1) Write down the three-by-three matrix with ones on the diagonal and zeros elsewhere.

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

2) Write down the three-by-four matrix with ones on the diagonal and zeros elsewhere

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

3) Write down the four-by-three matrix with ones on the diagonal and zeros elsewhere

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

4) $A = \begin{bmatrix} 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 4 & -2 & 1 \\ 2 & -4 & -2 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 3 & 4 \\ 4 & 3 \end{bmatrix}$, $E = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$

Compute if defined

$B - 2A$: $\begin{bmatrix} 4 & -2 & 1 \\ 2 & -4 & -2 \end{bmatrix} - \begin{bmatrix} -4 & -2 & 2 \\ -2 & 2 & -2 \end{bmatrix} = \begin{bmatrix} 0 & -4 & -1 \\ 0 & -2 & -4 \end{bmatrix}$

$3C - E$: undefined

AC : undefined

CD : $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 3 & 4 \\ 4 & 3 \end{bmatrix} = \begin{bmatrix} 11 & 10 \\ 10 & 11 \end{bmatrix}$

CB : $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 4 & -2 & 1 \\ 2 & -4 & -2 \end{bmatrix} = \begin{bmatrix} 8 & -10 & -3 \\ 10 & -8 & 0 \end{bmatrix}$

5) Let $A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$, $C = \begin{bmatrix} 4 & 3 \\ 0 & 2 \end{bmatrix}$. Verify that $AB = AC$ and yet $B \neq C$.

$A \cdot B = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix} \cdot \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 4 & 7 \\ 8 & 14 \end{bmatrix}$

$A \cdot C = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix} \cdot \begin{bmatrix} 4 & 3 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 4 & 7 \\ 8 & 14 \end{bmatrix}$

$B \neq C$

6) Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 4 \end{bmatrix}$ and $D = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix}$. Compute AD and DA.

$A \cdot D = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix} = \begin{bmatrix} 2 & 3 & 4 \\ 2 & 6 & 12 \\ 2 & 9 & 16 \end{bmatrix}$

$D \cdot A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 4 \end{bmatrix} \cdot \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 4 \end{bmatrix} = \begin{bmatrix} 2 & 2 & 2 \\ 3 & 6 & 9 \\ 4 & 12 & 16 \end{bmatrix}$