Transformation

Transformation means changing some graphics into something else by applying rules. We can have various types of transformations such as translation, scaling up or down, rotation, shearing, etc. When a transformation takes place on a 2D plane, it is called 2D transformation.

Transformations play an important role in computer graphics to reposition the graphics on the screen and change their size or orientation.

# Homogenous Coordinates

To perform a sequence of transformation such as translation followed by rotation and scaling, we need to follow a sequential process −

**Translate the coordinates,**

**Rotate the translated coordinates, and then**

**Scale the rotated coordinates to complete the composite transformation.**

To shorten this process, we have to use 3×3 transformation matrix instead of 2×2 transformation matrix. To convert a 2×2 matrix to 3×3 matrix, we have to add an extra dummy coordinate W.

In this way, we can represent the point by 3 numbers instead of 2 numbers, which is called

Homogenous Coordinate system. In this system, we can represent all the transformation equations

**in matrix multiplication.**

# Translation

**A translation moves an object to a different position on the screen. You can translate a point in 2D by adding translation coordinate (tx, ty) to the original coordinate to get the new coordinate**

**Translation**

From the above figure, you can write that −

X’ = X + tx Y’ = Y + ty

The pair (tx, ty) is called the translation vector or shift vector. The above equations can also be represented using the column vectors.

We can write it as −

P’ = P + T