

Linear Algebra – 1594

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Homework #1 page 100 # 1&3

Referring to the matrices of exercises 1 and 2 please also compute  $B^T$ ,  $D^T$ ,  $D^T+C$ ,  $AB^T$ ,  $B^T A$ , and  $E^T C$ .

For these computations explain any undefined expression

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

$$E = \begin{pmatrix} -5 \\ 3 \end{pmatrix}$$

1.  $-2A$ ,  $B-2A$ ,  $AC$ ,  $CD$

A.  $-2A$

$$\begin{pmatrix} 2(-2) & 0(-2) & 1(-1) \\ 4(-2) & -5(-2) & 2(-2) \end{pmatrix} = \begin{pmatrix} -4 & 0 & 2 \\ -8 & 10 & -4 \end{pmatrix}$$

B.  $B-2A = B+(-2A)$

$$\begin{pmatrix} 7 & -5 & 1 \\ 1 & -4 & -3 \end{pmatrix} + \begin{pmatrix} -4 & 0 & 2 \\ -8 & 10 & -4 \end{pmatrix} = \begin{pmatrix} (-4) + 7 & (-5) + 0 & 1 + 2 \\ (-8) + 1 & (-4) + 10 & (-3) + (-7) \end{pmatrix}$$

$$= \begin{pmatrix} 3 & -5 & 3 \\ -7 & 6 & -7 \end{pmatrix}$$

C.  $AC$

$$\begin{pmatrix} 2 & 0 & -1 \\ 4 & -5 & 2 \end{pmatrix} * \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}$$

$\begin{matrix} 2 \times 3 & & 2 \times 2 \\ | & & | \\ \hline & & \end{matrix}$

In order to multiply matrices the two numbers indicate by the lines have to be the same size so in this case we cannot multiply so it is undefined.

D.  $CD$

$$\begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix} * \begin{pmatrix} 3 & 5 \\ -1 & 4 \end{pmatrix} = \begin{pmatrix} 1 * 3 + 2 * (-1) & 1 * 5 + 2 * 4 \\ (-2) * 3 + 1 * (-1) & 5 * (-2) + 1 * 4 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 13 \\ -7 & -6 \end{pmatrix}$$

3.

$$\text{Let } A = \begin{pmatrix} 2 & -5 \\ 3 & -2 \end{pmatrix} \quad \text{Compute } 3I_2 - A \text{ and } (3I_2)A$$

$$I_2 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$3I_2 - A = \begin{pmatrix} 1 * 3 & 0 * 3 \\ 0 * 3 & 1 * 3 \end{pmatrix} - \begin{pmatrix} 2 & -5 \\ 3 & -2 \end{pmatrix} = \begin{pmatrix} 1 & 5 \\ -3 & 5 \end{pmatrix}$$

$$(3I_2)A = \begin{pmatrix} 2 * 3 & (-5) * 3 \\ 3 * 3 & (-2) * 3 \end{pmatrix} = \begin{pmatrix} 6 & -15 \\ 9 & -6 \end{pmatrix}$$

$B^T$

$$B = \begin{pmatrix} 7 & -5 & 1 \\ 1 & -4 & -3 \end{pmatrix} \quad B \text{ transpose} = \begin{pmatrix} 7 & 1 \\ -5 & -4 \\ 1 & -3 \end{pmatrix}$$

$D^T$

$$D = \begin{pmatrix} 3 & 5 \\ -1 & 4 \end{pmatrix} \quad D \text{ transpose} = \begin{pmatrix} 3 & -1 \\ 5 & 4 \end{pmatrix}$$

$D^T + C$

$$D = \begin{pmatrix} 3 & 5 \\ -1 & 4 \end{pmatrix} \quad C = \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}$$

$$D \text{ transpose} = \begin{pmatrix} 3 & -1 \\ 5 & 4 \end{pmatrix}$$

$$D^T + C = \begin{pmatrix} 3 & -1 \\ 5 & 4 \end{pmatrix} + \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix} = \begin{pmatrix} 4 & 1 \\ 3 & 5 \end{pmatrix}$$

$AB^T$

$$A = \begin{pmatrix} 2 & 0 & -1 \\ 4 & -5 & 2 \end{pmatrix} \quad B = \begin{pmatrix} 7 & -5 & 1 \\ 1 & -4 & -3 \end{pmatrix} \quad B \text{ transpose} = \begin{pmatrix} 7 & 1 \\ -5 & -4 \\ 1 & -3 \end{pmatrix}$$

$$AB^T = \begin{pmatrix} 2 & 0 & 1 \\ -4 & -5 & 2 \end{pmatrix} * \begin{pmatrix} 7 & 1 \\ -5 & -4 \\ 1 & -3 \end{pmatrix} =$$

$$\begin{pmatrix} (2 * -7) + (0 * -5) + (-1 * -1) & (2 * 1) + (0 * -4) + (-1 * -3) \\ (-4 * -7) + (-5 * -5) + (2 * -1) & (4 * 1) + (-5 * -4) + (2 * -3) \end{pmatrix}$$

$$\begin{pmatrix} -13 & 5 \\ -5 & 18 \end{pmatrix} = AB^T$$

$B^T A$

$$B = \begin{pmatrix} 7 & -5 & 1 \\ 1 & -4 & -3 \end{pmatrix} \quad A = \begin{pmatrix} 2 & 0 & -1 \\ 4 & -5 & 2 \end{pmatrix} \quad B \text{ transpose} = \begin{pmatrix} 7 & 1 \\ -5 & -4 \\ 1 & -3 \end{pmatrix}$$

$$\begin{pmatrix} 7 & 1 \\ -5 & -4 \\ 1 & -3 \end{pmatrix} * \begin{pmatrix} 2 & 0 & -1 \\ 4 & -5 & 2 \end{pmatrix}$$

$$\begin{pmatrix} (7 * 2) + (1 * 4) + (0 * 0) & (7 * 0) + (1 * -5) + (0 * 0) & (7 * -1) + (1 * 2) + (0 * 0) \\ (-5 * 2) + (-4 * -4) + (0 * 0) & (-5 * 0) + (-4 * -5) + (0 * 0) & (-5 * -1) + (-4 * 2) + (0 * 0) \\ (1 * 2) + (-3 * 4) + (0 * 0) & (1 * 0) + (-3 * -5) + (0 * 0) & (1 * -1) + (-3 * 2) + (0 * 0) \end{pmatrix}$$

$$= \begin{pmatrix} 18 & -5 & -5 \\ -26 & 20 & -3 \\ -10 & 15 & -7 \end{pmatrix}$$

