EE5609: Matrix Theory Assignment-2

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***Abstract*—This document contains a solution for proving the determinant of the given matrix is zero.**

Download the python codes from latex-tikz codes from

https://github.com/pavanmanesh/EE5609/tree/master/Assignment3

1 PROBLEM

P is a point equidistant from two lines l and m intersecting at point A. Show that the line AP bisects the angle between them.

2 SOLUTION

1) Here, the following information is given:

$$\|\mathbf{P}-\mathbf{B}\| = \|\mathbf{P}-\mathbf{C}\| \tag{2.0.1}$$

2) The lines PB is the perpendicular to line AB and PC is the perpendicular to line AC:

$$\left(\mathbf{P}-\mathbf{B}\right)\left(\mathbf{A}-\mathbf{B}\right)^{T} = 0 \tag{2.0.2}$$

$$\left(\mathbf{P}-\mathbf{C}\right)\left(\mathbf{A}-\mathbf{C}\right)^{T} = 0 \tag{2.0.3}$$

We need to prove that the line AP bisects the angle between them

$$\angle BAP = \angle CAP \tag{2.0.4}$$

$$\implies \cos\angle BAP = \cos\angle CAP \tag{2.0.5}$$

$$\frac{(\mathbf{A}-\mathbf{B})^{T}(\mathbf{A}-\mathbf{P})}{\|\mathbf{A}-\mathbf{B}\|\,\|\mathbf{A}-\mathbf{P}\|} = \frac{(\mathbf{A}-\mathbf{C})^{T}(\mathbf{A}-\mathbf{P})}{\|\mathbf{A}-\mathbf{C}\|\,\|\mathbf{A}-\mathbf{P}\|} \tag{2.0.6}$$

This is reduced to

$$\implies \frac{(\mathbf{A}-\mathbf{B})^{T}}{\|\mathbf{A}-\mathbf{B}\|} = \frac{(\mathbf{A}-\mathbf{C})^{T}}{\|\mathbf{A}-\mathbf{C}\|} \tag{2.0.7}$$

From (2.0.2) and (2.0.3),We can write that

$$\left(\mathbf{P}-\mathbf{B}\right)\left(\mathbf{A}-\mathbf{B}\right)^{T} = \left(\mathbf{P}-\mathbf{C}\right)\left(\mathbf{A}-\mathbf{C}\right)^{T} \tag{2.0.8}$$

using (2.0.2) , the above equation reduces to

$$\left(\mathbf{A}-\mathbf{B}\right)^{T} = \left(\mathbf{A}-\mathbf{C}\right)^{T} \tag{2.0.9}$$

By using (2.0.9) in (2.0.7),We can say that the line AP bisects the angle between them

$$\angle BAP = \angle CAP \tag{2.0.10}$$

The Figure below shows the plot of given lines

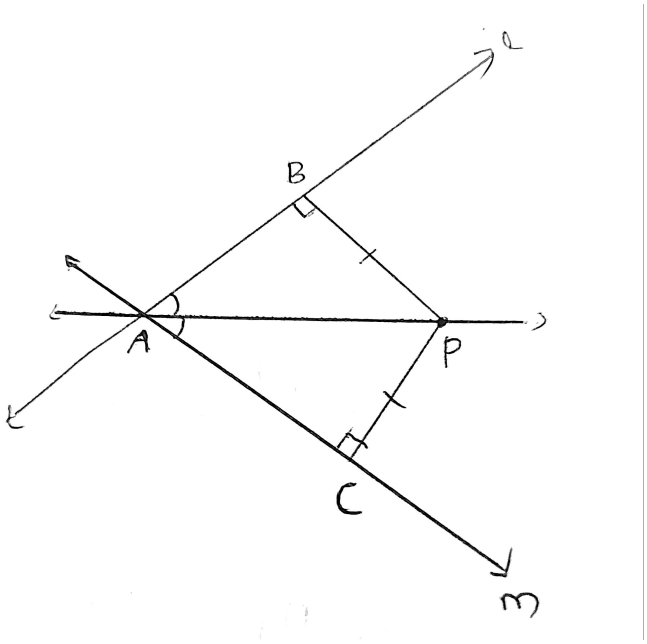

Fig. 2: Plotting the lines