

# ASSIGNMENT 1

RONGALA ARUN SIDDARDHA :AI20BTECH11019

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[https://github.com/ArunSiddardha/EE3900/tree/main/Assignment\\_1/Assignment\\_1.tex](https://github.com/ArunSiddardha/EE3900/tree/main/Assignment_1/Assignment_1.tex)

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[https://github.com/ArunSiddardha/EE3900/tree/main/Assignment\\_1/code/Assignment\\_1.py](https://github.com/ArunSiddardha/EE3900/tree/main/Assignment_1/code/Assignment_1.py)

## 1 PROBLEM- RAMSEY/1.1 POINTS/ Q.7

If the vertices of an isosceles triangle are given by  $\mathbf{B} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}$ ,  $\mathbf{A} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$  and  $\mathbf{C} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ . Find the distance of the vertex A from the base of the triangle

### SOLUTION

Since, Given that triangle is isosceles let us check which two sides are equal,

$$\begin{aligned} BC^2 &= a^2 = (\mathbf{B} - \mathbf{C})^T (\mathbf{B} - \mathbf{C}) \\ &= \begin{pmatrix} -5 & -3 \end{pmatrix} \begin{pmatrix} -5 \\ -3 \end{pmatrix} \\ &= (-5)^2 + (-3)^2 \\ &= 25 + 9 \\ &= 34 \end{aligned}$$

$$\begin{aligned} AB^2 &= c^2 = (\mathbf{A} - \mathbf{B})^T (\mathbf{A} - \mathbf{B}) \\ &= \begin{pmatrix} 1 & 4 \end{pmatrix} \begin{pmatrix} 1 \\ 4 \end{pmatrix} \\ &= (1)^2 + (4)^2 \\ &= 1 + 16 \\ &= 17 \end{aligned}$$

$$\begin{aligned} CA^2 &= b^2 = (\mathbf{C} - \mathbf{A})^T (\mathbf{C} - \mathbf{A}) \\ &= \begin{pmatrix} 4 & -1 \end{pmatrix} \begin{pmatrix} 4 \\ -1 \end{pmatrix} \\ &= (4)^2 + (-1)^2 \\ &= 16 + 1 \\ &= 17 \end{aligned}$$

So, we can see that sides AB , AC are same.

So, the distance between A and the side BC is same as distance between the vertex A and mid point D the side BC.

Mid point of BC is

$$\mathbf{D} = \frac{\mathbf{B} + \mathbf{C}}{2} = \left( \frac{\begin{pmatrix} -2 \\ -2 \end{pmatrix} + \begin{pmatrix} 3 \\ 1 \end{pmatrix}}{2} \right) = \begin{pmatrix} \frac{-1}{2} \\ \frac{-1}{2} \end{pmatrix}$$

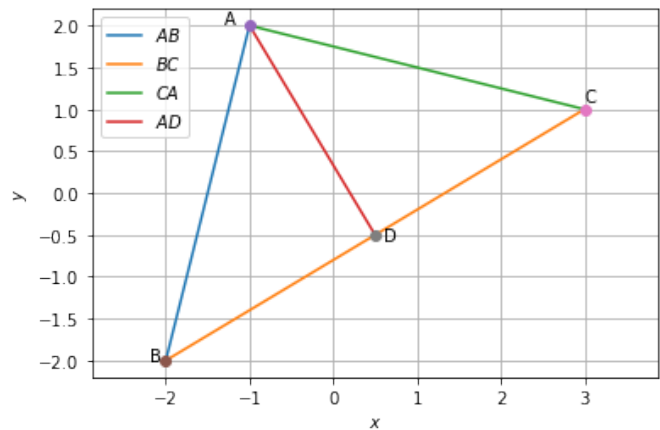


Fig. 0: plot

$$\begin{aligned} AD &= \|\mathbf{A} - \mathbf{D}\| = \sqrt{\left(-1 - \frac{1}{2}\right)^2 + \left(2 - \frac{-1}{2}\right)^2} \\ &= \sqrt{\frac{9}{4} + \frac{25}{4}} \\ &= \sqrt{\frac{34}{4}} \\ &= \frac{\sqrt{34}}{2} \end{aligned}$$

Therefore the distance is  $\frac{\sqrt{34}}{2}$