1.1.9.20

EE24BTECH11058 - P.Shiny Diavajna

Question:

Find a point on the Y axis which is equidistant from the points $\begin{pmatrix}5\\-2\end{pmatrix}$ and $\begin{pmatrix}-3\\2\end{pmatrix}$.

Solution:

Symbol	Value	Description
A	$\begin{pmatrix}5\\-2\end{pmatrix}$	First point
B	$\begin{pmatrix}-3\\2\end{pmatrix}$	Second point
Y	$\begin{pmatrix}0\\y\end{pmatrix}$	Point on Y-Axis equidistant from A and B

TABLE 0: Variables Used

$$\|\mathbf{A}-\mathbf{Y}\|^2 = \|\mathbf{B}-\mathbf{Y}\|^2 \tag{0.1}$$

$$(\mathbf{A}-\mathbf{Y})^\top(\mathbf{A}-\mathbf{Y}) = (\mathbf{B}-\mathbf{Y})^\top(\mathbf{B}-\mathbf{Y}) \tag{0.2}$$

$$\left(\mathbf{A}^\top\right)(\mathbf{A}) + \left(\mathbf{Y}^\top\right)(\mathbf{Y}) - 2\left(\mathbf{A}^\top\right)(\mathbf{Y}) = \left(\mathbf{B}^\top\right)(\mathbf{B}) + \left(\mathbf{Y}^\top\right)(\mathbf{Y}) - 2\left(\mathbf{B}^\top\right)(\mathbf{Y}) \tag{0.3}$$

$$\mathbf{A}^\top\mathbf{A} - \mathbf{B}^\top\mathbf{B} = 2\left(\mathbf{A}^\top - \mathbf{B}^\top\right)(\mathbf{Y}) \tag{0.4}$$

$$\begin{pmatrix}5 & -2\end{pmatrix}\begin{pmatrix}5\\-2\end{pmatrix} - \begin{pmatrix}-3 & 2\end{pmatrix}\begin{pmatrix}-3\\2\end{pmatrix} = 2\left(\begin{pmatrix}5 & -2\end{pmatrix} - \begin{pmatrix}-3 & 2\end{pmatrix}\right)\begin{pmatrix}0\\y\end{pmatrix} \tag{0.5}$$

$$25 + 4 - (9+4) = 2\begin{pmatrix}8 & -4\end{pmatrix}\begin{pmatrix}0\\y\end{pmatrix} \tag{0.6}$$

$$y = -2 \tag{0.7}$$

The point on the Y axis which is equidistant to **A** and **B** is $\begin{pmatrix}0\\-2\end{pmatrix}$

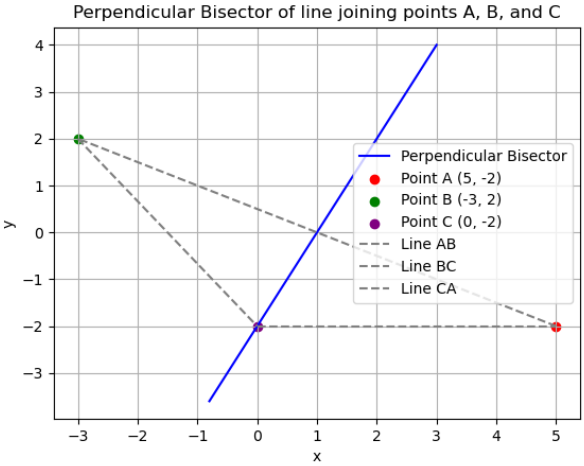

Fig. 0.1: Plot of the given points and the bisector