LAB ASSIGNMENT 6

Objective : Implement 2D reflection and shearing transformations on geometric shapes.
Tasks:

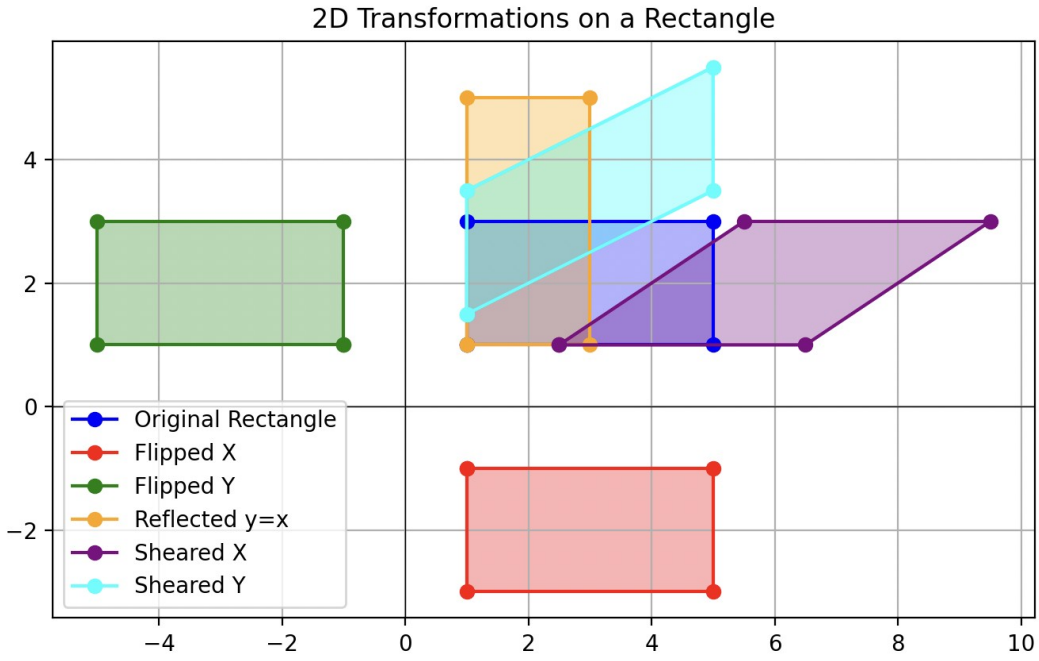
- **Flip the point or shape across the x-axis.**
- **Flip the point or shape across the y-axis.**
- **Reflect the point or shape across a given line.**
- **Skew the point or shape along the x-axis.**
- **Skew the point or shape along the y-axis.**

CODE:

```
import numpy as np
import matplotlib.pyplot as plt

# Function to plot the shape
def plot_shape(points, label, color):
    points = np.array(points)
    x, y = points[:, 0], points[:, 1]
    plt.plot(x, y, marker='o', label=label, color=color)
    plt.fill(x, y, alpha=0.3, color=color)

# Transformation function using matrix multiplication
def apply_transformation(points, matrix):
    return [matrix.dot([x, y]) for x, y in points]

# Define a rectangle (5 points to close the shape)
rectangle = [[1, 1], [5, 1], [5, 3], [1, 3], [1, 1]]

# Define transformation matrices
flip_x = np.array([[1, 0],
                   [0, -1]])
```

```
flip_y = np.array([[-1, 0],
                   [0, 1]])
reflect_yx = np.array([[0, 1],
                       [1, 0]])
shear_x = np.array([[1, 1.5],
                    [0, 1]])
shear_y = np.array([[1, 0],
                    [0.5, 1]])

# Plot original shape and transformations
plt.figure(figsize=(8, 8))
plot_shape(rectangle, "Original Rectangle", 'blue')
plot_shape(apply_transformation(rectangle, flip_x), "Flipped X", 'red')
plot_shape(apply_transformation(rectangle, flip_y), "Flipped Y", 'green')
plot_shape(apply_transformation(rectangle, reflect_yx), "Reflected y=x", 'orange')
plot_shape(apply_transformation(rectangle, shear_x), "Sheared X", 'purple')
plot_shape(apply_transformation(rectangle, shear_y), "Sheared Y", 'cyan')

# Show plot with settings
plt.axhline(0, color='black',linewidth=0.5)
plt.axvline(0, color='black',linewidth=0.5)
plt.grid(True)
plt.legend()
plt.gca().set_aspect('equal', adjustable='box')
plt.title("2D Transformations on a Rectangle")
plt.show()
```

OUTPUT:


2D Transformations on a Rectangle
Original Rectangle
Flipped X
Flipped Y
Reflected y=x
Sheared X
Sheared Y
4
2
0
−2
−4
−2
0
2
4
6
8
10