Answer on Question #55771 –Math– Linear Algebra

Given matrices A, B, and C, below, preform the indicated operations if possible. If the operation is not possible, explain why.

$$A = \begin{vmatrix} 2 & -1 & 0 \\ 0 & 5 & 0.3 \\ 1 & 4 & 10 \end{vmatrix}, B = \begin{vmatrix} 5 & 0 & 2 \\ 1 & -3 & 9 \\ 2 & 0 & 4 \end{vmatrix}, C = |1 \quad 3 \quad 5|$$

a. $3A + B$

b. $2B + C$

c. CA

Solution

a) $3A + B = 3 \cdot \begin{pmatrix} 2 & -1 & 0 \\ 0 & 5 & 0.3 \\ 1 & 4 & 10 \end{pmatrix} + \begin{pmatrix} 5 & 0 & 2 \\ 1 & -3 & 9 \\ 2 & 0 & 4 \end{pmatrix} = \begin{pmatrix} 3 \cdot 2 + 5 & 3 \cdot (-1) + 0 & 3 \cdot 0 + 2 \\ 3 \cdot 0 + 1 & 3 \cdot 5 + (-3) & 3 \cdot 0.3 + 9 \\ 3 \cdot 1 + 2 & 3 \cdot 4 + 0 & 3 \cdot 10 + 4 \end{pmatrix} =$

$$= \begin{pmatrix} 6 + 5 & -3 + 0 & 0 + 2 \\ 0 + 1 & 15 - 3 & 0.9 + 9 \\ 3 + 2 & 12 + 0 & 30 + 4 \end{pmatrix} = \begin{pmatrix} 11 & -3 & 2 \\ 1 & 12 & 9.9 \\ 5 & 12 & 34 \end{pmatrix}.$$

b) The sum of two matrices is defined when they have the same dimensions (the same number of rows and columns). Matrix B has 3 rows and 3 columns, but matrix C has 1 row and 3 columns. The matrices have different dimensions, therefore, it is impossible to find their sum.

c) To work with matrix multiplication, the columns of the second matrix should have the same number of entries as in the rows which the first matrix has. The number of column of matrix C is equal to the number of rows of the matrix A so we can multiply matrices

$$D = CA = (1 \quad 3 \quad 5)\begin{pmatrix} 2 & -1 & 0 \\ 0 & 5 & 0.3 \\ 1 & 4 & 10 \end{pmatrix} = (7 \quad 34 \quad 50{,}9)$$

The components of the matrix D are calculated as follows:

$$d_{11} = c_{11}a_{11} + c_{12}a_{21} + c_{13}a_{31} = 1 \cdot 2 + 3 \cdot 0 + 5 \cdot 1 = 7$$

$$d_{12} = c_{11}a_{12} + c_{12}a_{22} + c_{13}a_{32} = 1 \cdot (-1) + 3 \cdot 5 + 5 \cdot 4 = 34$$

$$d_{13} = c_{11}a_{13} + c_{12}a_{23} + c_{13}a_{33} = 1 \cdot 0 + 3 \cdot 0.3 + 5 \cdot 10 = 50.9$$

Answer: a) $3A + B = \begin{pmatrix} 11 & -3 & 2 \\ 1 & 12 & 9.9 \\ 5 & 12 & 34 \end{pmatrix}$; **b)** The matrices have different dimensions, therefore it is impossible to find their sum; **c)** $CA = (7 \quad 34 \quad 50{,}9)$.