

Let

$$\mathbf{A} = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}, \quad \mathbf{C} = \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

(1) [5] Compute $\mathbf{BC} - 3\mathbf{A}^T$ if possible. (If the expression is not defined then say so.)

(2) [5] Compute $\text{tr}(\mathbf{ABC})$ if possible. (If the expression is not defined then say so.)

(3) [5] Find all values of k so that

$$\begin{bmatrix} k & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = 0$$