

## **2D AND 3D TRANSFORMATIONS:**

### **2D TRANSFORMATIONS:**

2D Transformation in Computer Graphics is utilized to modify the position, orientation, or size of objects within a two-dimensional space. These transformations involve applying mathematical operations to the coordinates of points or vertices in order to achieve the desired changes.

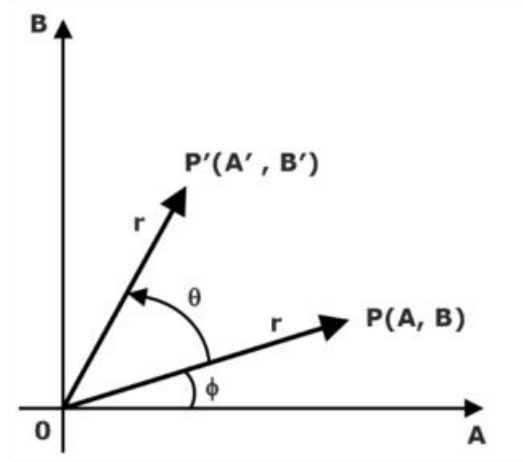
These transformations can be applied in a sequence to achieve more complex effects. For example, a combination of translation, rotation, and scaling operations can be used to animate an object's movement, rotation, and resizing in a 2D animation.

The fundamental geometrical **2d Transformation in Computer Graphics** include:

- Rotation
- Translation
- Scaling
- Reflection
- Shearing

### **Rotation:**

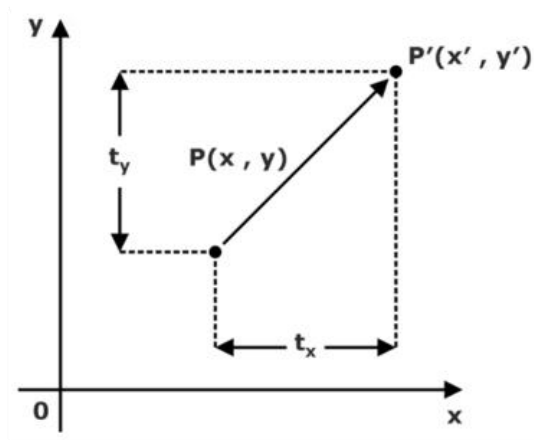
2D rotation is a fundamental concept that involves changing the orientation of an object or a coordinate system in a 2D plane. It enables us to rotate graphical elements around a specified point or axis by a certain angle.



To perform a 2D rotation, we need to consider two key components: the rotation angle and the rotation center. The rotation angle, denoted as  $\theta$  (in radians), represents the amount of rotation to be applied. The rotation center, represented as  $(cx, cy)$ , defines the point around which the rotation will occur.

**Translation:**

2D Translation is a transformation technique that changes the position of each point in an object or a coordinate system by a specified distance in the x and y

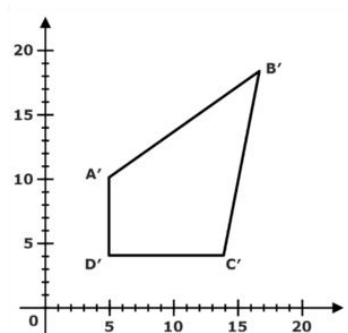
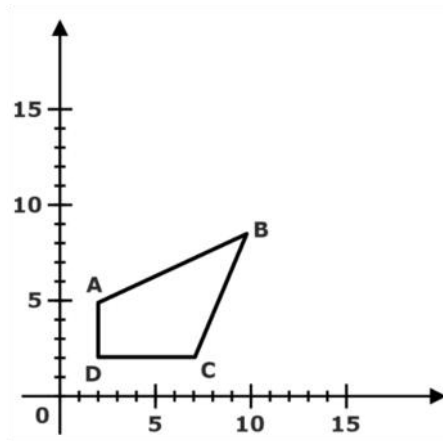


axes.

**Scaling:**

2D Scaling in Computer Graphics involves resizing objects or coordinate systems in a 2D plane. It allows us to change the size of each point in the object or coordinate system by applying scaling factors in the x and y directions.

The scaling process is depicted using the scaling matrix  $S$  in the given figure:



### **Reflection:**

2D reflection is a transformation technique that involves flipping or mirroring an object or coordinate system across a specific axis in a 2D plane. It allows us to change the orientation of each point in the object or coordinate system in relation to the reflection axis.

### **Shearing:**

2D Shearing transformation slants or distorts an object or coordinate system along either the x-axis or y-axis in a 2D plane. It involves shifting the position of points in a specific direction based on their original coordinates.

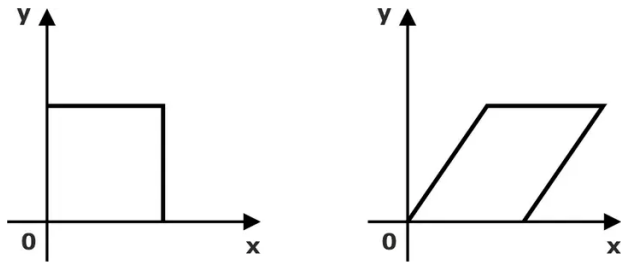


fig. shearing about the x-axis

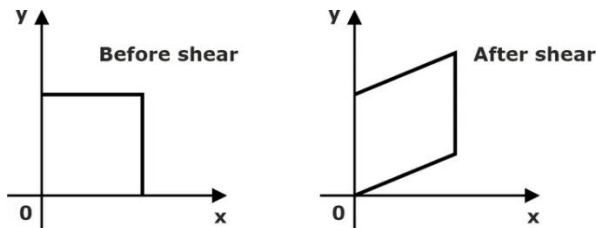


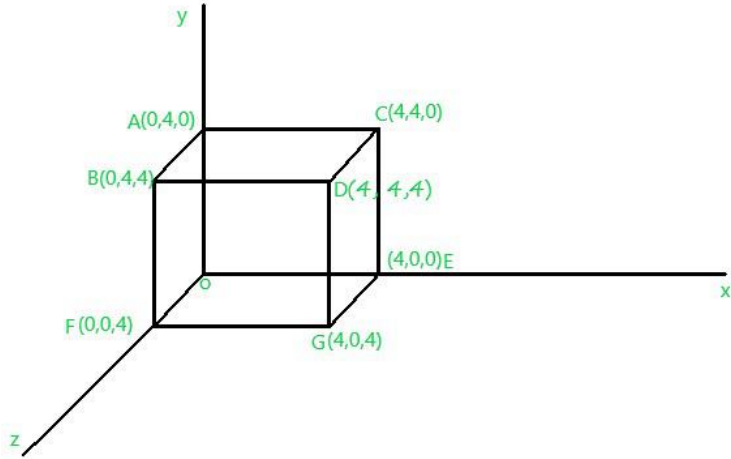
fig. shear in y direction

### 3D TRANSFORMATIONS:

3-D Transformation is the process of manipulating the view of a three-D object with respect to its original position by modifying its physical attributes through various methods of transformation like Translation, Scaling, Rotation, Shear, etc.

#### Translation:

It is the process of changing the relative location of a 3-D object with respect to the original position by changing its coordinates.



NOTE: USE ONLY THE ALPHABETS (A, B, C, D, E, F, G)

