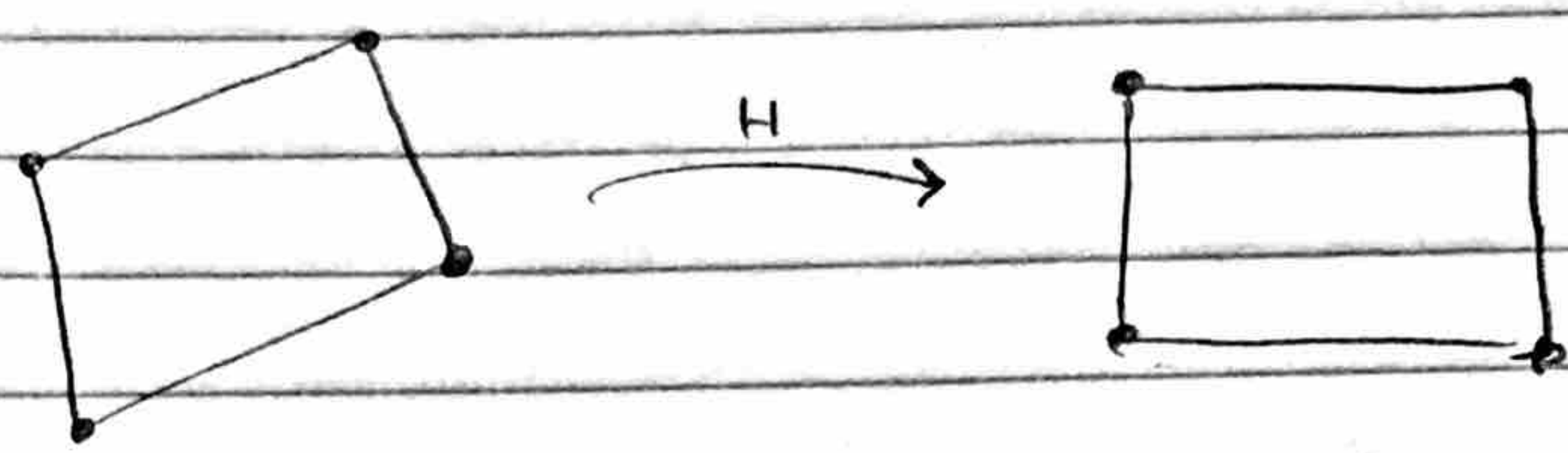
Homework # 2

2)



Since we are working in homogeneous coordinates, the relationship between two corresponding points X and X' can be re-written as

$$c \begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = H \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \qquad \text{(eq 1)}$$

where c is any non-zero constant, $(u \ v \ 1)^T$ represents x', $(x \ y \ 1)^T$ represents x and

$$H = \begin{bmatrix} h_1 & h_2 & h_3 \\ h_4 & h_5 & h_6 \\ h_7 & h_8 & h_9 \end{bmatrix}$$

Dividing the first row of eq. 1 by the third row and the second row by the third row we get the following two equations.

$$-h_1x - h_2y - h_3 + (h_7x + h_8y + h_9)u = 0$$
$$-h_4x - h_5y - h_6 + (h_7x + h_8y + h_9)u = 0$$

Now it can be written in matrix form as

$$Aq = 0$$

where $A = \begin{bmatrix} -x & -y & -1 & 0 & 0 & 0 & ux & uy & u \\ 0 & 0 & 0 & -x & -y & -1 & vx & vy & v \end{bmatrix}$

and $H = [h_1 \ h_2 \ h_3 \ h_4 \ h_5 \ h_6 \ h_7 \ h_8 \ h_9]^T$

The 1D Nullspace of A is the solution space for h

The full rank of A is 8 if there are perfect corresponding points