COSC 4370 - Homework 1

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1 Problem

The assignment requires the rasterization of the ellipse with the formula $(x/12)^2 + (y/6)^2 = 642$ where y>=0. While assuming the dimension of the image to create this rasterization is 200x200.

2 Method

The first step before starting rasterizing the ellipse is to modify the equation so it will be easier to read. Putting the equation in standard form will give the following equation $(x/768)^2 + (y/384)^2 = 1$

The second step that needs to be completed, is to scale down the equation in order for it to fit into a 200x200 image. With the original numbers, this ellipse will easily fit in a 2000x2000 setting but not a 200x200 image. Multiplying the a and b variables in this equation by 1/10 while rounding down, will bring the numbers of the equation in range with a 200x200 image.

The way to rasterize this arc is done by rearranging the equation and solving for y. Using x = 0 and running until it reaches the width will be enough to draw one quadrant of the ellipse. From here, using the symmetry of an ellipse, the other half can be drawn.

3 Implementation

As x will be the variable that will be constantly known throughout the algorithm, we must for y. Rearranging the standard equation of an ellipse, y can be solved for using $y^2 = b^2 - \frac{b^2 x^2}{a^2}$.

From knowing how to get y, the next step would be to run a nested for loop to cover all pixels in one quadrant of an ellipse. The first for loop will run from $x = 0$ to the width of the ellipse. Before nesting the second for loop, y is solved in this area due to knowing the coordinates of x. The nested for loop will run from y=0 to the height of the ellipse. From here if the current coordinate is equal to the y solved before, a point is plotted.

In order to make sure there are no gaps in the rasterization, the algorithm also records the y position of the previous point plotted. From remembering this point, a line is draw upwards to close any gap and make a continuous arc. These two for loops will have completed drawing the ellipse in the first quadrant.

To graph the points above $y > 0$, the symmetry of an eclipse is used in order to create the image. Because the requirements only want the points that are above the Y axis, the plotting function can ignore the 2 quadrants below the mid point. Therefore when the plotting function is called, it only plots the points at plot(centerX+x,centerY+y) and plot(centerX-x,centerY+y) to avoid the bottom two quadrants.

4 Results

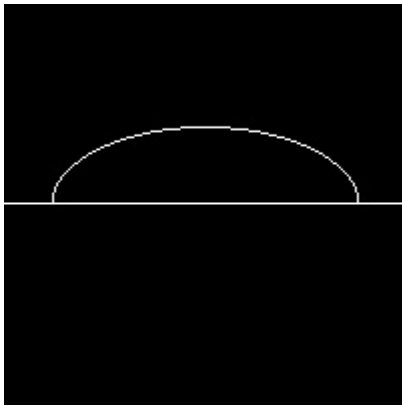The output is a bmp file with a half ellipse where $y > 0$ is printed. The photo bellow is with the middle line printed.

Image without the middle line.