

Assignment 5

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Download all python codes from

https://github.com/SavaranaDatta/EE3900/blob/main/EE3900_As5/codes/EE3900_As5.py

Download latex-tikz codes from

https://github.com/SavaranaDatta/EE3900/blob/main/EE3900_As5/EE3900_As5.tex

As **B** lie on the positive side of the x-axis

$$\lambda_1 > 0 \quad (2.0.9)$$

As **B** lie on the circle, we have

$$\mathbf{B}^\top \mathbf{B} = 4 \quad (2.0.10)$$

$$\lambda_1^2 = 4 \quad (2.0.11)$$

$$\Rightarrow \lambda_1 = \pm 2 \quad (2.0.12)$$

1 PROBLEM(QUADRATIC FORMS Q.2.5)

Find the area of the region in the first quadrant enclosed by x-axis, line $(1 - \sqrt{3})\mathbf{x} = 0$ and the circle $\mathbf{x}^\top \mathbf{x} = 4$.

From 2.0.9

$$\lambda_1 = 2 \quad (2.0.13)$$

$$\Rightarrow \mathbf{B} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \quad (2.0.14)$$

2 SOLUTION

Let **A** be the point of intersection of the line $(1 - \sqrt{3})\mathbf{x} = 0$ and the circle $\mathbf{x}^\top \mathbf{x} = 4$.

The angle(θ) of the sector AOB is

$$\cos \theta = \frac{\mathbf{A}^\top \mathbf{B}}{\|\mathbf{A}\| \|\mathbf{B}\|} \quad (2.0.15)$$

$$= \frac{2\sqrt{3}}{2 \times 2} \quad (2.0.16)$$

$$= \frac{\sqrt{3}}{2} \quad (2.0.17)$$

$$\Rightarrow \theta = 30^\circ \quad (2.0.18)$$

As **A** lie in the 1st quadrant

$$\lambda > 0 \quad (2.0.2)$$

As **A** lie on the circle, we have

$$\mathbf{A}^\top \mathbf{A} = 4 \quad (2.0.3)$$

$$\lambda^2 + \frac{\lambda^2}{3} = 4 \quad (2.0.4)$$

$$\Rightarrow \lambda = \pm \sqrt{3} \quad (2.0.5)$$

$$\text{Area of the sector} = \left(\frac{\theta}{360^\circ} \right) \pi r^2 \quad (2.0.19)$$

$$= \frac{\pi}{3} \quad (2.0.20)$$

From 2.0.2,

$$\lambda = \sqrt{3} \quad (2.0.6)$$

Therefore

$$\mathbf{A} = \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix} \quad (2.0.7)$$

Let **B** be the point of intersection of x-axis and the circle.

$$\mathbf{B} = \lambda_1 \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (2.0.8)$$

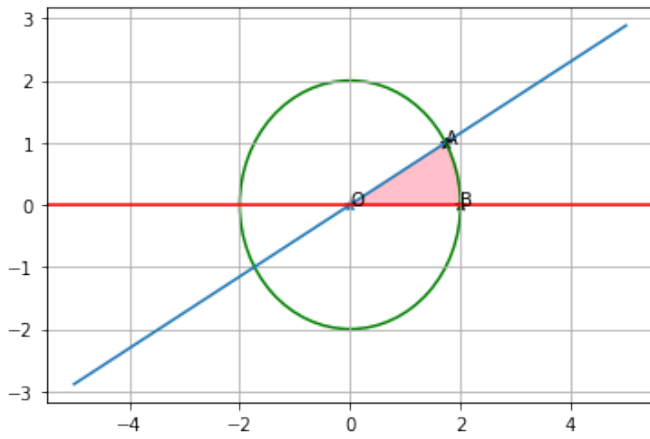


Fig. 0: Reference plot