Week 5 Homework Solutions.

1. $-2A = \begin{bmatrix} -4 & 0 & 2 \\ -8 & 10 & -4 \end{bmatrix}$

$B - 2A = \begin{bmatrix} 3 & -5 & 3 \\ -7 & 6 & -7 \end{bmatrix}$

AC is undefined (need #cols (A) = #rows (C)).

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

2. $A + 3B = \begin{bmatrix} 23 & -15 & 2 \\ 7 & -17 & -7 \end{bmatrix}$

$2C - 3E$ undefined.

$DB = \begin{bmatrix} 26 & -35 & -12 \\ -3 & -11 & -13 \end{bmatrix}$

EC undefined.

5 $AB = \begin{bmatrix} -10 & 11 \\ 0 & 8 \\ 26 & -19 \end{bmatrix}$

7. B is 3×7.

8 5 rows.

9. $AB = \begin{bmatrix} -7 & 18+3k \\ -4 & -9+k \end{bmatrix}$ $\quad BA = \begin{bmatrix} -7 & 12 \\ -6-k & -9+k \end{bmatrix}$

$AB = BA \iff -4 = -6 - k \iff \underline{k = -2}$.

& $18 + 3k = 12$

11) $AD = \begin{bmatrix} 5 & 6 & 6 \\ 10 & 12 & 10 \\ 15 & 15 & 12 \end{bmatrix}$ Multiplies colums of A by corresp. entries in D.

$DA = \begin{bmatrix} 5 & 10 & 15 \\ 6 & 12 & 15 \\ 6 & 10 & 12 \end{bmatrix}$ Multiplies rows of A by corresp. entries in D.

eg $B = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$.

12) eg. $B = \begin{bmatrix} 2 & 4 \\ 1 & 2 \end{bmatrix}$

15) a) False; $\underline{a}_1$ $\underline{b}_1$ makes no sense.

b) False; weights come from the corresponding row of A.

c) True; one of the basic properties.

d) True, -11- -11- -11-

e) False; $(AB)^T = B^T A^T \neq A^T B^T$ in general.

31) Say $A = [\underline{a}_1 \cdots \underline{a}_n]$, $\underline{a}_i \in \mathbb{R}^m$.

Then

$$I_m A = [I_m \underline{a}_1 \cdots I_m \underline{a}_n] = [\underline{a}_1, \cdots \underline{a}_n]$$

32 $AI_n = (AI_n)^{TT} = (I_n^T A^T)^T$

$= (A^T)^T$ by (31), noting A^T is $n \times m$.

$= A$

a) $T: \mathbb{R}^3 \longrightarrow \mathbb{R}^2$. Standard matrix $A = \begin{bmatrix} 1 & -5 & 4 \\ 0 & 1 & -6 \end{bmatrix}$
(note already in row echelon form).

b) A does not have a pivot in every column, so T is not injective.

c) A does have a pivot in every row, so T is surjective.