

4.8.31

AI25BTECH11035 - SUJAL RAJANI

QUESTION

Given $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\mathbf{b} = 3\hat{i} - \hat{k}$ and $\mathbf{c} = 2\hat{i} + \hat{j} - 2\hat{k}$ Find a vector \mathbf{d} which is perpendicular to both \mathbf{a} and \mathbf{b} and $\mathbf{c} \cdot \mathbf{d} = 3$

solution as mention in the question :

$$\mathbf{a} = \begin{pmatrix} 2 \\ -1 \\ 1 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 3 \\ 0 \\ -1 \end{pmatrix}, \mathbf{c} = \begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}$$

$$\mathbf{a}^\top \mathbf{d} = 0, \mathbf{b}^\top \mathbf{d} = 0, \mathbf{c}^\top \mathbf{d} = 3. \quad (1)$$

$$\begin{pmatrix} \mathbf{a} & \mathbf{b} \end{pmatrix}^\top \mathbf{d} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} 2 & -1 & 1 \\ 3 & 0 & -1 \end{pmatrix} \mathbf{d} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}.$$

$$\mathbf{d} = k \begin{pmatrix} 1 \\ 5 \\ 3 \end{pmatrix}$$

k is a constant
by equation (1):

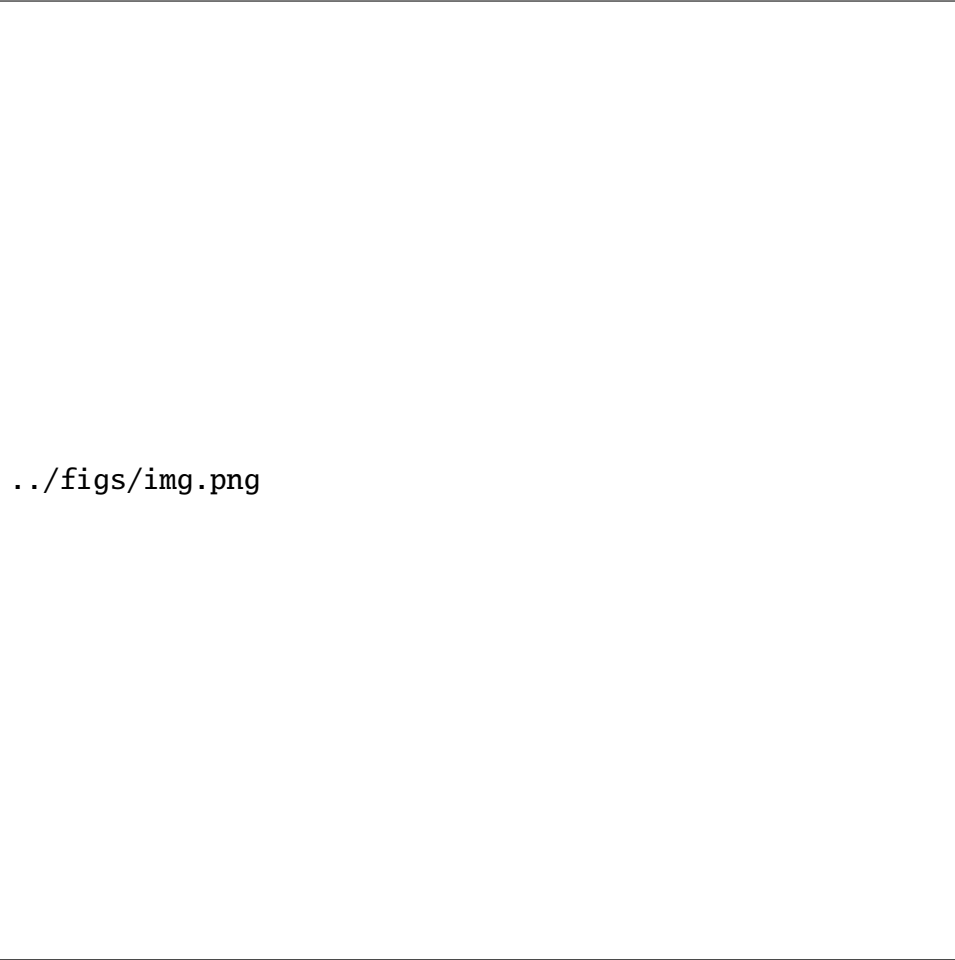
$$\mathbf{c}^\top \mathbf{d} = 3$$

$$\begin{pmatrix} 2 \\ 1 \\ -2 \end{pmatrix}^\top \mathbf{d} = 3$$

$$k = \frac{3}{1}.$$

the position vector \mathbf{d} :

$$\mathbf{d} = \begin{pmatrix} 3 \\ 15 \\ 9 \end{pmatrix}$$



`../figs/img.png`