

HOMEWORK-4 - ANSWER KEY-EEE281

Q1: (i) $A+B = \begin{bmatrix} 5 & 4 & 3 \\ 2 & 1 & 6 \\ 7 & -1 & 3 \end{bmatrix}$ (ii) $A+C \rightarrow$ Not define, dimensions are incompatible

(iii) $A+D \rightarrow$ Not define (v) $A^T = \begin{bmatrix} 3 & 2 & 4 \\ 1 & -3 & 9 \\ 4 & 3 & 2 \end{bmatrix}$

(iv) $D+E = \begin{bmatrix} 7 \\ 0 \\ 2 \end{bmatrix}$

(vi) $D^T = [4 \ -2 \ 3]$

Q2: $A \cdot B = \begin{bmatrix} 18 & 17 & 4 \\ 13 & -9 & -8 \\ 14 & 10 & -2 \end{bmatrix}$

$C \cdot A =$ Not defined
(3x2)(3x3)

$A \cdot E = \begin{bmatrix} 7 \\ -3 \\ 10 \end{bmatrix}$

$AC = \begin{bmatrix} 5 & -2 \\ 7 & -13 \\ 8 & 0 \end{bmatrix}$
(3x3)(3x2)
(3x2)

$D \cdot A =$ Not defined
(3x1)(3x3)

$D^T E = \begin{bmatrix} 3 \\ 15 \\ 2 \end{bmatrix}$

Q3: a) $A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

$A^2 = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ $B^2 = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

b) $A = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$

$A^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = A^m$

$B = \begin{bmatrix} 4 & -4 \\ 4 & -4 \end{bmatrix}$ $B^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

c) (i) $A^T = \begin{bmatrix} 3 & 2 & 4 \\ 1 & -3 & 0 \\ 4 & 3 & 2 \end{bmatrix}$

$A + A^T = \begin{bmatrix} 6 & 3 & 8 \\ 3 & -6 & 3 \\ 8 & 3 & 4 \end{bmatrix} \rightarrow$ Symmetric (✓)

(ii) $A - A^T = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 3 \\ 0 & -3 & 0 \end{bmatrix} \rightarrow$ Skew Symmetric (✓)

(iii) $\Rightarrow A = \frac{1}{2}(S+T) = \frac{1}{2} \begin{bmatrix} 6 & 2 & 8 \\ 4 & -6 & 6 \\ 8 & 0 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 1 & 4 \\ 2 & -3 & 3 \\ 4 & 0 & 2 \end{bmatrix} = A$ in 1st question.

Q4: (i) $\begin{bmatrix} 4 & -6 \\ 3 & 8 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ 5 \end{bmatrix}$

$$\begin{bmatrix} -12 & 18 \\ 0 & 50 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 42 \\ 50 \end{bmatrix} \rightarrow \begin{matrix} x_1 = -2 \\ x_2 = 1 \end{matrix} \left. \vphantom{\begin{matrix} x_1 = -2 \\ x_2 = 1 \end{matrix}} \right\} \text{Single solution}$$

(ii) $\begin{bmatrix} 4 & 6 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 12 \\ 5 \end{bmatrix} \rightarrow \text{No solution}$

(iii) $\begin{bmatrix} 4 & 6 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 10 \\ 5 \end{bmatrix} \rightarrow \text{multiple solutions}$

(iv) $\begin{bmatrix} 3 & 1 & 1 \\ 1 & -3 & -2 \\ -1 & 1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 9 \\ 5 \\ -9 \end{bmatrix} \rightarrow \text{Single solution}$

$$\left[\begin{array}{ccc|c} 3 & 1 & 1 & 9 \\ 1 & -3 & -2 & 5 \\ 0 & -2 & -4 & -4 \end{array} \right] \xrightarrow{\substack{R_1 \leftrightarrow R_2 \\ R_2 \times (-1)}} \left[\begin{array}{ccc|c} 1 & -3 & -2 & 5 \\ 0 & 10 & 7 & -6 \\ 0 & -2 & -4 & -4 \end{array} \right] \xrightarrow{\substack{R_2 \times (-1) \\ R_3 \times (-1)}} \left[\begin{array}{ccc|c} 1 & -3 & -2 & 5 \\ 0 & 10 & 7 & -6 \\ 0 & 0 & -13 & -26 \end{array} \right]$$

$$-13x_3 = -26$$

$$\boxed{x_3 = 2}$$

$$10x_2 + 7x_3 = -6$$

$$10x_2 + 14 = -6$$

$$10x_2 = -20$$

$$\boxed{x_2 = -2}$$

$$3x_1 = 9$$

$$\boxed{x_1 = 3}$$