VECTOR ALGEBRA

12^{th} Maths - Chapter 10

This is Problem-3 from Exercise 10.3

1. Find the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$.

   Solution: let $\mathbf{A}$ and $\mathbf{B}$ be the given vectors

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} \tag{1}$$

   The projection of $\mathbf{A}$ on $\mathbf{B}$ is given as

$$\frac{\mathbf{A}^\top \mathbf{B}}{\|\mathbf{B}\|} \tag{2}$$

   The magnitude of $\mathbf{B}$ is

$$\|\mathbf{B}\| = \sqrt{2} \tag{3}$$

   Then substituting the values of $\mathbf{A}$ and $\mathbf{B}$ in (2) gives

$$\frac{\begin{pmatrix} 1 & -1 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}}{\sqrt{2}} = 0 \tag{4}$$