ASSIGNMENT 1

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Download latex-tikz code from

https://github.com/ArunSiddardha/EE3900/tree/main/Assignment_1/Assignment_1.tex

Download python code from

https://github.com/ArunSiddardha/EE3900/tree/main/Assignment_1/code/Assignment_1.py

1 PROBLEM

If the vertices of an isoceles 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 iscoceles 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

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

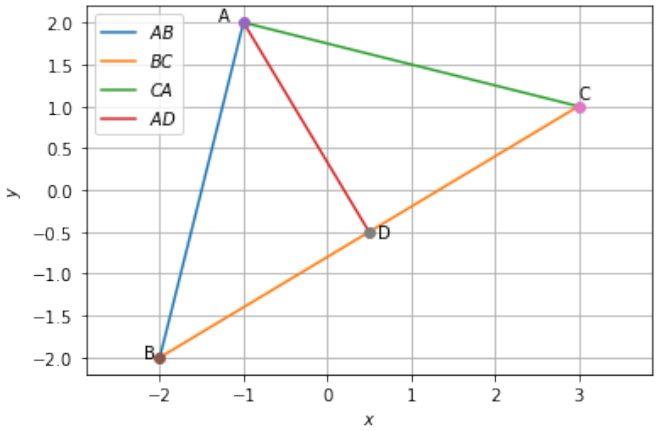

Fig. 0: plot

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

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