SSN COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UCS1712 – GRAPHICS AND MULTIMEDIA LAB

EX NO: 5b – 2D Transformations – Reflection and Shearing

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AIM :

To write a C++ menu-driven program using OPENGL to perform 2D transformations – reflection and shearing for polygons.

ALGORITHM :

1. Read the no. of edges of the polygon from the user.
2. Read the vertices of the polygon.
3. Plot the original polygon.
4. Read the transformation from the user given the menu
5. If option is Reflection along X axis, multiply -1 to the Y coordinates of the original polygon and plot
6. If option is Reflection along Y axis, multiply -1 to the X coordinates of the original polygon and plot
7. If option is Reflection about the origin, multiply -1 to both the X and Y coordinates of the original polygon and plot
8. If option is Reflection along Y = X line, swap the X and Y coordinates of the original polygon and plot
9. If the option is shearing along the X axis then, read the shearing factor and add the shearing factor to the topmost vertices of the polygon and plot. You may also translate the sheared polygon so that it doesn’t overlap on the original polygon
10. If the option is shearing along the Y axis then, read the shearing factor and add the shearing factor to the rightmost vertices of the polygon and plot.You may also translate the sheared polygon so that it doesn’t overlap on the original polygon

CODE :

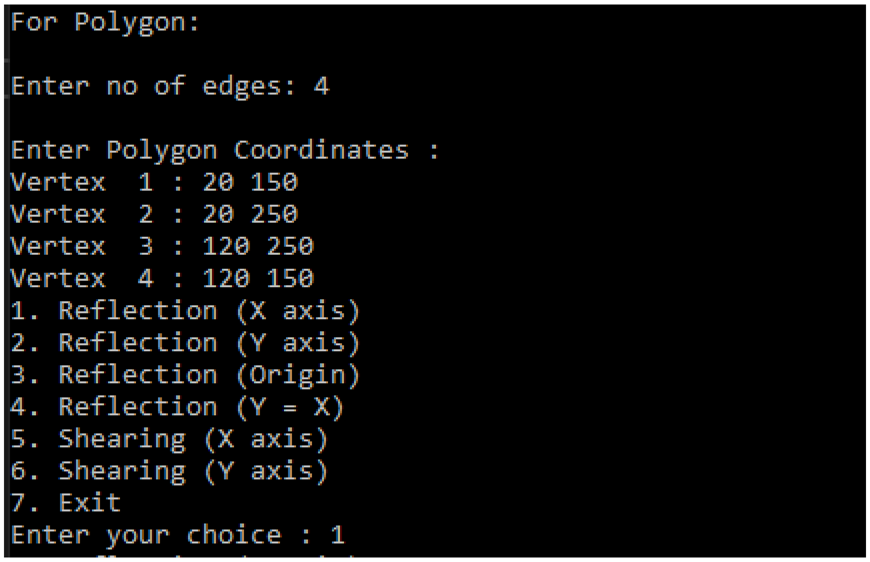
```cpp
#include <stdio.h>
#include <math.h>
#include <iostream>
#include <vector>
#include <glut.h>
using namespace std;

int pntX1, pntY1, op = 0, edges;
vector<int> pntX;
vector<int> pntY;
int shearingX, shearingY;

double round(double d)
{
      return floor(d + 0.5);
}

void drawPolygon()
{
      glBegin(GL_POLYGON);
      glColor3f(1, 0.01, 0.18);
      for (int i = 0; i < edges; i++)
      {
            glVertex2i(pntX[i], pntY[i]);
      }
      glEnd();
}

void reflection(int option)
{
      if (option == 4) {
            glBegin(GL_LINES);
            glVertex2i(-640, -640);
            glVertex2i(640, 640);
            glEnd();
      }
      glBegin(GL_POLYGON);
      glColor3f(0.02, 0.72, 0.09);

      //X axis reflection
```

```
	if (option == 1)
	{
		for (int i = 0; i < edges; i++)
		{
			glVertex2i(round(pntX[i]), round(pntY[i] * -1));

		}
	}//Y axis reflection
	else if (option == 2 )
	{
		for (int i = 0; i < edges; i++)
		{
			glVertex2i(round(pntX[i] * -1), round(pntY[i]));
		}
	}//origin reflection
	else if (option == 3) {
		for (int i = 0; i < edges; i++) {
			glVertex2i(round(pntX[i] * -1), round(pntY[i])*-1);
		}
	}//Y=X reflection
	else if (option == 4) {
		for (int i = 0; i < edges; i++) {
			glVertex2i(round(pntY[i]), round(pntX[i]));
		}
	}
	glEnd();
}

void shearing(int option)
{
	glBegin(GL_POLYGON);
	glColor3f(0.02, 0.72, 0.09);

	//translating the transformed polygon so that it doesn't overlap on the
original polygon
	if (option == 5)
	{
		glVertex2i(pntX[0]+200, pntY[0]);

		glVertex2i(pntX[1] + shearingX + 200, pntY[1]);
		glVertex2i(pntX[2] + shearingX + 200, pntY[2]);

		glVertex2i(pntX[3] + 200, pntY[3]);
```

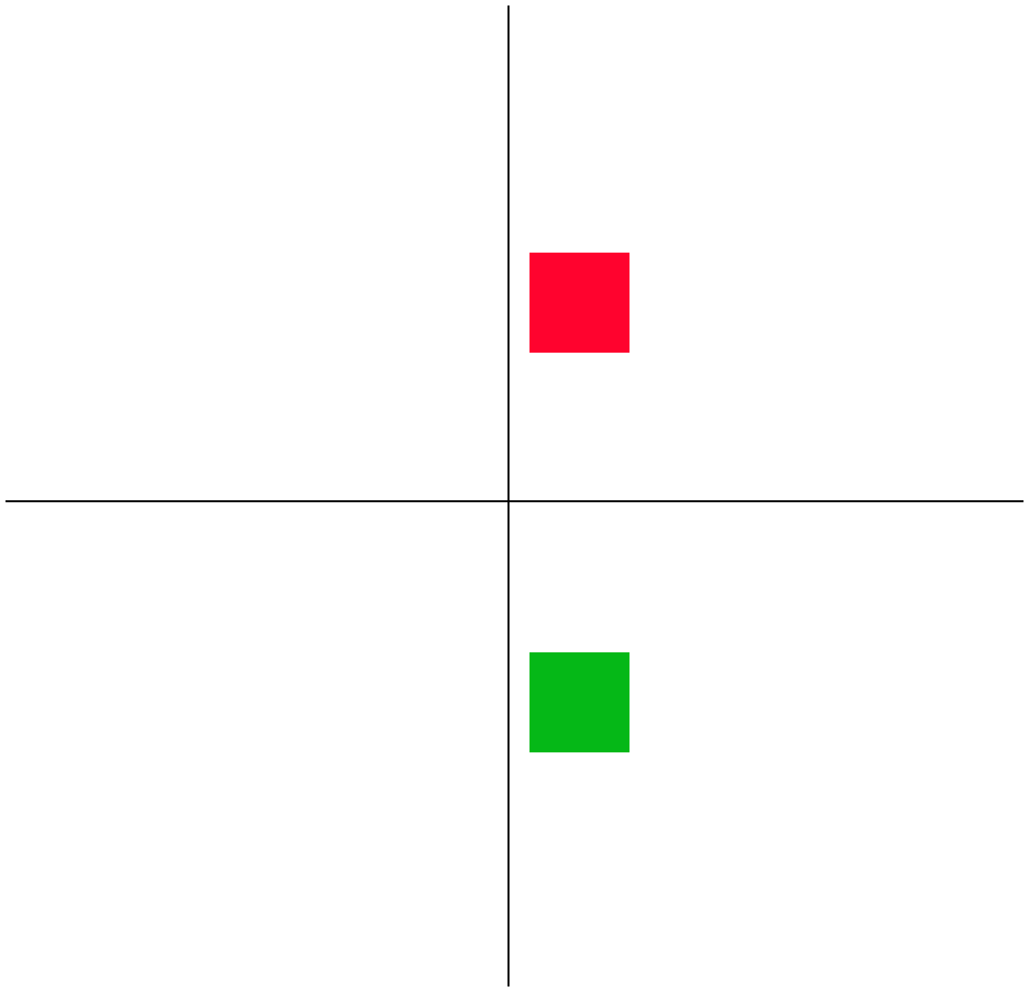
```
      }
      else if (option == 6)
      {
            glVertex2i(pntX[0] + 200, pntY[0]);
            glVertex2i(pntX[1] + 200, pntY[1]);

            glVertex2i(pntX[2] + 200, pntY[2] + shearingY);
            glVertex2i(pntX[3] + 200, pntY[3] + shearingY);
      }
      glEnd();
}
void myInit(void)
{
      glClearColor(1.0, 1.0, 1.0, 0.0);
      glColor3f(0.0f, 0.0f, 0.0f);
      glPointSize(4.0);
      glMatrixMode(GL_PROJECTION);
      glLoadIdentity();
      gluOrtho2D(-640.0, 640.0, -640, 640.0);
}

void myDisplay(void)
{
      while (true) {
            glClear(GL_COLOR_BUFFER_BIT);
            glColor3f(0.0, 0.0, 0.0);
            glBegin(GL_LINES);
            glVertex2i(-640, 0);
            glVertex2i(640, 0);
            glEnd();
            glBegin(GL_LINES);
            glVertex2i(0, -640);
            glVertex2i(0, 640);
            glEnd();
            drawPolygon();
            cout << "1. Reflection (X axis)\n";
            cout << "2. Reflection (Y axis)\n";
            cout << "3. Reflection (Origin)\n";
            cout << "4. Reflection (Y = X)\n";
            cout << "5. Shearing (X axis) \n";
            cout << "6. Shearing (Y axis) \n";
            cout << "7. Exit\n";
            cout << "Enter your choice : ";
            cin >> op;

            if (op >= 1 && op <= 4)
            {
                  reflection(op);
            }
            else if (op == 5 ) {
                  cout << "Enter the shearing factor for X: ";cin>> shearingX;
                  shearing(op);
            }
            else if(op == 6){
                  cout << "Enter the shearing factor for Y: ";cin>> shearingY;
                  shearing(op);
            }else{
                  break;
            }
            glFlush();
      }

}

void main(int argc, char** argv)
{
      cout << "For Polygon:\n" << endl;
      cout << "Enter no of edges: "; cin >> edges;
      cout << "\nEnter Polygon Coordinates : \n";

      for (int i = 0; i < edges; i++) {
            cout << "Vertex  " << i + 1 << " : "; cin >> pntX1 >> pntY1;
            pntX.push_back(pntX1);
            pntY.push_back(pntY1);
      }

      glutInit(&argc, argv);
      glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
      glutInitWindowSize(640, 640);
      glutInitWindowPosition(50, 50);
      glutCreateWindow("Transformations - 2");
      glutDisplayFunc(myDisplay);
      myInit();
      glutMainLoop();
}
```

OUTPUT :

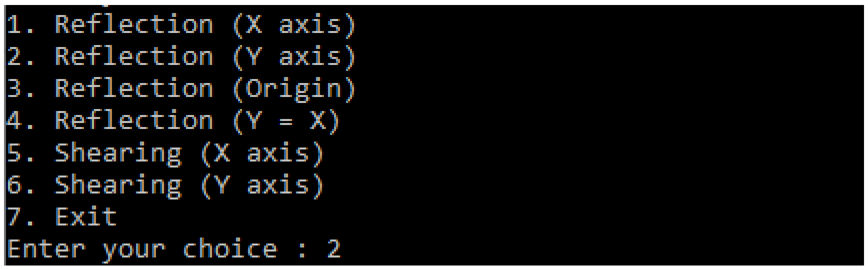
1) **Reflection along X axis**



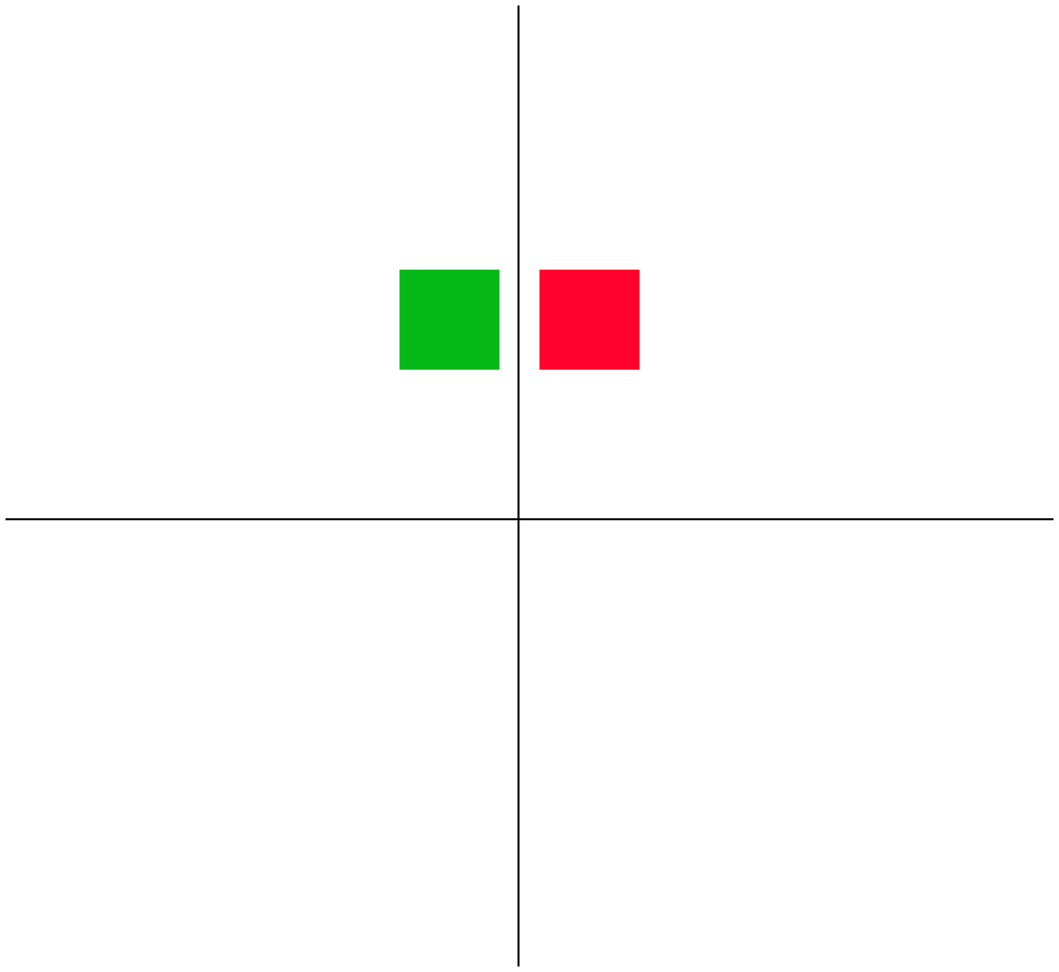
```
For Polygon:

Enter no of edges: 4

Enter Polygon Coordinates :
Vertex  1 : 20 150
Vertex  2 : 20 250
Vertex  3 : 120 250
Vertex  4 : 120 150
1. Reflection (X axis)
2. Reflection (Y axis)
3. Reflection (Origin)
4. Reflection (Y = X)
5. Shearing (X axis)
6. Shearing (Y axis)
7. Exit
Enter your choice : 1
```



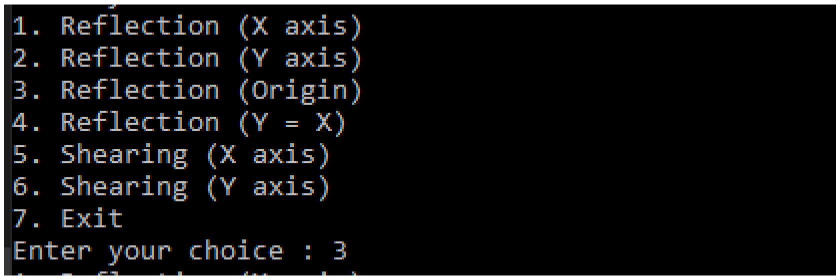
2) Reflection along Y axis



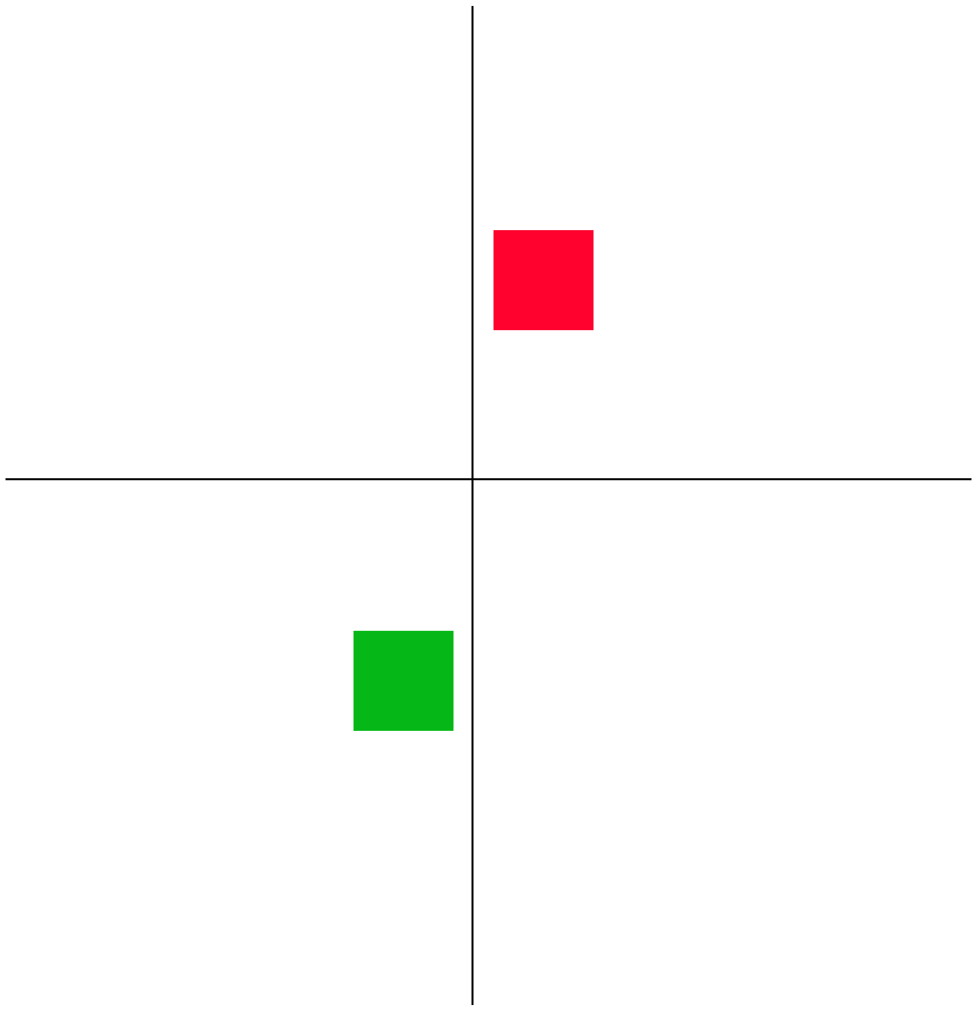
```
1. Reflection (X axis)
2. Reflection (Y axis)
3. Reflection (Origin)
4. Reflection (Y = X)
5. Shearing (X axis)
6. Shearing (Y axis)
7. Exit
Enter your choice : 2
```



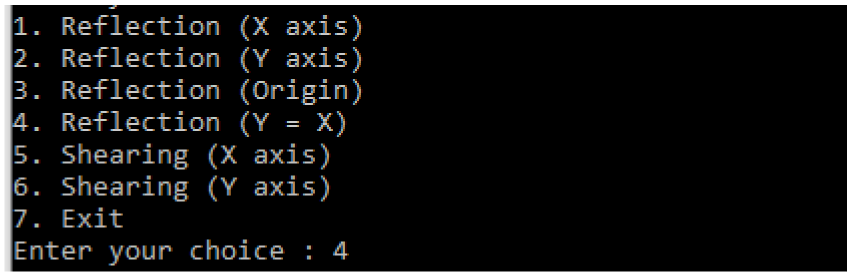
3) Reflection about the origin



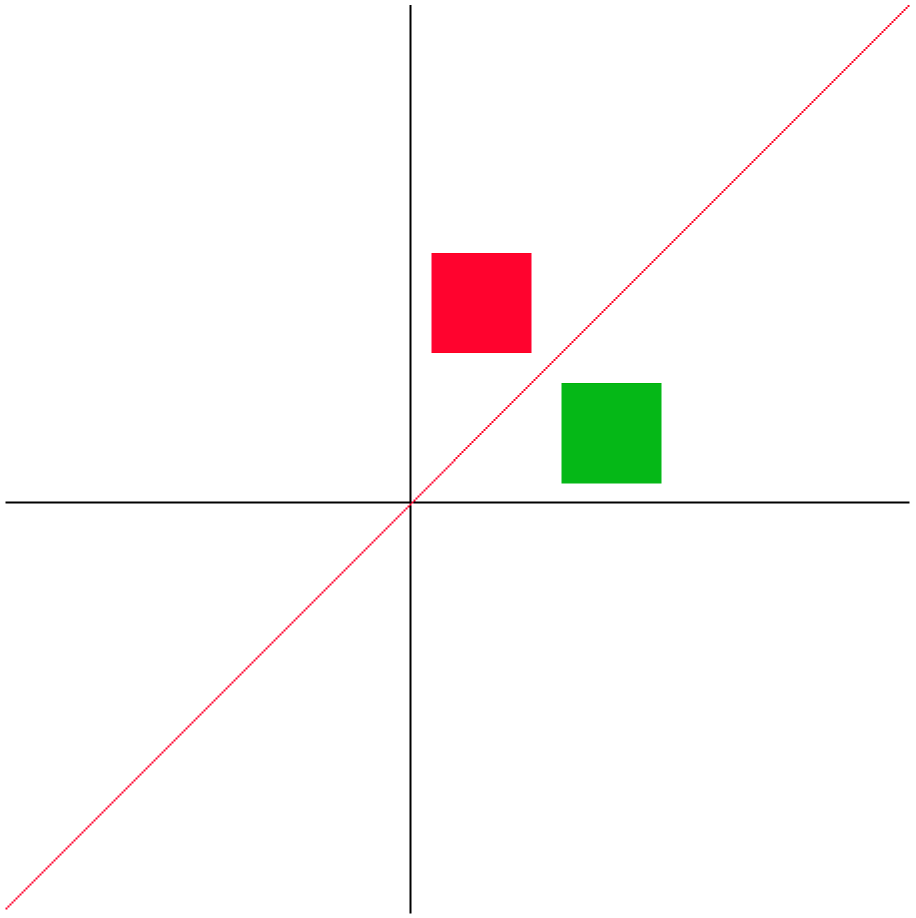
```
1. Reflection (X axis)
2. Reflection (Y axis)
3. Reflection (Origin)
4. Reflection (Y = X)
5. Shearing (X axis)
6. Shearing (Y axis)
7. Exit
Enter your choice : 3
```



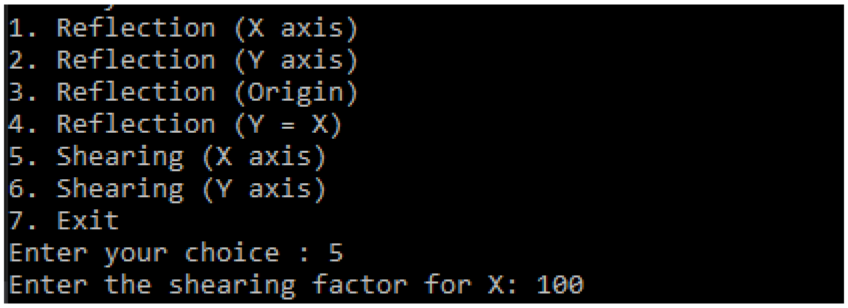
4) Reflection along Y=X line



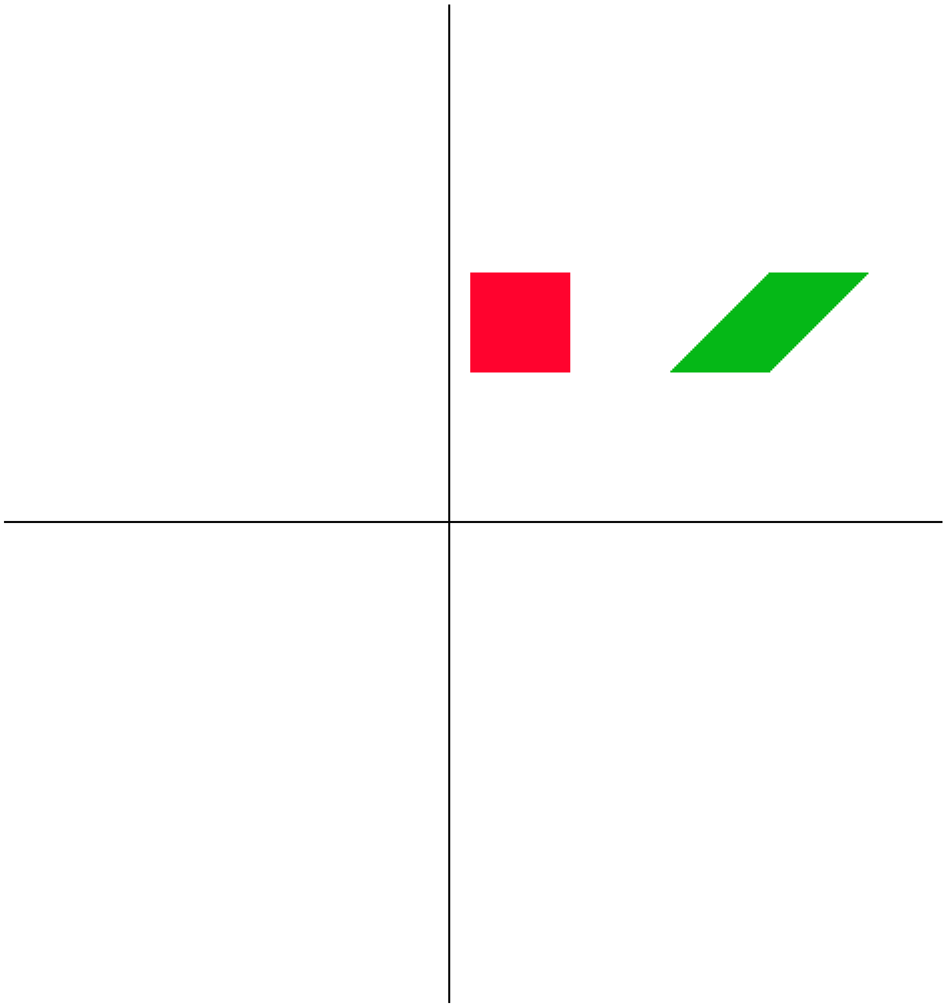
```
1. Reflection (X axis)
2. Reflection (Y axis)
3. Reflection (Origin)
4. Reflection (Y = X)
5. Shearing (X axis)
6. Shearing (Y axis)
7. Exit
Enter your choice : 4
```



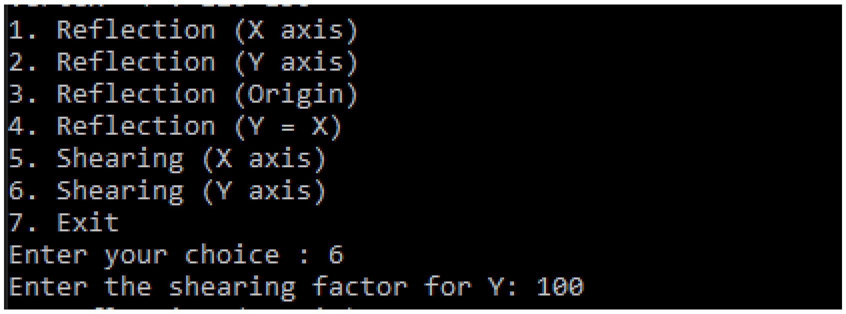
5) **Shearing along X axis**



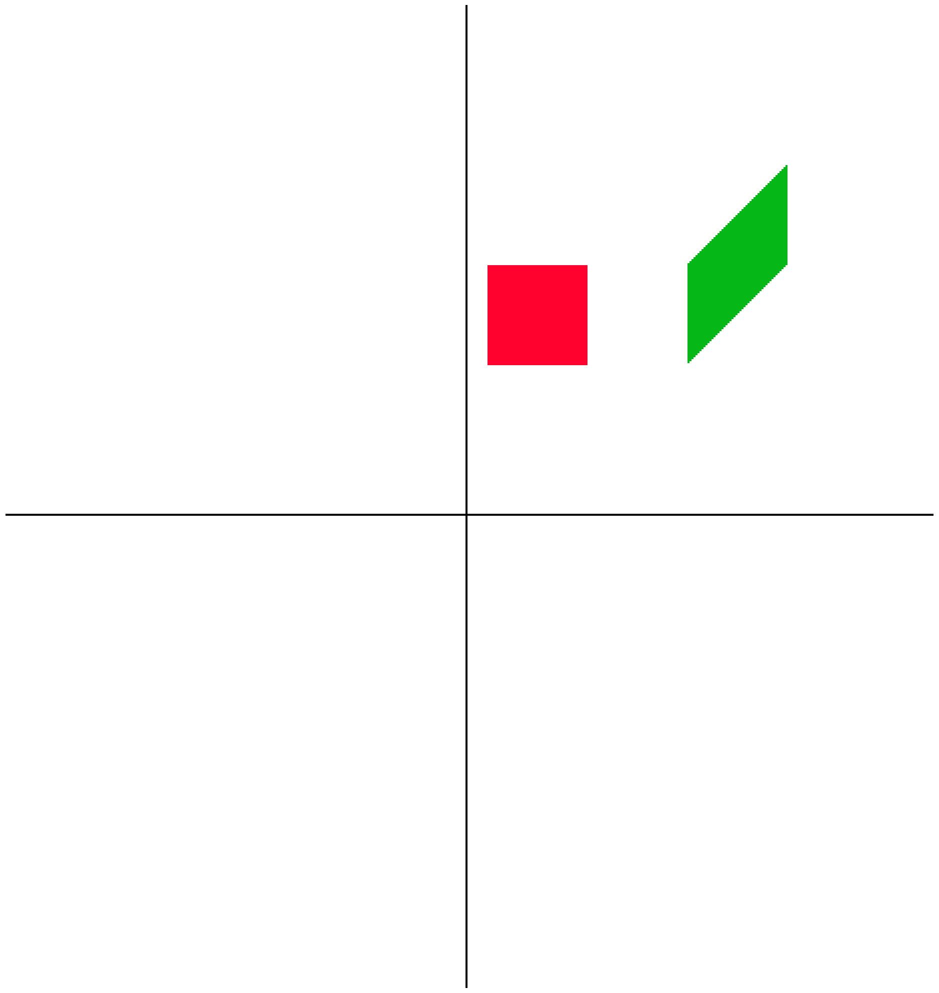
```
1. Reflection (X axis)
2. Reflection (Y axis)
3. Reflection (Origin)
4. Reflection (Y = X)
5. Shearing (X axis)
6. Shearing (Y axis)
7. Exit
Enter your choice : 5
Enter the shearing factor for X: 100
```



6) **Shearing along Y axis**



```
1. Reflection (X axis)
2. Reflection (Y axis)
3. Reflection (Origin)
4. Reflection (Y = X)
5. Shearing (X axis)
6. Shearing (Y axis)
7. Exit
Enter your choice : 6
Enter the shearing factor for Y: 100
```



RESULT :

Thus compiled and executed a C++ menu-driven program using OPENGL to perform 2D transformations –reflection and shearing for polygon successfully.