

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

Let $\mathbf{d} = \mathbf{a} + k\mathbf{b}$ then,

$$\mathbf{d} = \begin{pmatrix} 2 - k \\ 2 + 2k \\ 3 + k \end{pmatrix}.$$

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

We have $\mathbf{d} \perp \mathbf{c}$.

So,

$$\mathbf{d}^T \mathbf{c} = 0$$

which can be written as,

$$\mathbf{d}^T \begin{pmatrix} 2 \\ 1 \\ -4 \end{pmatrix} = 0$$

On solving the matrix multiplication we get,

$$3(2 - k) + 1(2 + 2k) = 0$$

$$6 - 3k + 2 + 2k = 0$$

$$8 - k = 0$$

$$k = 8$$

Thus for the value of $k=8$,

we get $(\mathbf{a} + k\mathbf{b}) \perp \mathbf{c}$.