

EE5609 Assignment 1

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Abstract—This assignment involves finding the value of k such that the two vectors are perpendicular to each other.

The python code solution can be downloaded from

https://github.com/Vaibhav11002/Assignment_1/blob/master/solution_1.py

1 PROBLEM

For $\mathbf{a} = \begin{pmatrix} 2 \\ 2 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$. Find k such that $(\mathbf{a} + k\mathbf{b}) \perp \mathbf{c}$.

2 SOLUTION

The two vectors are perpendicular to each other if their dot product is zero.

So,

$$\begin{aligned}\mathbf{c}^T (\mathbf{a} + k\mathbf{b}) &= 0 \\ \mathbf{c}^T \mathbf{a} + k\mathbf{c}^T \mathbf{b} &= 0 \\ k\mathbf{c}^T \mathbf{b} &= -\mathbf{c}^T \mathbf{a}\end{aligned}$$

$$k = \frac{-\mathbf{c}^T \mathbf{a}}{\mathbf{c}^T \mathbf{b}}$$

On solving the matrix multiplication,

$$\begin{aligned}\mathbf{c}^T \mathbf{b} &= -1, \\ \mathbf{c}^T \mathbf{a} &= 8\end{aligned}$$

So,

$$\begin{aligned}k &= \frac{-8}{-1} \\ k &= 8\end{aligned}$$

Thus for the value of $k=8$, we get $(\mathbf{a}+k\mathbf{b}) \perp \mathbf{c}$.