# Assignment-2 : Transformation

1. Find the new coordinate of the point P (-5, 7) after a simultaneous shear where shear factor is 2 in X-axis direction and shear factor is 5 in Y-axis direction. [You can assume tan θ_1 = 2 and tan θ_2=5 in shear matrix as if the angle is not given that means the value indicate tan θ]

2. Given a rectangle where 4 points are A(10,-20) , B(30,-20) , C(30,-10) and D(10,-10). We sheared the rectangle 30 degree in the direction of X axis and then 45 degree in the direction of y axis. After shearing the rectangle has changed and it's new position is AB'C'D'. [See the figure below for better understanding]

   (i)   Find out the matrix for doing this shearing on the rectangle
   (ii)   Using this shearing matrix find out the co-ordinates of the points B',C' and D'
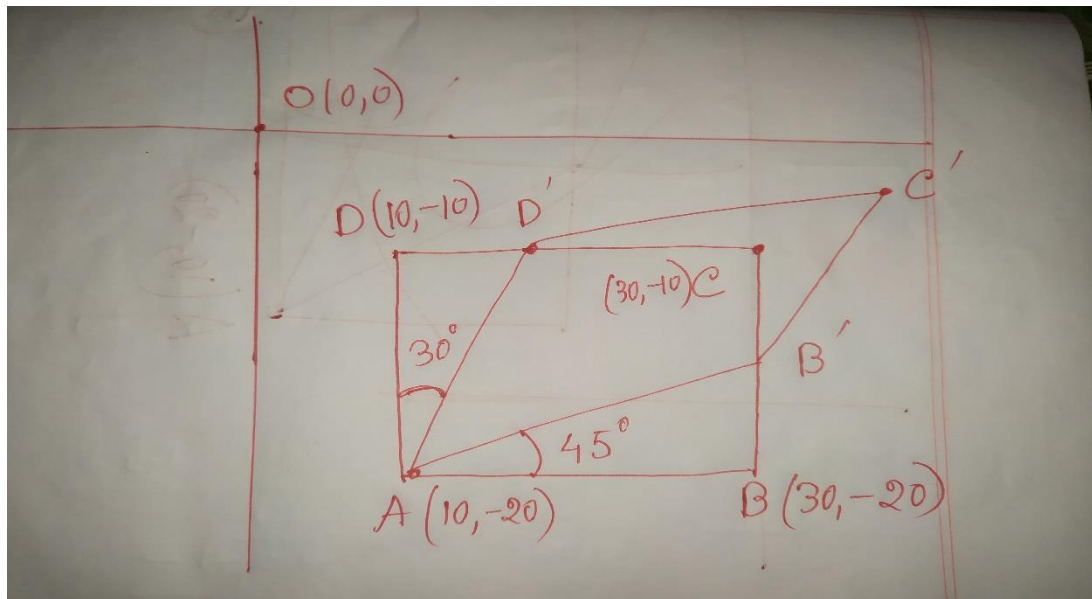
3. Find the matrix that represents rotation of an object by 30° (counter-clockwise) about the origin.
   What are the new coordinates of the point P (3, -7) if the above rotation is applied?

4. Consider the following list of transformations.

   1. A reflection across the Y-axis.
   2. A counterclockwise rotation by 45 degrees.
   3. A translation of 1 unit to the right followed by a translation of 2 units upwards.
   4. A reflection across the line y=x.

Now answer the following questions.

Write down the transformation matrices corresponding to transformations **(1)**, **(2)** and **(3)**. Use homogeneous coordinates.

In what order should you apply transformations **(1)**, **(2)** and **(3)** to achieve the overall transformation indicated by the figure below?
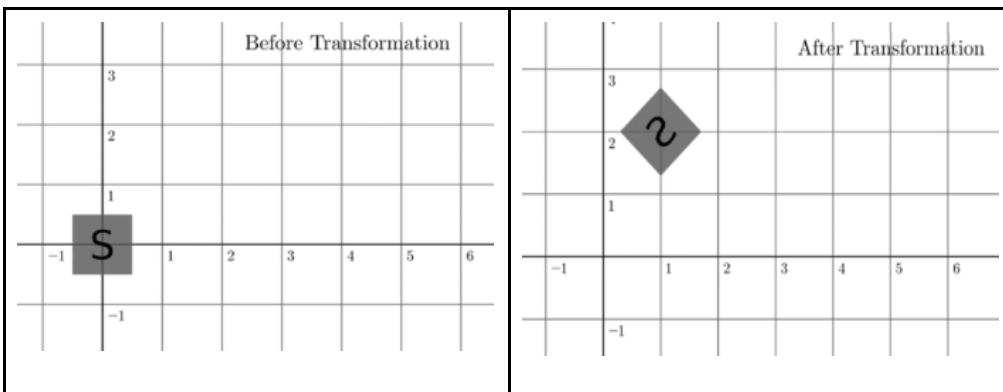
Your friend wants to find the transformation matrix corresponding to the transformation **(4)**. However, she only knows how to reflect something across the Y-axis. You tell her that in order to reflect something along the y=x line, she can -

i. First, apply a rotation transformation such that the line y=x becomes the Y-axis.

ii. Then perform a reflection across the Y-axis.

iii. And finally apply the inverse of the transformation in **(i)**.

Now, write the matrices for **(i)**, **(ii)**, **(iii)** and the final transformation matrix which combines all three.

Solve these questions as you might see these type of questions in your final exam.