2.7.8

EE25BTECH11026-Harsha

Question:
Find $|\mathbf{a}-\mathbf{b}|$, if two vectors $\mathbf{a}$ and $\mathbf{b}$ are such that $|\mathbf{a}| = 2$,$|\mathbf{b}| = 3$ and $\mathbf{a}.\mathbf{b} = 4$.
Solution:
Let us solve the given equation theoretically and then verify the solution computationally.

According to the question,

$$|\mathbf{a}| = 2 \;\; ; \;\; |\mathbf{b}| = 3 \;\; ; \;\; \mathbf{a}^T\mathbf{b} = 4 \tag{0.1}$$

The value of $\|\mathbf{a}-\mathbf{b}\|$ can be computed by the following formula,

$$\|\mathbf{a}-\mathbf{b}\|^2 = \|\mathbf{a}\|^2 + \|\mathbf{b}\|^2 - 2\mathbf{a}^T\mathbf{b} \tag{0.2}$$

$$\therefore \|\mathbf{a}-\mathbf{b}\|^2 = 2^2 + 3^2 - 2\times 4 \tag{0.3}$$

$$\|\mathbf{a}-\mathbf{b}\|^2 = 5 \tag{0.4}$$

$$\implies \|\mathbf{a}-\mathbf{b}\| = \sqrt{5} = 2.2361 units \tag{0.5}$$

From the figure, taking an example of vectors $\mathbf{a}$ and $\mathbf{b}$,it is clearly verified that the theoretical solution matches with the computational solution.