

12.873

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Question. Consider a Cartesian coordinate system defined over a 3-dimensional vector space with orthogonal unit basis vectors \hat{i} , \hat{j} and \hat{k} . Let vector $\mathbf{a} = \sqrt{2}\hat{i} + \frac{1}{\sqrt{2}}\hat{j} + \hat{k}$ and vector $\mathbf{b} = \frac{1}{\sqrt{2}}\hat{i} + \sqrt{2}\hat{j} - \hat{k}$. The inner product of these vectors ($\mathbf{a} \cdot \mathbf{b}$) is

Solution: The given vectors can be given as:

$$\mathbf{a} = \begin{pmatrix} \sqrt{2} \\ \frac{1}{\sqrt{2}} \\ 1 \end{pmatrix} \quad (1)$$

$$\mathbf{b} = \begin{pmatrix} \frac{1}{\sqrt{2}} \\ \sqrt{2} \\ -1 \end{pmatrix} \quad (2)$$

And also

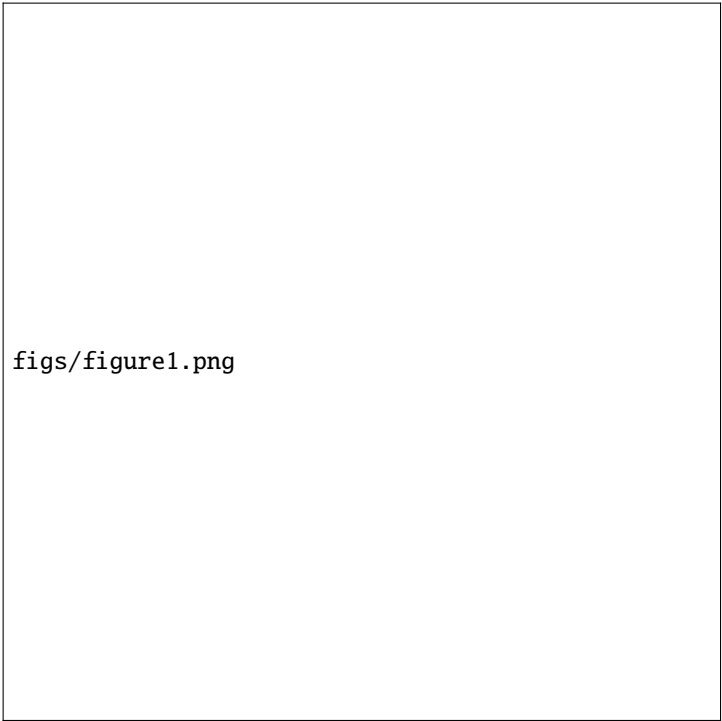
$$\mathbf{a} \cdot \mathbf{b} = \mathbf{a}^T \mathbf{b} \quad (3)$$

$$\mathbf{a}^T \mathbf{b} = \begin{pmatrix} \sqrt{2} \\ \frac{1}{\sqrt{2}} \\ 1 \end{pmatrix}^T \begin{pmatrix} \frac{1}{\sqrt{2}} \\ \sqrt{2} \\ -1 \end{pmatrix} \quad (4)$$

$$\mathbf{a}^T \mathbf{b} = 1 + 1 - 1 \quad (5)$$

$$\mathbf{a}^T \mathbf{b} = 1 \quad (6)$$

$$\mathbf{a} \cdot \mathbf{b} = 1 \quad (7)$$



`figs/figure1.png`