WORKSHEET 3

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Section/Group: KRG_IOT-1-A	**Semester: 6th Semester**
Branch: BE-CSE	**Date of Performance: 30/01/2025**
Subject Name: Computer Graphics with Lab	**Subject Code: 22CSH-352**

1) **Aim:** Apply translation, scaling, and rotation transformations on a given triangle and observe the changes.

2) **Objective:** To apply geometric transformations such as translation, scaling, and rotation on a given triangle.

3) Algorithm:

a) Translation:

- Initialize Graphics Mode.
- Take Input for Triangle Coordinates
- Draw the Original Triangle.
- Use the line() function to draw three lines connecting the three given points.
- Prompt the user to enter translation values tx and ty.
- Update the coordinates: $x1'=x1+tx$, $y1'=y1+ty$ $x2'=x2+tx$, $y2'=y2+ty$ $x3'=x3+tx$, $y3'=y3+ty$

b) Scaling:

- Initialize Graphics Mode.
- Take Input for Triangle Coordinates
- Draw the Original Triangle
- Prompt the user to enter scaling factors sx and sy
- Update the coordinates of each vertex by multiplying them with the respective scaling factors:
  $x1'=x1\times sx$, $y1'=y1\times sy$ $x2'=x2\times sx$,
  $y2'=y2\times sy$ $x3'=x3\times sx$, $y3'=y3\times sy$

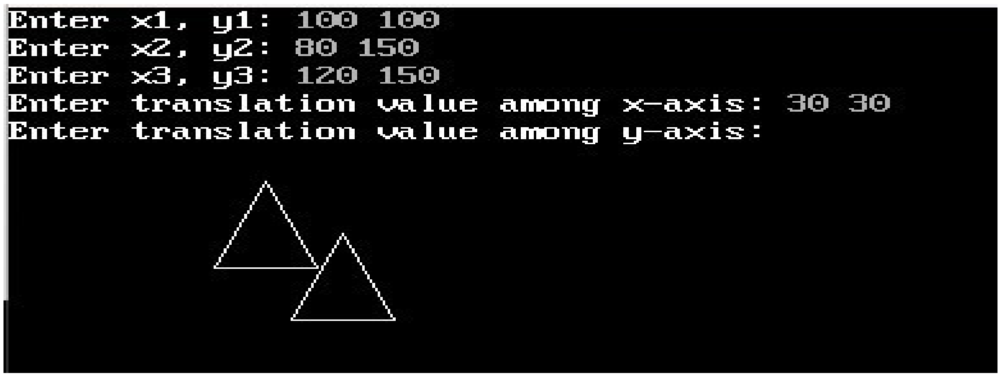
c) Rotation:

- Initialize Graphics Mode.
- Take Input for Triangle Coordinates
- Draw the Original Triangle.
- Take Input for Rotation Angle.
- Use the rotation transformation formulas $x'=x\cos(\theta)-y\sin(\theta)$ $y'=x\sin(\theta)+y\cos(\theta)$

4) Implementation/Code:

a) Translation:

```
#include<iostream.h>
#include<conio.h>
#include<graphics.h> void
main() {
 clrscr();
 int gd = DETECT, gm;
initgraph(&gd, &gm,"c://turboc3//bgi");
int x1, y1, x2, y2, x3, y3, tx, ty;
cout << "Enter x1, y1: ";     cin >> x1 >> y1;
cout << "Enter x2, y2: ";     cin >> x2 >> y2;
cout << "Enter x3, y3: ";     cin >> x3 >> y3;
cout << "Enter translation value among x-axis: ";
cin >> tx;
cout << "Enter translation value among y-axis: ";
cin >> ty;
 x1 += tx; x2 += tx; x3 += tx;     y1 += ty; y2 +=
 ty; y3 += ty;
 line(x1, y1, x2, y2);
 line(x2, y2, x3, y3);
 line(x3, y3, x1, y1);
 getch();
 closegraph();
}
```

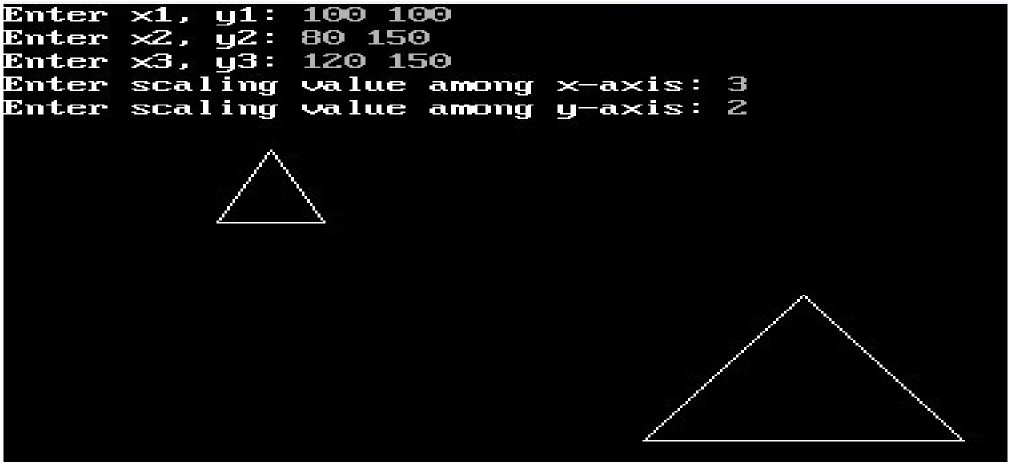


```
Enter x1, y1: 100 100
Enter x2, y2: 80 150
Enter x3, y3: 120 150
Enter translation value among x-axis: 30 30
Enter translation value among y-axis:
```

Fig 1: Translation

b) Scaling:

```
#include<iostream.h>
#include<conio.h>
#include<graphics.h> void
main() {
   clrscr();
   int gd = DETECT, gm;     initgraph(&gd, &gm,
"c://turboc3//bgi");
int x1, y1, x2, y2, x3, y3, sx, sy;
cout << "Enter x1, y1: ";     cin >> x1 >> y1;
cout << "Enter x2, y2: ";     cin >> x2 >> y2;
cout << "Enter x3, y3: ";     cin >> x3 >> y3;
line(x1, y1, x2, y2);
line(x2, y2, x3, y3);
line(x3, y3, x1, y1);
cout << "Enter scaling value among x-axis: ";
cin >> sx;
cout << "Enter scaling value among y-axis: ";
cin >> sy;
x1 *= sx; x2 *= sx; x3 *= sx;
y1 *= sy; y2 *= sy; y3 *= sy;
line(x1, y1, x2, y2);
line(x2, y2, x3, y3);
line(x3, y3, x1, y1);
getch();
closegraph();
}
```

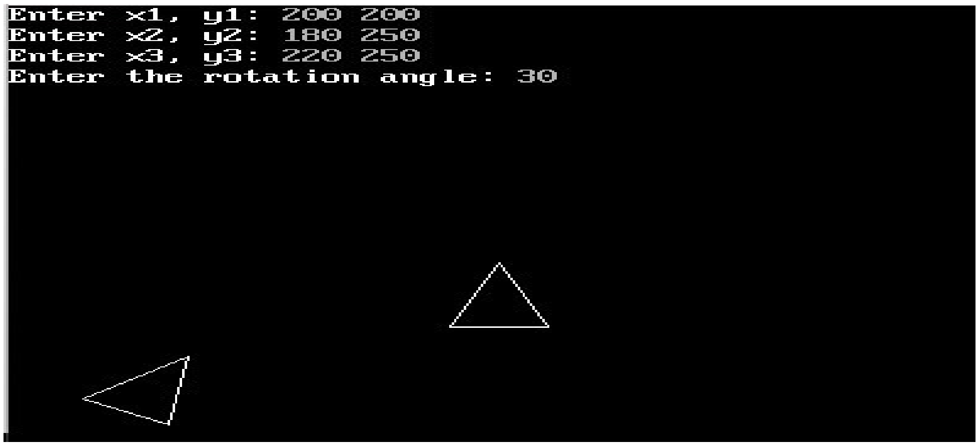


```
Enter x1, y1: 100 100
Enter x2, y2: 80 150
Enter x3, y3: 120 150
Enter scaling value among x-axis: 3
Enter scaling value among y-axis: 2
```

Fig 2: Scaling

c) Rotation

```
#include<iostream.h>
#include<conio.h>
#include<math.h>
#include<graphics.h> void
main() {
   clrscr();
   int gd = DETECT, gm;
 initgraph(&gd, &gm, "c://turboc3//bgi");
int x1, y1, x2, y2, x3, y3;
float angle;
cout << "Enter x1, y1: ";     cin >> x1 >> y1;
cout << "Enter x2, y2: ";     cin >> x2 >> y2;
cout << "Enter x3, y3: ";     cin >> x3 >> y3;
line(x1, y1, x2, y2);
line(x2, y2, x3, y3);
line(x3, y3, x1, y1);
cout << "Enter the rotation angle: ";
cin >> angle;     angle = angle * 3.1428 / 180;
int tempX, tempY;
tempX = x1; tempY = y1;
x1 = tempX * cos(angle) - tempY * sin(angle);
y1 = tempX * sin(angle) + tempY * cos(angle);
tempX = x2; tempY = y2;
x2 = tempX * cos(angle) - tempY * sin(angle);
y2 = tempX * sin(angle) + tempY * cos(angle);
tempX = x3; tempY = y3;
x3 = tempX * cos(angle) - tempY * sin(angle);
y3 = tempX * sin(angle) + tempY * cos(angle);
line(x1, y1, x2, y2);
line(x2, y2, x3, y3);
line(x3, y3, x1, y1);
getch();
closegraph();
}
```



```
Enter x1, y1: 200 200
Enter x2, y2: 180 250
Enter x3, y3: 220 250
Enter the rotation angle: 30
```

Fig 3: Rotation

5. Learning Outcome:

- Understanding Basic Graphics Programming.
- Understanding 2D Transformations.
- Understood the concept of coordinate transformation using trigonometric functions