Experiment No. 4
Implement midpoint Ellipse algorithm.
Name: Aryan Gaikwad
Roll Number: 09
Date of Performance:
Date of Submission:

Experiment No. 4

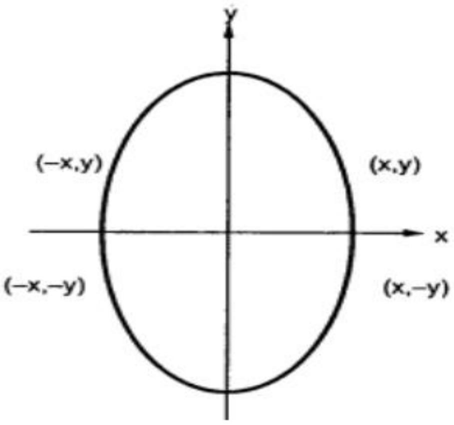
Aim-To implement midpoint Ellipse algorithm

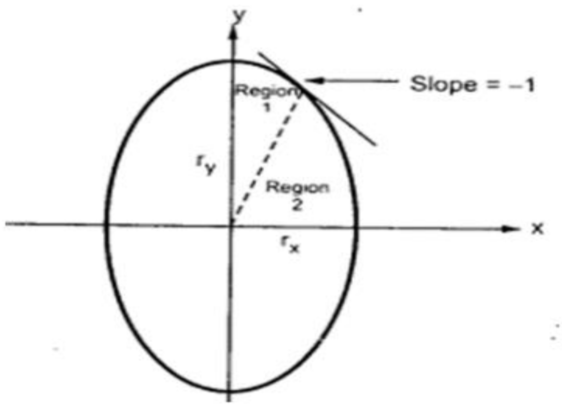
Objective:

Draw the ellipse using Mid-point Ellipse algorithm in computer graphics. Midpoint ellipse algorithm plots (finds) points of an ellipse on the first quadrant by dividing the quadrant into two regions.

Theory:

Midpoint ellipse algorithm uses four way symmetry of the ellipse to generate it. Figure shows the 4-way symmetry of the ellipse.





Here the quadrant of the ellipse is divided into two regions as shown in the fig. Fig. shows the division of first quadrant according to the slope of an ellipse with rx < ry. As ellipse is drawn

from 90^0 to 0^0, x moves in positive direction and y moves in negative direction and ellipse passes through two regions 1 and 2.

The equation of ellipse with center at (xc, yc) is given as -

$[(x - x_c) / r_x]^2 + [(y - y_c) / r_y]^2 = 1$

Therefore, the equation of ellipse with center at origin is given as -

$[x / r_x]^2 + [y / r_y]^2 = 1$

i.e. $x^2 r_y^2 + y^2 r_x^2 = r_x^2 r_y^2$

Let, $f_{ellipse}(x, y) = x^2 r_y^2 + y^2 r_x^2 - r_x^2 r_y^2$

Algorithm:

```
int x=0, y=b; [starting point]
int fx=0, fy=2a² b [initial partial derivatives]
int p = b²-a² b+a²/4
while (fx<="" 1="" {="" set="" pixel="" (x,="" y)="" x++;="" fx="fx" +="" 2b²;
        if (p<0)
        p = p + fx +b2;
        else
        {
                y--;
                fy=fy-2a2
                p = p + fx +b2-fy;
        }
}
Setpixel (x, y);
p=b2(x+0.5)2+ a2 (y-1)2- a2 b2
while (y>0)
{
        y--;
        fy=fy-2a2;
        if (p>=0)
        p=p-fy+a2
       else
        {
                x++;
                fx=fx+2b2
                p=p+fx-fy+a2;
        }
        Setpixel (x,y);
}
```

Program:

```
#include<stdio.h>
#include<graphics.h>
#include<dos.h>
#include<conio.h>
int main()
{
   long x,y,x_center,y_center;
   long a_sqr,b_sqr,fx,fy,d,a,b,tmp1,tmp2;
   int g_driver=DETECT,g_mode;
   initgraph(&g_driver,&g_mode,"C:\\TurboC3\\BGI");
   printf("*MID POINT ELLIPSE*");
   printf("\n Enter coordinate x = ");
   scanf("%ld",&x_center);
   printf(" Enter coordinate y = ");
   scanf("%ld",&y_center);
   printf("\n Now Enter constants a =");
   scanf("%ld",&a,&b);
   printf(" Now Enter constants b =");
   scanf("%ld",&b);
   x=0;
   y=b;
   a_sqr=a*a;
   b_sqr=b*b;
   fx=2*b_sqr*x;
   fy=2*a_sqr*y;
   d=b_sqr-(a_sqr*b) + (a_sqr*0.25);
   do
```

```
{
   putpixel(x_center+x,y_center+y,4);
   putpixel(x_center-x,y_center-y,3);
   putpixel(x_center+x,y_center-y,2);
   putpixel(x_center-x,y_center+y,1);

   if(d<0)
   {
      d=d+fx+b_sqr;
   }
   else
   {
      y=y-1;
      d=d+fx+-fy+b_sqr;
      fy=fy-(2*a_sqr);
   }
   x=x+1;
   fx=fx+(2*b_sqr);
   delay(10);
}
while(fx<fy);
tmp1=(x+0.5)*(x+0.5);
tmp2=(y-1)*(y-1);
d=b_sqr*tmp1+a_sqr*tmp2-(a_sqr*b_sqr);

do
{
   putpixel(x_center+x,y_center+y,1);
```

```
        putpixel(x_center-x,y_center-y,2);
        putpixel(x_center+x,y_center-y,3);
        putpixel(x_center-x,y_center+y,4);

        if(d>=0)
        d=d-fy+a_sqr;
        else
        {
            x=x+1;
            d=d+fx-fy+a_sqr;
            fx=fx+(2*b_sqr);
        }
        y=y-1;
        fy=fy-(2*a_sqr);
    }
    while (y>0);
    getch();
    closegraph();
  return 0;
}
```

Output:

Conclusion:

The algorithm for drawing ellipses differs from circles because ellipses lack the same symmetry. Unlike circles with a constant radius, ellipses require variable radii for their horizontal and vertical dimensions as they traverse the curve. The significance of ellipse drawing algorithms lies in their versatility for representing real-world objects encountered in fields like engineering, computer graphics, and mathematics. Ellipses depict not only simple shapes but also practical objects like wheels, celestial orbits, and the human eye's cornea. To accurately represent these objects in various applications, a robust and efficient ellipse-drawing algorithm is crucial for creating realistic and precise depictions.