Problem Statement

Write a program to illustrate composite transformations (translation, rotation, scaling) as well as shearing, in graphics window.

Background Theory

In computer graphics, geometric transformations are essential for manipulating shapes and objects within a scene. These transformations modify an object’s position, orientation, size, or shape. The most common transformations are translation, rotation, scaling, and shearing

1. TRANSLATION

- Translation shifts an object from one location to another in the 2D plane.

- It does not alter shape, size, or orientation, just position.

- Matrix:



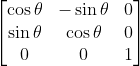
- `tx` and `ty` are the distances to move in x and y directions.

2. ROTATION

- Rotation turns an object around a fixed point, typically the origin.

- It \*\*preserves the shape and size\*\* but changes the direction it faces.

- Matrix (for counterclockwise rotation by θ):



- Useful in animations and object orientation control.

3. SCALING

- Scaling resizes an object — \*\*enlarges or shrinks\*\* it along x and/or y axes.

- Uniform scaling keeps the proportions the same; non-uniform changes the aspect ratio.

- Matrix:



- `sx` and `sy` are the scale factors for width and height.

4. SHEARING

- Shearing skews an object — it \*\*distorts\*\* the shape by shifting layers.

- Commonly used to simulate 3D perspectives or italic effects in fonts.

- X-Shear Matrix:



- Y-Shear Matrix:



- `shx` and `shy` determine how much to slant in respective directions.