1.1.9.17

EE24BTECH11030 - J.KEDARANANDA

Question:
Write the coordinates of the point **P** on the x-axis which is equidistant from the points $\mathbf{A}\left(-2,0\right)$ $\mathbf{B}\left(6,0\right)$. (10, 2019)

Solution:

Variable	Description	Formula
A	A Point to be plotted	$A = \begin{pmatrix} -2 \\ 0 \end{pmatrix}$
B	A Point to be plotted	$B = \begin{pmatrix} 6 \\ 0 \end{pmatrix}$
P	Midpoint of A and B	$(A-B)^\top P = \frac{\|\|A\|\|^2 - \|\|B\|\|^2}{2}$

TABLE 0

If **P** is equidistant from the points **A** and **B**

$$\|\mathbf{P}-\mathbf{A}\| = \|\mathbf{P}-\mathbf{B}\| \tag{0.1}$$

$$\|\mathbf{P}-\mathbf{A}\|^2 = \|\mathbf{P}-\mathbf{B}\|^2 \tag{0.2}$$

$$\|\mathbf{P}\|^2 - 2\mathbf{P}^\top\mathbf{A} + \|\mathbf{A}\|^2 = \|\mathbf{P}\|^2 - 2\mathbf{P}^\top\mathbf{B} + \|\mathbf{B}\|^2 \tag{0.3}$$

By simplifying further,

$$(\mathbf{A}-\mathbf{B})^\top \mathbf{P} = \frac{\|\mathbf{A}\|^2 - \|\mathbf{B}\|^2}{2} \tag{0.4}$$

$$\begin{pmatrix} -8 \\ 0 \end{pmatrix}^\top \mathbf{P} = \frac{\left\|\begin{pmatrix} -2 \\ 0 \end{pmatrix}\right\|^2 - \left\|\begin{pmatrix} 6 \\ 0 \end{pmatrix}\right\|^2}{2} = -16 \tag{0.5}$$

Comparing with $n^\top x = c$

$$\mathbf{n} = \begin{pmatrix} -8 \\ 0 \end{pmatrix} \tag{0.6}$$

$$\mathbf{c} = -16 \tag{0.7}$$

$$-8x + 0y = -16 \tag{0.8}$$

$$x = 2, y = 0 \tag{0.9}$$

$$\mathbf{P} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \tag{0.10}$$

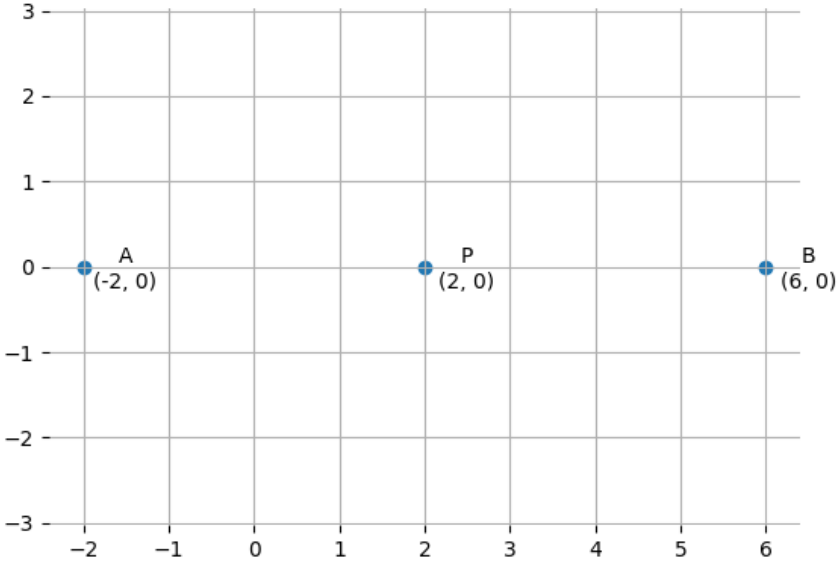

Fig. 0.1