Assignment No.2

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Download all python codes from

https://github.com/Vallidevibolla/Assignment−2−1/blob/main/code.py

and latex-tikz codes from

https://github.com/Vallidevibolla/Assignment−2−1/blob/main/main.tex

Question taken from

https://github.com/gadepall/ncert/blob/main/linalg/vectors/gvv_ncert_vectors.pdf− Q.no.2.25

1 Question No.2.25

Find a point on the y-axis which is equidistant from the points A=$\begin{pmatrix}6\\5\end{pmatrix}$ and B=$\begin{pmatrix}-4\\3\end{pmatrix}$

2 Solution

Given,

$$\mathbf{A} = \begin{pmatrix}6\\5\end{pmatrix} \tag{2.0.1}$$

$$\mathbf{B} = \begin{pmatrix}-4\\3\end{pmatrix} \tag{2.0.2}$$

Let $\underline{x}$ be the point on y-axis.Then

$$||\underline{x}-\underline{A}||^2 = ||\underline{x}-\underline{B}||^2 \tag{2.0.3}$$

$$\boxed{(\underline{x}-\underline{A})^T(\underline{x}-\underline{A}) = (\underline{x}-\underline{B})^T(\underline{x}-\underline{B})} \tag{2.0.4}$$

$$(\underline{x}-\underline{A})^T(\underline{x}-\underline{A}) = \underline{x}^T\underline{x}-\underline{x}^T\underline{A}-\underline{A}^T\underline{x}+\underline{A}^T\underline{A} \tag{2.0.5}$$

$$(\underline{x}-\underline{B})^T(\underline{x}-\underline{B}) = \underline{x}^T\underline{x}-\underline{x}^T\underline{B}-\underline{B}^T\underline{x}+\underline{B}^T\underline{B} \tag{2.0.6}$$

Consider the expressions

$$\underline{x}^T\underline{x} = ||x||^2 \tag{2.0.7}$$

$$\underline{x}^T\underline{A} = \underline{A}^T\underline{x} \tag{2.0.8}$$

Final expression of equ.2.0.4 using this written as

$$||x||^2 - 2\underline{A}^T\underline{x}+\underline{A}^T\underline{A} = ||x||^2 - 2\underline{B}^T\underline{x}+\underline{B}^T\underline{B} \tag{2.0.9}$$

$$\implies -2\underline{A}^T\underline{x}+2\underline{B}^T\underline{x} = \underline{B}^T\underline{B}-\underline{A}^T\underline{A} \tag{2.0.10}$$

$$\implies 2\underline{x}(\underline{A}^T-\underline{B}^T) = \underline{A}^T\underline{A}-\underline{B}^T\underline{B}$$

$$2\underline{x}(\underline{A}^T-\underline{B}^T) = ||A||^2 - ||B||^2 \tag{2.0.11}$$

(2.0.12)

$\underline{x}$ lies on the y-axis

$\underline{x}$ = y$\begin{pmatrix}0\\1\end{pmatrix}$= y $\underline{e}_2$ Now substitute this in equ.2.0.12

$$2y\begin{pmatrix}0\\1\end{pmatrix}.\begin{pmatrix}10 & 2\end{pmatrix} = 61 - 25 \tag{2.0.13}$$

$$2y\left(0+2\right) = 36 \tag{2.0.14}$$

$$4y = 36 \tag{2.0.15}$$

$$\boxed{\therefore\ y=9} \tag{2.0.16}$$

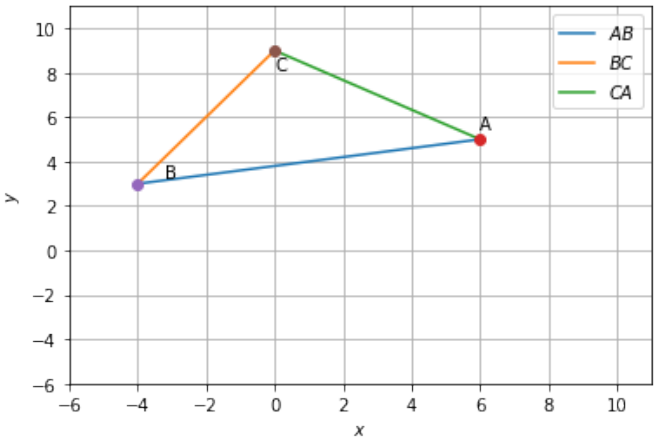

Fig. 2.1: Fig. 2.25