Example Homework for Linear Algebra

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Instructions: Let

$$A = \begin{bmatrix} -3 & 0 & 1 \\ 2 & 5 & -4 \end{bmatrix} \quad B = \begin{bmatrix} 6 & -7 & 1 \\ -1 & 5 & 2 \end{bmatrix}$$
$$C = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \quad D = \begin{bmatrix} 1 & -3 \\ 0 & 1 \end{bmatrix} \quad E = \begin{bmatrix} 4 \\ -5 \end{bmatrix}.$$

Compute the following expressions. If an expression is undefined, explain why.
Solutions

1.
$$\begin{aligned} -3A &= -3 \begin{bmatrix} -3 & 0 & 1 \\ 2 & 5 & -4 \end{bmatrix} \\ &= -3 \begin{bmatrix} (-3)\cdot(-3) & (-3)\cdot 0 & (-3)\cdot 1 \\ (-3)\cdot 2 & (-3)\cdot 5 & (-3)\cdot(-4) \end{bmatrix} \\ &= -3 \begin{bmatrix} 9 & 0 & -3 \\ -6 & -15 & 12 \end{bmatrix} \end{aligned}$$

2.
$$\begin{aligned} B - 3A &= B + (-3)A \\ &= \begin{bmatrix} 6 & -7 & 1 \\ -1 & 5 & 2 \end{bmatrix} + \begin{bmatrix} 9 & 0 & -3 \\ -6 & -15 & 12 \end{bmatrix} \\ &= \begin{bmatrix} (6+9) & (-7+0) & (1-3) \\ (-1-6) & (5-15) & (2+14) \end{bmatrix} \\ &= \begin{bmatrix} 15 & -7 & -2 \\ -7 & -10 & 16 \end{bmatrix} \end{aligned}$$

3. $A + C$ is undefined because A has more columns than C.

4. AD is undefined because A has more columns than D has rows.

5.

$$
\begin{aligned}
CD &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & -3 \\ 0 & 1 \end{bmatrix} \\
&= \begin{bmatrix} 1 \cdot 1 + 2 \cdot 0 & 1 \cdot (-3) + 2 \cdot 1 \\ 0 \cdot 1 + 1 \cdot 0 & 0 \cdot (-3) + 1 \cdot 1 \end{bmatrix} \\
&= \begin{bmatrix} 1 + 0 & (-3) + 2 \\ 0 + 0 & 0 + 1 \end{bmatrix} \\
&= \begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix}
\end{aligned}
$$

6.

$$
\begin{aligned}
CE &= \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 4 \\ -5 \end{bmatrix} \\
&= \begin{bmatrix} 1 \cdot 4 + 2 \cdot (-5) \\ 0 \cdot 4 + 1 \cdot (-5) \end{bmatrix} \\
&= \begin{bmatrix} -6 \\ -5 \end{bmatrix}
\end{aligned}
$$