Assignment 5

Adarsh Srivastava

The link to the solution is

https://github.com/Adarsh1310/EE5609

***Abstract*—This documents solves a problem based on circles.**

1 Problem

Find the area of the region bounded by the circle $\mathbf{x^T}\ \mathbf{x}= 2$ and $\left\|\mathbf{x}-\begin{pmatrix}2\\0\end{pmatrix}\right\| = 2$.

2 Solution

$[x^T\mathbf{x} - 2(O)^T\mathbf{x} + \|\mathbf{O}\|^2 - \mathbf{r}^2 = 0$

So from above equation we can say that

Circle 1:

radius=2
point of origin as (0,0)

Circle 2:
radius=2
point of origin as (2,0)

Now finding points of intersection:

Equation in general form is as follows:

$$x^2 + y^2 = 4 \tag{2.0.1}$$
$$(x-2)^2 + y^2 = 4 \tag{2.0.2}$$

Now Comparing equation 2.0.1 and 2.0.2:

$$(x-2)^2 + (4 - x^2) = 4 \tag{2.0.3}$$
$$x^2 + 4 - 2x + 4 - x^2 = 4 \tag{2.0.4}$$

x comes out to be 1

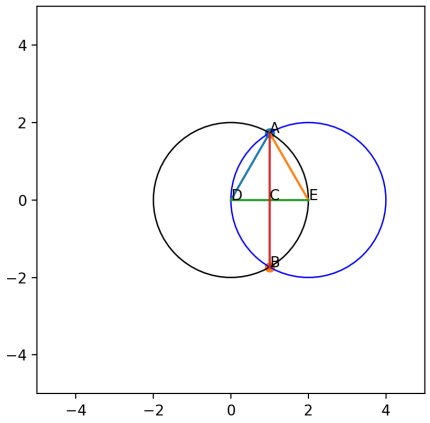

Fig. 0: Figure depicting intersection points of circle

Now,Substituting the value of x in equation 2.0.1:

y comes out to be $\sqrt{3} and -\sqrt{3}$

Now to find the area inclosed between these circles we have to find the integral of these point w.r.t the circles.For this we need to find the area of segment **ABE** and double it to find the area of the entire overlapped region.

To find the area of segment ABE we need angle CDA as:
Here,
r=2 and $\theta = \angle CDA$
$\sin\theta = \frac{\mathbf{AC}}{\mathbf{AD}}$
$\theta = 60$

$$Area = \frac{1}{2}(\frac{\pi}{3} - \sin 60)r^2 \quad (2.0.5)$$

$$(Areaof Sector - Areaof Triangle)$$

$$= \frac{1}{2}(\frac{4\pi}{3} - \sqrt{3}) \quad (2.0.6)$$

$$Totalarea = 2 * Area \quad (2.0.7)$$

$$= \frac{4\pi}{3} - \sqrt{3} \quad (2.0.8)$$