x

1-1.9-13

EE24BTECH11063 - Y.Harsha Vardhan Reddy

Question:
A man goes 5 meters due west and then 12 meters due north. How far is he from the starting point?
Solution:

Variable	Description
x_1	Displacement-1
x_2	Displacement-2
x	Net displacement
x^T	Transpose of net displacement
$\|\|x\|\|$	Magnitude of displacement

TABLE 0: Variables Used

$$x_1 = \begin{pmatrix} -5 \\ 0 \end{pmatrix} \tag{0.1}$$

$$x_2 = \begin{pmatrix} 0 \\ 12 \end{pmatrix} \tag{0.2}$$

Net displacement is given by,

$$x = x_1 + x_2 \tag{0.3}$$

$$x = \begin{pmatrix} -5 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ 12 \end{pmatrix} = \begin{pmatrix} -5 \\ 12 \end{pmatrix} \tag{0.4}$$

$$x^T = \begin{pmatrix} -5 & 12 \end{pmatrix} \tag{0.5}$$

Therefore, the magnitude of x is given by,

$$\|x\| = \sqrt{x^T * x} \tag{0.6}$$

$$\|x\| = \sqrt{25 + 144} = \sqrt{169} = 13 units \tag{0.7}$$

Therefore, the distance of man from starting point is 13 units.