1.11.14 Matgeo

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Question

If $\vec{a} = 4\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector parallel to the vector $\vec{a} + \vec{b}$.

Solution

The unit vector in the direction of the vector $\mathbf{a} + \mathbf{b}$ is given by the equation :

$$\frac{\mathbf{a}+\mathbf{b}}{\|\mathbf{a}+\mathbf{b}\|}$$

$$\mathbf{a}+\mathbf{b} = \begin{bmatrix} 4 \\ -1 \\ 1 \end{bmatrix} + \begin{bmatrix} 2 \\ -2 \\ 1 \end{bmatrix} = \begin{bmatrix} 6 \\ -3 \\ 2 \end{bmatrix} \tag{1}$$

$$\frac{\mathbf{a}+\mathbf{b}}{\|\mathbf{a}+\mathbf{b}\|} = \frac{1}{7}\begin{bmatrix} 6 \\ -3 \\ 2 \end{bmatrix} = \begin{bmatrix} \frac{6}{7} \\ -\frac{3}{7} \\ \frac{2}{7} \end{bmatrix} \tag{2}$$

Graphical Representation

Hence the unit vector in the direction of the vector $\mathbf{a}+\mathbf{b}$ is $\frac{6}{7}\hat{i} - \frac{3}{7}\hat{j} + \frac{2}{7}\hat{k}$