

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,

$$\mathbf{c}^T (\mathbf{a} + k\mathbf{b}) = 0 \quad (2.0.1)$$

$$\mathbf{c}^T \mathbf{a} + k\mathbf{c}^T \mathbf{b} = 0 \quad (2.0.2)$$

$$k\mathbf{c}^T \mathbf{b} = -\mathbf{c}^T \mathbf{a} \quad (2.0.3)$$

$$\Rightarrow k = \frac{-\mathbf{c}^T \mathbf{a}}{\mathbf{c}^T \mathbf{b}} \quad (2.0.4)$$

On solving the matrix multiplication,

$$\mathbf{c}^T \mathbf{b} = -1, \quad (2.0.5)$$

$$\mathbf{c}^T \mathbf{a} = 8 \quad (2.0.6)$$

So,

$$\Rightarrow k = \frac{-8}{-1} \quad (2.0.7)$$

$$k = 8 \quad (2.0.8)$$

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