Objective

To draw a triangle and apply rotation and reflection transformations using C/C++

Theory

Transformation refers to changing the shape, size and orientation of an object. These are accomplished with *geometric transformations* that alter the coordinate descriptions of objects. The basic geometric transformations are translation, rotation, reflection and scaling.

Reflection

Reflection is a transformation that produces a mirror image of an object. The mirror image for a two-dimensional reflection is generated relative to an axis of reflection by rotating the object 180° about the reflection axis.

Reflection on the line $y = 0$, the x axis, is accomplished as

$$(x', y') = (x, -y)$$

Reflection on the line $x = 0$, the y axis, is accomplished as

$$(x', y') = (-x, y)$$

Reflection on the line $y = x$ is accomplished as

$$(x', y') = (y, x)$$

Rotation

A two-dimensional rotation is applied to an object by repositioning it along a circular path in the xy plane. To generate a rotation, we specify a rotation angle θ and the position (x_r, y_r) of the rotation point about which the object is to rotated.

Rotation by an angle θ about the origin is accomplished as

$$x' = x\cos\theta - y\sin\theta$$
$$y' = x\sin\theta + y\cos\theta$$

Rotation by angle θ about an arbitary point (x_r, y_r) is accomplished as

$$x' = x_r + (x - x_r)\cos\theta - (y - y_r)\sin\theta$$
$$y' = y_r + (x - x_r)\sin\theta + (y - y_r)\cos\theta$$