Experiment No. 4
Implement midpoint Ellipse algorithm.
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Date of Performance:
Date of Submission:

Experiment No. 4

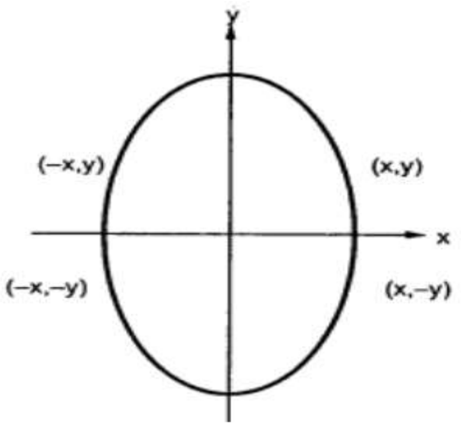
Aim-To implement midpoint Ellipse algorithm

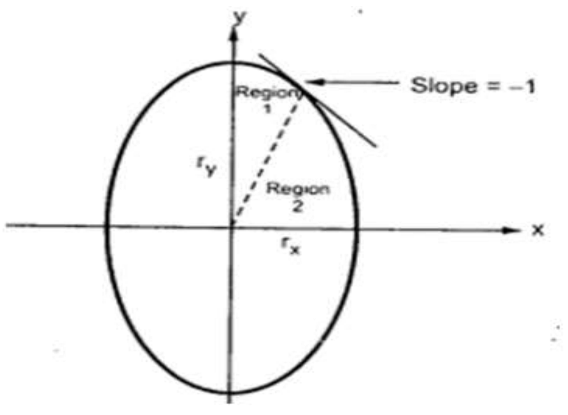
Objective:

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 &lt; 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=2a$^2$ b [initial partial derivatives]
int p = b$^2$-a$^2$ b+a$^2$/4
while (fx<="" 1="" {="" set="" pixel="" (x,="" y)="" x++;="" fx="fx" +="" 2b$^{2;}$
        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);
}
```

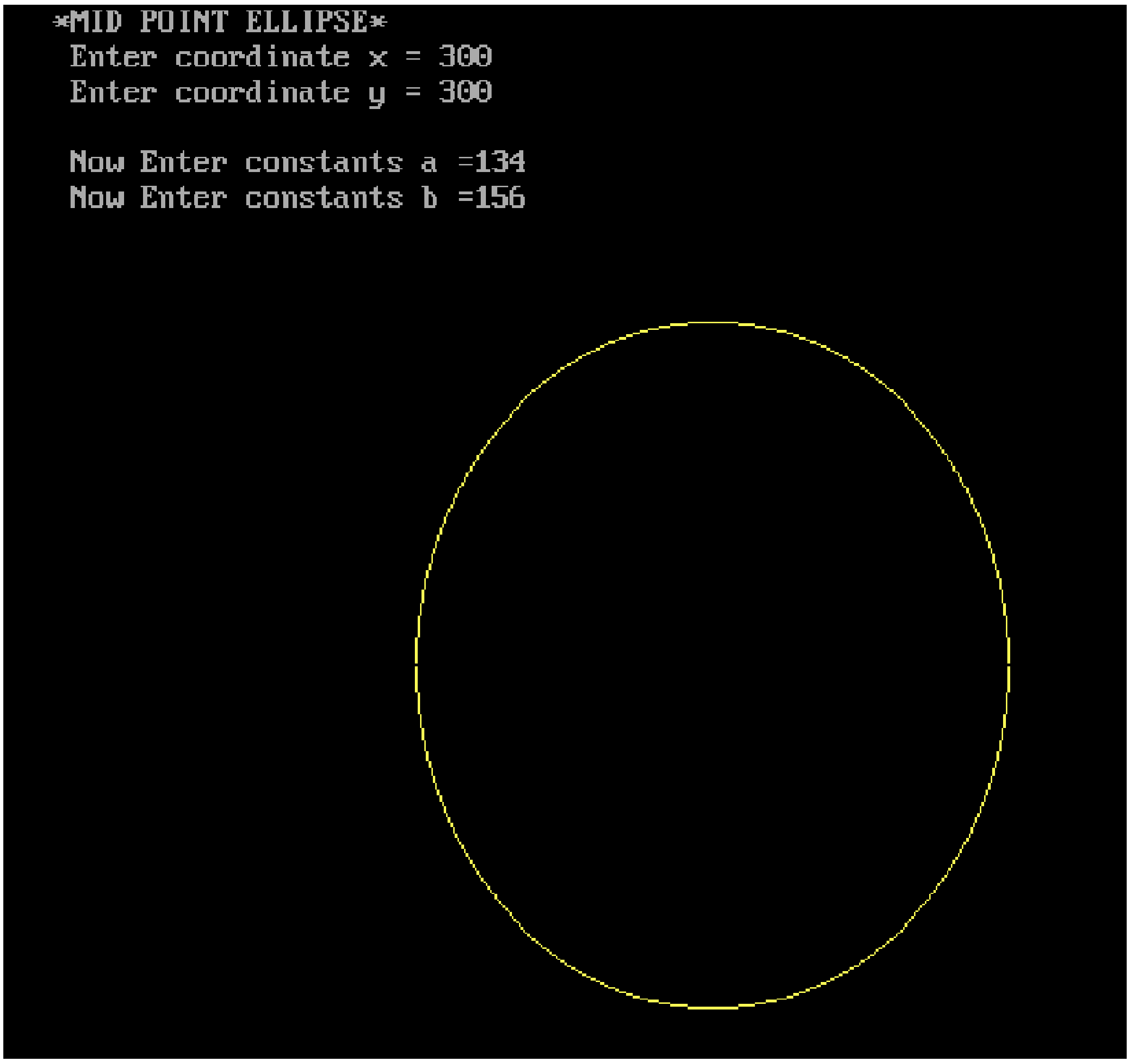
Program:

```
#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:



```
 *MID POINT ELLIPSE*
  Enter coordinate x = 300
  Enter coordinate y = 300

  Now Enter constants a =134
  Now Enter constants b =156
```

Conclusion:

Drawing an ellipse demands a distinct algorithm compared to drawing a circle, primarily because ellipses lack the symmetrical properties of circles. The key contrast arises in the process of determining and plotting the points along the ellipse's path, where both the horizontal and vertical radii change as it traverses the curve. In contrast, circles maintain a constant radius throughout their circumference.

The significance of employing ellipse drawing algorithms lies in their relevance to various real-world objects. Ellipses frequently appear in diverse fields like engineering, computer graphics, and mathematics. They represent not just elementary geometric forms but also numerous practical entities, such as wheels, orbits of celestial bodies, and even the shape of the human eye's cornea. Achieving precise and accurate ellipse rendering proves crucial for faithfully representing these objects in the realms of computer graphics, engineering blueprints, and scientific simulations. Therefore, the availability of a robust and efficient algorithm for drawing ellipses holds immense value, enabling the creation of lifelike and precise depictions of objects and phenomena in these domains.