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/EE5609/blob/
    master/Codes/assignment_1.py

1 PROBLEM

For,

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

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,

$$\mathbf{c}^T (\mathbf{a} + k\mathbf{b}) = 0 \qquad (2.0.1)$$
$$\mathbf{c}^T \mathbf{a} + k\mathbf{c}^T \mathbf{b} = 0 \qquad (2.0.2)$$
$$k\mathbf{c}^T \mathbf{b} = -\mathbf{c}^T \mathbf{a} \qquad (2.0.3)$$
$$\implies k = \frac{-\mathbf{c}^T \mathbf{a}}{\mathbf{c}^T \mathbf{b}} \qquad (2.0.4)$$

On solving the matrix multiplication,

$$\mathbf{c}^T \mathbf{b} = -1, \qquad (2.0.5)$$
$$\mathbf{c}^T \mathbf{a} = 8 \qquad (2.0.6)$$

So,

$$\implies k = \frac{-8}{-1} \qquad (2.0.7)$$
$$k = 8 \qquad (2.0.8)$$

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