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Section :- 3D

Roll No :- 20K-1890

Course :- Linear Algebra

Assignment #01

Exercise 1.3

Date:

A	B	C	D	E
(4x5)	(4x5)	(5x2)	(4x2)	(5x4)

1.

(a) BA = False ∴ B/c the number of Column of B does not to A.

(b) AB^T = True. → when we take the transpose of B then the matrix multiplication is Possible.

(c) AC+D = False → AC = 4x2 and O(E) = 5x4.

(d) E(AC) = E(4x2) = 5x4 = 4x2 = True

(e) $A - 3E^T$ = True (4x5).

(f) E(5B+A) = True (5x5).

2.

(a) CDT = True (5x4)

(b) DC = False num: of ~~rows~~ columns of D ≠ num: of rows of C

(c) BC−3D = True (4x2).

(d) $D^T(BE)$ = True (2×4)

(e) $BTD + ED$ = True (5×2).

(f) $BAT + D$ = false

→ In Exercise 2-6, use the following matrices to compute the indicated expression if it is defined

$$A=\begin{bmatrix}3 & 0\\ -1 & 2\\ 1 & 1\end{bmatrix},\quad B=\begin{bmatrix}4 & -1\\ 0 & 2\end{bmatrix},\quad C=\begin{bmatrix}1 & 4 & 2\\ 3 & 1 & 5\end{bmatrix},$$

$$D=\begin{bmatrix}1 & 5 & 2\\ -1 & 0 & 1\\ 3 & 2 & 4\end{bmatrix},\quad E=\begin{bmatrix}6 & 1 & 3\\ -1 & 1 & 2\\ 4 & 1 & 3\end{bmatrix}$$

(3)

a. $D+E$

$$=\begin{bmatrix}7 & 6 & 5\\ -2 & 1 & 3\\ 7 & 3 & 7\end{bmatrix}$$ Ans.

b. $D-E$

$$\begin{bmatrix}-5 & 4 & -1\\ 0 & -1 & -1\\ -1 & 1 & 1\end{bmatrix}$$ Ans.

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c. $5A$

$$= \begin{bmatrix} 15 & 0 \\ -5 & 10 \\ 5 & 5 \end{bmatrix}$$

Ans.

d. $-7C$

$$= \begin{bmatrix} -7 & -28 & -14 \\ -21 & -7 & -35 \end{bmatrix}$$

Ans

e. $2B - C$

$2B$

$$\begin{bmatrix} 8 & -2 \\ 0 & 4 \end{bmatrix} - \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

Not Possible (The order is not equal).

(f) $4E - 2D$

$$\begin{bmatrix} 24 & 4 & 12 \\ -4 & 4 & 8 \\ 16 & 4 & 12 \end{bmatrix} + \begin{bmatrix} -2 & -10 & -4 \\ +2 & 0 & -2 \\ -6 & -4 & -8 \end{bmatrix} = \begin{bmatrix} 22 & -6 & 8 \\ -2 & 4 & 6 \\ 10 & 0 & 4 \end{bmatrix}$$

Ans.

g. $-3(D + 2E)$ 4 $(D + 2E)$, first we will compute this.

$$-3 \begin{bmatrix} 13 & 7 & 8 \\ -3 & 2 & 5 \\ 11 & 4 & 10 \end{bmatrix}$$

$$= \begin{bmatrix} -39 & -21 & -24 \\ 9 & -6 & -15 \\ -33 & -12 & -30 \end{bmatrix}$$

Answer.

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h. $A - A$.

$$= \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} + \begin{bmatrix} -3 & 0 \\ +1 & -2 \\ -1 & -1 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$ Ans.

(i) $tr(D)$ (we will add the values of main/Leading diagon

$= 5$ Ans.

(j) $tr(D-3E)$

$$D-3E = \begin{bmatrix} -17 & 2 & -7 \\ +2 & -3 & -5 \\ -9 & -1 & -5 \end{bmatrix}$$

∴ Now we will find the Trace:

$= -25$ Ans.

K. $4\,tr(7B)$

$$7B = \begin{bmatrix} 28 & -7 \\ 0 & 14 \end{bmatrix}$$

$= 4 \times 32$

$= 128$ Ans.

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1. $tr(A)$.

$= 4$ Ans.

(4)

a. $2A^T + C$

$$\begin{bmatrix} 6 & -2 & 2 \\ 0 & 4 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & 2 & 4 \\ 3 & 5 & 7 \end{bmatrix}$$ Ans.

b. $D^T - E^T$.

$$\begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix} + \begin{bmatrix} -6 & 1 & -4 \\ -1 & -1 & -1 \\ -3 & -2 & -3 \end{bmatrix}$$

$$= \begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & -1 & 1 \end{bmatrix}$$ Ans.

c. $(D-E)^T$: "(D-E) first we will Compute and then Transpose"

$$\begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & -1 & 1 \end{bmatrix}$$ Ans.

d. $B^T + 5C^T$

$$\begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} + \begin{bmatrix} 5 & 15 \\ 20 & 5 \\ 10 & 25 \end{bmatrix}$$

= The order is not equal So therefore the addition is not Possible.

e. $\frac{1}{2} C^T - \frac{1}{4} A$.

$$\begin{bmatrix} 1/2 & 3/2 \\ 2 & 1/2 \\ 1 & 5/2 \end{bmatrix} + \begin{bmatrix} -3/4 & 0 \\ +1/4 & -1/2 \\ -1/4 & -1/4 \end{bmatrix}$$

$$= \begin{bmatrix} -1/4 & 3/2 \\ 9/4 & 0 \\ 3/4 & 9/4 \end{bmatrix}$$ Ans.

f. $B - B^T$.

$$\begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} + \begin{bmatrix} -4 & 0 \\ 1 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & -1 \\ 1 & 4 \end{bmatrix}$$ Ans.

g. $2E^T - 3D^T$

$$\begin{bmatrix} 12 & -2 & 8 \\ 2 & 2 & 2 \\ 6 & 4 & 6 \end{bmatrix} + \begin{bmatrix} -3 & 3 & -9 \\ -15 & 0 & -6 \\ -6 & -3 & -12 \end{bmatrix}$$

$$= \begin{bmatrix} 9 & 1 & -1 \\ -13 & 2 & -4 \\ 0 & 1 & -6 \end{bmatrix}$$ Ans.

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h. $(2E^T - 3D^T)$: $(2E^T - 3D^T)$ first we will Compute".

$$= \begin{bmatrix} 9 & -13 & 0 \\ 1 & 2 & 1 \\ -1 & -4 & -6 \end{bmatrix}$$ Ans.

(i) $(CD)E$

$$\begin{bmatrix} 3 & 9 & 14 \\ & & \\ 17 & 25 & 27 \end{bmatrix} \times \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

$$\begin{bmatrix} 56 & 26 & 59 \\ & & \\ 192 & 69 & 182 \end{bmatrix}$$ Ans.

j $C(BA)$

Not possible because the Number of Column of B does not equal to the Rows of A.

k. $tr(DE^T)$

$$= \begin{bmatrix} 17 & 8 & 15 \\ & & \\ -3 & 3 & 1 \\ 32 & 7 & 26 \end{bmatrix}$$

The Trace of Matrix is

$= 46$

Answer

1. tr(BC).

$$\begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 4-3 & 16-1 & 8-5 \\ 0+6 & 0+2 & 0+10 \end{bmatrix} = \begin{bmatrix} 1 & 15 & 3 \\ 6 & 2 & 10 \end{bmatrix}$$

→ Trace of matrix is only possible for square matrix.

(5)

a) AB

Sol:-

$$A \cdot B = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} (3\times4)+(0\times0) & (3\times-1)+(0\times2) \\ (-1\times4)+(2\times0) & (-1\times-1)+(2\times2) \\ (1\times4)+(1\times0) & (1\times-1)+(1\times2) \end{bmatrix}$$

$$= \begin{bmatrix} 12 & -3 \\ -4 & 5 \\ 4 & 1 \end{bmatrix}$$ Ans.

(b) BA

Sol:-

undefined (No of Columns of B ≠ rows of A)

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(c) (3E)D.

Sol:-

$$(3E)D = \begin{bmatrix} 3\times6 & 3\times1 & 3\times3 \\ -1\times3 & 3\times1 & 3\times2 \\ 4\times3 & 1\times3 & 3\times3 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}.$$

$$= \begin{bmatrix} 18 & 3 & 9 \\ -3 & 3 & 6 \\ 12 & 3 & 9 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}.$$

$$= \begin{bmatrix} (18\times1)+(3\times-1)+(9\times3) & (18\times5)+(3\times0)+(9\times2) & (18\times2)+(3\times1)+(9\times4) \\ (-3\times1)+(3\times-1)+(6\times3) & (-3\times5)+(3\times0)+(3\times2) & (3\times2)+(3\times1)+(9\times4) \\ (12\times1)+(12\times-1)+(12\times3) & (12\times5)+(12\times0)+(12\times9) & (12\times2)+(12\times1)+(12\times2) \end{bmatrix}$$

$$= \begin{bmatrix} 42 & 108 & 75 \\ 12 & -3 & 21 \\ 36 & 78 & 63 \end{bmatrix}$$ Ans.

(d) (AB) C

$$(AB)C = \left(\begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \right) \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 12 & -3 \\ -4 & 5 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}.$$

$$\begin{bmatrix} (12\times1)-(3\times3) & (12\times4)-(3\times1) & (12\times2)-(3\times5) \\ -(4\times1)+(5\times3) & -(4\times4)+(5\times1) & -(4\times2)+(5\times5) \\ (4\times1)+(1\times3) & (4\times4)+(1\times1) & (4\times2)+(1\times5) \end{bmatrix} = \begin{bmatrix} 3 & 45 & 9 \\ 11 & -11 & 17 \\ 7 & 17 & 13 \end{bmatrix}$$

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(e) $A(BC)$

$$A(BC) = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \left(\begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \right)$$

$$= \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} (4\times1)-(1\times3) & (4\times4)-(1\times1) & (4\times2)-(1\times5) \\ (0\times1)+(2\times3) & (0\times4)+(2\times1) & (0\times2)+(2\times5) \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 15 & 3 \\ 6 & 2 & 10 \end{bmatrix}$$

$$= \begin{bmatrix} (3\times1)+(0\times6) & (3\times15)+(0\times2) & (3\times3)+(0\times10) \\ -(1\times1)+(2\times6) & -(1\times15)+(2\times2) & -(1\times3)+(2\times10) \\ (1\times1)+(1\times6) & (1\times15)+(1\times2) & (1\times3)+(1\times10) \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 45 & 9 \\ 11 & -11 & 17 \\ 7 & 17 & 13 \end{bmatrix}$$ Ans

(f) $C.C^T$

Sol

$$C.C^T = \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix}$$

$$\begin{bmatrix} (1\times1)+(4\times4)+(2\times2) & (1\times3)+(4\times1)+(2\times5) \\ (3\times1)+(1\times4)+(5\times2) & (3\times3)+(1\times1)+(5\times5) \end{bmatrix}$$

$$= \begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix}$$ Ans

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(g) $(DA)^T$

$$(DA)^T = \left(\begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \right)^T$$

$$= \left(\begin{bmatrix} (1\times3)-(5\times1)+(2\times1) & (1\times0)+(5\times2)+(2\times1) \\ -(1\times3)-(0\times1)+(1\times1) & -1(0)+(0\times2)+(1\times1) \\ (3\times3)-2(1)+(4\times1) & (3\times0)+(2\times2)+(4\times1) \end{bmatrix} \right)^T$$

$$= \begin{bmatrix} 0 & -2 & 11 \\ 12 & 1 & 8 \end{bmatrix}$$ Ans

(h) $(C^TB)A^T$

&/or

$$(C^TB)A^T = \left(\begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \right) \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} (1\times4)+(3\times0) & -(1\times1)+(3\times2) \\ (4\times4)+(1\times0) & -(4\times1)+(1\times2) \\ (2\times4)+(5\times0) & -(2\times1)+(5\times2) \end{bmatrix} \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 4 & 5 \\ 16 & -2 \\ 8 & 8 \end{bmatrix} \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} (4\times3)+(5\times0) & -(4\times1)+(5\times2) & (4\times1)+(5\times1) \\ (16\times3)-(2\times0) & -(16\times1)-(2\times2) & (16\times1)-(2\times1) \\ (8\times3)+(8\times0) & -(8\times1)+(8\times2) & (8\times1)+(8\times1) \end{bmatrix}$$

$$= \begin{bmatrix} 12 & 6 & 9 \\ 48 & -20 & 14 \\ 24 & 8 & 16 \end{bmatrix}$$ Ans

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(i) $tr(D.D^T)$

Sol:

$$= tr\left(\begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix} \right)$$

$$= tr\left(\begin{bmatrix} (1\times1)+(5\times5)+(2\times2) & -(1\times1)+(5\times0)+(2\times1) & (1\times3)+(5\times2)+(2\times4) \\ -(1\times1)+(0\times5)+(1\times2) & (1\times1)+(0\times0)+(1\times1) & -(3)+(0\times2)+(1\times1) \\ +(3\times1)+(2\times5)+(4\times2) & -(3\times1)+(2\times0)+(4\times1) & (3\times3)+(2\times2)+(4\times4) \end{bmatrix} \right)$$

$$= tr\left(\begin{bmatrix} 30 & 1 & 21 \\ 1 & 2 & 1 \\ 21 & 1 & 29 \end{bmatrix} \right) = 30+2+29 = 61$$

Ans

(j) $tr(4E^T - D)$

$$tr\left(4\begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix} - \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \right)$$

$$tr\left(\begin{bmatrix} 24 & -1 & 16 \\ 4 & 4 & 4 \\ 12 & 8 & 12 \end{bmatrix} - \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \right)$$

$$tr\left(\begin{bmatrix} 24-1 & -1-5 & 16-2 \\ 4+1 & 4-0 & 4-1 \\ 12-3 & 8-2 & 12-4 \end{bmatrix} \right) = tr\left(\begin{bmatrix} 23 & -6 & 14 \\ 5 & 4 & 3 \\ 9 & 6 & 8 \end{bmatrix} \right)$$

$$= 23+4+8 = 35$$

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(k) $tr(C^T A^T + 2E^T)$

Sol:-

$$tr\left(\begin{bmatrix}1 & 3\\ 4 & 1\\ 2 & 5\end{bmatrix}\begin{bmatrix}3 & -1 & 1\\ 0 & 2 & 1\end{bmatrix} + 2\begin{bmatrix}6 & -1 & 4\\ 1 & 1 & 1\\ 3 & 2 & 3\end{bmatrix}\right)$$

$$= tr\left(\begin{bmatrix}(1\times3)+(3\times0) & -(1\times1)+(3\times2) & (1\times1)+(3\times1)\\ (4\times3)+(1\times0) & -(4\times1)+(1\times2) & (4\times1)+(1\times1)\\ (2\times3)+(5\times0) & -(2\times1)+(5\times2) & (2\times1)+(5\times1)\end{bmatrix} + \begin{bmatrix}6\times2 & 2\times-1 & 4\times2\\ 2 & 2 & 2\\ 2\times3 & 2\times2 & 2\times3\end{bmatrix}\right)$$

$$tr\left(\begin{bmatrix}3 & 5 & 4\\ 12 & -2 & 5\\ 6 & 8 & 7\end{bmatrix} + \begin{bmatrix}12 & -2 & 8\\ 2 & 2 & 2\\ 6 & 4 & 6\end{bmatrix}\right).$$

$$tr\left(\begin{bmatrix}15 & 3 & 12\\ 14 & 0 & 7\\ 12 & 12 & 13\end{bmatrix}\right)$$

$$= 15 + 0 + 13 = 28 \text{ Ans}$$

(l) $tr(ECT)^T A$.

$$tr\left(\left(\begin{bmatrix}6 & 1 & 3\\ -1 & 1 & 2\\ 1 & 1 & 3\end{bmatrix}\begin{bmatrix}1 & 3\\ 4 & 1\\ 2 & 5\end{bmatrix}\right)^T \begin{bmatrix}3 & 0\\ -1 & 2\\ 1 & 1\end{bmatrix}\right)$$

$$tr\left(\left(\begin{bmatrix}(6\times1)+(1\times4)+(3\times2) & (6\times3)+(1\times1)+(3\times5)\\ -(1\times1)+(1\times4)+(2\times2) & -(1\times3)+(1\times1)+(2\times5)\\ (4\times1)+(1\times4)+(3\times2) & (4\times3)+(1\times1)+(3\times5)\end{bmatrix}\right)^T \begin{bmatrix}3 & 0\\ -1 & 2\\ 1 & 1\end{bmatrix}\right)$$

$$tr\left(\left(\begin{bmatrix}16 & 34\\ 7 & 8\\ 14 & 28\end{bmatrix}\right)^T \left(\begin{bmatrix}3 & 0\\ -1 & 2\\ 1 & 1\end{bmatrix}\right)\right)$$

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$$= tr\left(\begin{bmatrix} (16\times3)-(7\times1)+(14\times1) & (16\times0)+(7\times2)+(14\times1) \\ (34\times3)-(8\times1)+(28\times1) & (34\times0)+(8\times2)+28 \end{bmatrix}\right)$$

$$= tr\left(\begin{bmatrix} 55 & 28 \\ 122 & 44 \end{bmatrix}\right)$$

$$= 55+44 = 99 \text{ Ans.}$$

(6) (a) $(2D^T - E)A$.

Sol:-

$$= \left(2\begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix} - \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}\right)\begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 2\times1-6 & 2\times(-1)-1 & 2\times3-3 \\ 2\times5-(-1) & 2\times0-1 & 2\times2-2 \\ 2\times2-4 & 2\times1-1 & 2\times4-3 \end{bmatrix}\begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -4 & -3 & 3 \\ 11 & -1 & 2 \\ 0 & 1 & 5 \end{bmatrix}\begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -(4\times3)+(3\times1)+(3\times1) & -(4\times0)-(3\times2)+(3\times1) \\ (11\times3)+(1\times1)+(2\times1) & (11\times0)-(1\times2)+(2\times1) \\ (0\times3)-(1\times1)+(5\times1) & (0\times0)+(1\times2)+(5\times1) \end{bmatrix}$$

$$= \begin{bmatrix} -6 & -3 \\ 36 & 0 \\ 4 & 7 \end{bmatrix} \text{ Ans.}$$

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(b) $(4B)C + 2B$.

Sol:

undefined (a 2×3 matrix $(4B)C$ cannot be added to a 2×2 matrix $2B$).

(c) $(-AC)^T + 5D^T$

$$= \left(- \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \right)^T + 5 \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix}$$

$$= 5 \left(- \begin{bmatrix} (3\times1)+(0\times3) & (3\times4)+(0\times1) & (3\times2)+(0\times5) \\ -(1\times1)+(2\times3) & -(1\times4)+(2\times1) & -(1\times2)+(2\times5) \\ (1\times1)+(1\times3) & (1\times4)+(1\times1) & (1\times2)+(1\times5) \end{bmatrix} \right)^T + \begin{bmatrix} 5 & -5 & 15 \\ 25 & 0 & 10 \\ 10 & 5 & 20 \end{bmatrix}$$

$$= \begin{bmatrix} -3+5 & -5-5 & -4+15 \\ -12+25 & 2+0 & -5+10 \\ -6+10 & -8+5 & -7+20 \end{bmatrix}.$$

$$= \begin{bmatrix} 2 & -10 & 11 \\ 13 & 2 & 5 \\ 4 & -3 & 13 \end{bmatrix}$$ Ans

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(d) $(BA^T - 2C)^T$

$$= \left(\begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix} - \begin{bmatrix} 2\times1 & 2\times4 & 2\times2 \\ 2\times3 & 2\times1 & 2\times5 \end{bmatrix} \right)$$

$$= \left\{ \begin{bmatrix} (4\times3)-(1\times0) & -(4\times1)-(1\times2) & (4\times1)-(1\times1) \\ (0\times3)+(2\times0) & -(0\times1)+(2\times2) & (0\times1)+(2\times1) \end{bmatrix} \right\}$$

$$- \begin{bmatrix} 2 & 8 & 4 \\ 6 & 2 & 10 \end{bmatrix} \Big)^T$$

$$= \left(\begin{bmatrix} 12-2 & -6-8 & 3-4 \\ 6-6 & 4-6 & 2-10 \end{bmatrix} \right)^T$$

$$= \begin{bmatrix} 10 & -6 \\ -14 & -2 \\ -1 & -8 \end{bmatrix}$$ Ans

(e) $B^T(CC^T - A^TA)$

Sol.

$$\begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \left(\begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix} - \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} \right)$$

$$= \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} (1\times1)+(4\times4)+(2\times2) & (1\times3)+(4\times1)+(2\times5) \\ (3\times1)+(1\times4)+(5\times2) & (3\times3)+(1\times1)+(5\times5) \end{bmatrix}$$

$$= \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \left(\begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix} - \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix} \right)$$

$$= \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} 10 & 18 \\ 18 & 30 \end{bmatrix}$$

$$= \begin{bmatrix} 40 & 72 \\ 26 & 42 \end{bmatrix}$$ Ans.

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(1) $D^TE^T - (ED)^T$

Sol:-

$$= \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix} \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix} - \left(\begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix} \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \right)^T$$

$$= \begin{bmatrix} (1\times6)-(1\times1)+(3\times3) & (1\times1)+(-1\times1)+(3\times2) & (1\times4)-(1\times1)+(3\times3) \\ (5\times6)+(0\times1)+(2\times3) & -(5\times1)+(0\times1)+(2\times2) & (5\times4)+(0\times1)+(2\times3) \\ (2\times6)+(1\times1)+(4\times3) & -(2\times1)+(1\times1)+(4\times2) & (2\times4)+(1\times1)+(4\times3) \end{bmatrix}$$

$$- \begin{bmatrix} (6\times1)-(1\times1)+(3\times3) & (6\times5)+(1\times6)+(3\times2) & (6\times2)+(1\times1)+(3\times4) \\ -(1\times1)-(1\times1)+(2\times3) & -(1\times5)+(1\times0)+(2\times2) & -(1\times2)+(1\times1)+(2\times4) \\ (4\times1)-(1\times1)+(3\times3) & (4\times5)+(1\times0)+(3\times2) & (4\times2)+(1\times1)+(3\times4) \end{bmatrix}$$

$$= \begin{bmatrix} 6-1+9 & -1-1+6 & 4-1+9 \\ 30+1+6 & -5+0+4 & 20+0+6 \\ 19+1+12 & -2+1+8 & 8+1+12 \end{bmatrix} - \begin{bmatrix} 6-1+9 & 30+0+6 & 12+1+12 \\ -1-1+6 & -5+0+4 & -2+1+8 \\ 4-1+9 & 20+0+6 & 8+1+12 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & 4 & 19 \\ 37 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix} - \begin{bmatrix} 14 & 36 & 25 \\ 4 & 1 & 6 \\ 19 & 26 & 21 \end{bmatrix}$$

$$= \begin{bmatrix} 2-14 & 4-36 & 19-25 \\ 37-4 & -1-1 & 26-6 \\ 25-12 & 7-26 & 21-21 \end{bmatrix}$$

$$= \begin{bmatrix} -19 & -32 & -13 \\ 33 & -2 & 20 \\ 13 & 19 & 0 \end{bmatrix}$$ Ans

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In Ex-7-8 use following matrices and either the row method or column method as appropriate to find the indicated row or column.

$$A=\begin{bmatrix}3 & -2 & 7\\ 6 & 5 & 4\\ 0 & 4 & 9\end{bmatrix} \text{ and } B=\begin{bmatrix}6 & -2 & 4\\ 0 & 1 & 3\\ 7 & 7 & 5\end{bmatrix}$$

(7)

(a) The first row of AB.

Sol:

$$= [\text{First row of } A]\, B.$$

$$= \begin{bmatrix}0 & 4 & 9\end{bmatrix} \begin{bmatrix}6 & -2 & 4\\ 0 & 1 & 3\\ 7 & 7 & 5\end{bmatrix}.$$

$$\begin{bmatrix}(0\times6)+(4\times0)+(9\times7) & (0\times-2)+(1\times4)+(9\times7) & (0\times4)+(4\times3)+(9\times5)\end{bmatrix}$$

$$= \begin{bmatrix}63 & 41 & 57\end{bmatrix} \text{ Ans.}$$

Date:

b) third row of AB.

Sol:

$= [\text{third row of } A]\ B.$

$$= \begin{bmatrix} 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix}.$$

$$\begin{bmatrix} (0\times6)+(4\times0)+(9\times7) & (0\times-2)+(4\times1)+(9\times7) & (0\times4)+(4\times3)+(9\times5) \end{bmatrix}$$

$$= \begin{bmatrix} 63 & 67 & 57 \end{bmatrix}.$$

c) Second Column of AB.

$= A\ [\text{Second column of } B].$

$$= \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} -2 \\ 1 \\ 7 \end{bmatrix}.$$

$$\begin{bmatrix} (3\times-2)+(-2\times1)+(7\times7) \\ (6\times-2)+(5\times1)+(4\times7) \\ (0\times-2)+(4\times1)+(9\times7) \end{bmatrix}$$

$$= \begin{bmatrix} 41 \\ 21 \\ 67 \end{bmatrix}$$

Sandal

Date:

d) Second column of BA.

Sol:

⇒ B [First column of A].

$$= \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix} \begin{bmatrix} 3 \\ 6 \\ 0 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} (6\times3)+(2\times-6)+(4\times0) \\ (0\times3)+(1\times6)+(3\times0) \\ (7\times3)+(7\times6)+(5\times0) \end{bmatrix} = \begin{bmatrix} 6 \\ 6 \\ 63 \end{bmatrix}$$ Ans.

e) third row of AA.

[third row of A] A.

$$\begin{bmatrix} 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix}.$$

$$\begin{bmatrix} (0\times3)+(4\times6)+(9\times0) & -(0\times2)+(4\times5)+(9\times4) & (0\times7)+(4\times4)+(9\times9) \end{bmatrix}.$$

$$\begin{bmatrix} 24 & 56 & 97 \end{bmatrix}$$ Ans.

Date:

(8).

a) First columns of AB.

Sol:-

$= A$ [Third column of A].

$$= \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 6 \\ 0 \\ 7 \end{bmatrix}.$$

$$= \begin{bmatrix} (3\times6) + (-2\times0) + (7\times7) \\ (6\times6) + (6\times0) + (4\times7) \\ (0\times6) + (4\times0) + (9\times7) \end{bmatrix} = \begin{bmatrix} 67 \\ 64 \\ 63 \end{bmatrix}.$$

b) Third column of BB.

Sol:-

$= B$ [third column of B].

$$= \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix} \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix}.$$

$$= \begin{bmatrix} (6\times4) - (2\times3) + (7\times7) \\ (6\times6) + (5\times0) + (4\times7) \\ (0\times6) + (4\times4) + (9\times9) \end{bmatrix}$$

$$= \begin{bmatrix} 38 \\ 18 \\ 74 \end{bmatrix}$$ ✱

Date:

c) Second row of BB.

= [Second row of B] × B.

$$= \begin{bmatrix} 0 & 1 & 3 \end{bmatrix} \begin{bmatrix} 6 & -2 & 4 \\ 0 & 1 & 3 \\ 7 & 7 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} (0\times6)+(1\times0)+(3\times7) & -(0\times2)+(1\times1)+(3\times7) & (0\times4)+(1\times3)+(3\times5) \end{bmatrix}.$$

$$= \begin{bmatrix} 21 & 22 & 18 \end{bmatrix}$$ Ans.

d) first column of AA.

Sol:

$$= \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 3 \\ 6 \\ 6 \end{bmatrix}.$$

$$= \begin{bmatrix} (3\times3)-(2\times6)+(7\times0) \\ (6\times3)+(5\times6)+(4\times0) \\ (0\times3)+(4\times6)+(9\times0) \end{bmatrix}.$$

$$= \begin{bmatrix} -3 \\ 48 \\ 24 \end{bmatrix}$$ Ans.

e) third column of AB.

$$\begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix} \begin{bmatrix} 4 \\ 3 \\ 5 \end{bmatrix} = \begin{bmatrix} (3\times4)-(2\times3)+(7\times0) \\ (6\times4)+(5\times3)+(5\times9) \\ (0\times4)+(4\times3)+(9\times5) \end{bmatrix} = \begin{bmatrix} 41 \\ 59 \\ 57 \end{bmatrix}$$ Ans.

Date:

4) First row of BA.

Sol:-

[First row of B] A.

$$= \begin{bmatrix} 6 & -2 & 4 \end{bmatrix} \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix}.$$

$$\begin{bmatrix} (6\times3)+(-2\times6)+(4\times0) & (6\times-2)+(-2\times5)+(4\times4) & (6\times7)+(-2\times4)(4\times9) \end{bmatrix}$$

$$= \begin{bmatrix} 6 & -6 & 70 \end{bmatrix}$$ Ans.

Sandal

Date:

9) In Ex-9-10, use matrices A and B from Ex 7-8.

9) Express each column vector of AA as a linear combination of column of vector A.

Solv

First column of AA = $3\begin{bmatrix}3\\6\\0\end{bmatrix} + 6\begin{bmatrix}-2\\5\\4\end{bmatrix} + 0\begin{bmatrix}7\\4\\9\end{bmatrix}$.

$= \begin{bmatrix}9\\18\\0\end{bmatrix} + \begin{bmatrix}-12\\30\\24\end{bmatrix} = \begin{bmatrix}-3\\48\\24\end{bmatrix}$ Ans

Second column of AA = $-2\begin{bmatrix}3\\6\\0\end{bmatrix} + 5\begin{bmatrix}-2\\5\\4\end{bmatrix} + 4\begin{bmatrix}7\\4\\9\end{bmatrix}$.

$= \begin{bmatrix}-6\\-12\\0\end{bmatrix} + \begin{bmatrix}-10\\25\\20\end{bmatrix} + \begin{bmatrix}28\\16\\36\end{bmatrix} = \begin{bmatrix}12\\29\\56\end{bmatrix}$ Ans

Third column of AA = $4\begin{bmatrix}6\\0\\7\end{bmatrix} + 3\begin{bmatrix}-2\\1\\7\end{bmatrix} + 5\begin{bmatrix}4\\3\\5\end{bmatrix}$.

$= \begin{bmatrix}24\\0\\28\end{bmatrix} + \begin{bmatrix}-6\\3\\21\end{bmatrix} + \begin{bmatrix}20\\15\\25\end{bmatrix}$.

$= \begin{bmatrix}76\\98\\97\end{bmatrix}$ Ans

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b) Express each column vector of BB as a linear combination of column vector of B.

Sol:

First column of $BB = 6\begin{bmatrix}6\\0\\7\end{bmatrix} + 6\begin{bmatrix}-2\\5\\7\end{bmatrix} + 7\begin{bmatrix}4\\3\\5\end{bmatrix}$.

$= \begin{bmatrix}36\\0\\42\end{bmatrix} + \begin{bmatrix}28\\21\\35\end{bmatrix} = \begin{bmatrix}64\\21\\77\end{bmatrix}$ Ans

Second column of BB

$= -2\begin{bmatrix}6\\0\\7\end{bmatrix} + 1\begin{bmatrix}-2\\1\\7\end{bmatrix} + 7\begin{bmatrix}4\\3\\5\end{bmatrix}$.

$= \begin{bmatrix}-12\\0\\-4\end{bmatrix} + \begin{bmatrix}-2\\1\\7\end{bmatrix} + \begin{bmatrix}28\\21\\35\end{bmatrix}$.

$= \begin{bmatrix}14\\22\\28\end{bmatrix}$ Ans

Third column of BB.

$= 4\begin{bmatrix}6\\0\\7\end{bmatrix} + 3\begin{bmatrix}-2\\1\\7\end{bmatrix} + 5\begin{bmatrix}4\\3\\5\end{bmatrix}$.

$= \begin{bmatrix}24\\0\\28\end{bmatrix} + \begin{bmatrix}-6\\3\\21\end{bmatrix} + \begin{bmatrix}20\\15\\25\end{bmatrix}$

$= \begin{bmatrix}38\\18\\28\end{bmatrix}$ Ans

Date:

(10) Express each column of vector of AB as linear combination of Column vector A.

First column of $AB = 6\begin{bmatrix}3\\6\\0\end{bmatrix} + 0\begin{bmatrix}-2\\5\\4\end{bmatrix} + 7\begin{bmatrix}7\\4\\9\end{bmatrix}$.

$= \begin{bmatrix}18\\36\\0\end{bmatrix} + \begin{bmatrix}49\\28\\63\end{bmatrix} = \begin{bmatrix}67\\64\\63\end{bmatrix}$ Ans

Second Column of $AB = -2\begin{bmatrix}3\\6\\0\end{bmatrix} + 1\begin{bmatrix}-2\\5\\4\end{bmatrix} + 7\begin{bmatrix}7\\4\\9\end{bmatrix}$.

$= \begin{bmatrix}-6\\-12\\0\end{bmatrix} + \begin{bmatrix}-2\\5\\4\end{bmatrix} + \begin{bmatrix}49\\28\\63\end{bmatrix}$

$= \begin{bmatrix}-8\\-7\\4\end{bmatrix} + \begin{bmatrix}49\\28\\63\end{bmatrix} =$

$= \begin{bmatrix}41\\21\\67\end{bmatrix}$ Ans.

Third Column of $AB = 4\begin{bmatrix}3\\6\\0\end{bmatrix} + 3\begin{bmatrix}-2\\5\\4\end{bmatrix} + 5\begin{bmatrix}7\\4\\9\end{bmatrix}$

$= \begin{bmatrix}12\\24\\0\end{bmatrix} + \begin{bmatrix}-6\\15\\12\end{bmatrix} + \begin{bmatrix}35\\20\\45\end{bmatrix}$

$= \begin{bmatrix}6\\9\\12\end{bmatrix} + \begin{bmatrix}35\\20\\45\end{bmatrix} = \begin{bmatrix}41\\29\\57\end{bmatrix}$.

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(11)

a) $2x_1 - 3x_2 + 5x_2 = 7$.

$9x_1 - x_2 + x_3 = -1$

$x_1 + 5x_2 + 4x_3 = 0$.

Sol:-

$Ax = b$.

the matrix eqn is

$$A = \begin{bmatrix} 2 & -3 & 5 \\ 9 & -1 & 1 \\ 1 & 5 & 4 \end{bmatrix}, \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}, \quad b = \begin{bmatrix} 7 \\ -1 \\ 0 \end{bmatrix}.$$ Ans

b) $4x_1 - 3x_3 + x_4 = 1$

$5x_1 + x_2 - 8x_4 = 3$

$2x_1 - 5x_2 + 9x_3 - x_4 = 0$.

$+3x_2 - x_3 + 7x_4 = 2$

Sol:-

$$A = \begin{bmatrix} 4 & 0 & -3 & 1 \\ 5 & 1 & 0 & -8 \\ 2 & -5 & 9 & -1 \\ 0 & 3 & -1 & 7 \end{bmatrix}, \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}, \quad b = \begin{bmatrix} 1 \\ 3 \\ 0 \\ 2 \end{bmatrix}.$$

The equation of Matrix is

$$\begin{bmatrix} 4 & 0 & -3 & 1 \\ 5 & 1 & 0 & -8 \\ 2 & -5 & 9 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ 0 \\ 2 \end{bmatrix}.$$ Ans

(12)

a. $x_1 - 2x_2 + 3x_3 = -3$

$2x_1 + x_2 = 0$

$-3x_2 + 4x_3 = 1$

$x_1 + x_3 = 5$.

Soln

$Ax = b$.

$$A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 1 & 0 \\ 0 & -3 & 4 \\ 1 & 0 & 1 \end{bmatrix}, \quad x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}, \quad b = \begin{bmatrix} 3 \\ 0 \\ 1 \\ 5 \end{bmatrix}$$

The equation of matrix is

$$\Rightarrow \begin{bmatrix} 1 & -2 & 3 \\ 2 & 1 & 0 \\ 0 & -3 & 4 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \\ 1 \\ 5 \end{bmatrix}$$

Ans

b) $3x_1 + 3x_2 + 3x_3 = -3$

$-x_1 - 5x_2 - 2x_3 = 3$

$-4x_2 + x_3 = 0$.

Soln

The equation of matrix is -

$$\begin{bmatrix} 3 & 3 & 3 \\ -1 & -5 & -2 \\ 0 & -4 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -3 \\ 3 \\ 6 \end{bmatrix}$$ Ans

Date:

(13) in each of Ex 13-14, express the matrix equation as a system of linear equation.

a) $\begin{bmatrix} 5 & 6 & -7 \\ -1 & -2 & 3 \\ 0 & 4 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \\ 3 \end{bmatrix}$.

Sol:-

$= 5x_1 + 6x_2 - 7x_3 = 2$.

$-x_1 - 2x_2 + 3x_3 = 0$

$4x_2 - x_3 = 3$ Ans

b) $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 0 \\ 5 & -3 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \\ -9 \end{bmatrix}$

Sol:-

$= x + y + z = 2$

$2x + 3y = 2$

$5x - 3y - 6z = -9$ Ans

Date:

(14)

a) $\begin{bmatrix} 3 & -1 & 2 \\ 4 & 3 & 7 \\ -2 & 1 & 5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \\ 4 \end{bmatrix}$.

Sol:-

$3x_1 - x_2 + 2x_2 = 2.$

$4x_1 + 3x_2 + 7x_3 = -1$

$-2x_1 + x_2 + 5x_3 = 4$ Ans.

b) $\begin{bmatrix} 3 & -2 & 0 & 1 \\ 5 & 0 & 2 & -2 \\ 3 & 1 & 4 & 7 \\ -2 & 5 & 1 & 6 \end{bmatrix} \begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

Sol:-

$3w - 2x + z = 0$

$5w + 2y - 2z = 0$

$3w + x + 4y + 7z = 0$

$-2w + 5x + y + 6z = 0$

Ans

Date:

In Ex-15-16 find all values of k if any that satisfy the equation.

(15) $\begin{bmatrix} k & 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} k \\ 1 \\ 1 \end{bmatrix} = 0$

Soln.

$= \begin{bmatrix} k & 1 & 1 \end{bmatrix} \begin{bmatrix} k+1 \\ k+2 \\ -1 \end{bmatrix}$

$= \begin{bmatrix} k & 1 & 1 \end{bmatrix} \begin{bmatrix} k+1 \\ k+2 \\ -1 \end{bmatrix}$

$= k^2 + k + k + 2 - 1 = k^2 + 2k + 1.$

$= (k+1)^2.$

∴ value of k satisfy the equation.

$k = -1.$

Date:

(16) $\begin{bmatrix} 2 & 2 & k \end{bmatrix} \begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 0 & 3 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ k \end{bmatrix}$

Sol:-

$\rightarrow \begin{bmatrix} 2 & 2 & k \end{bmatrix} \begin{bmatrix} 2+4 \\ 4+0+3k \\ 0+6+k \end{bmatrix}$.

$\rightarrow \begin{bmatrix} 2 & 2 & k \end{bmatrix} \begin{bmatrix} 6 \\ 3k+4 \\ 6+k \end{bmatrix}$.

$= 12 + 6k + 6k + k^2 + 8$.

$= k^2 + 12k + 20$.

$\Rightarrow (k+10)(k+2)$.

The only value of k that satisfy equation are $k=-10$ and $k=-2$.

In Ex-17-20 use column-row expression of AB to express this product as sum of matrix products.

(17) $A = \begin{bmatrix} 4 & -3 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 & 2 \\ -2 & 3 & 1 \end{bmatrix}$.

Sol- $\begin{bmatrix} 4 \\ 2 \end{bmatrix} \begin{bmatrix} 0 & 1 & 2 \end{bmatrix} + \begin{bmatrix} -3 \\ -1 \end{bmatrix} \begin{bmatrix} -2 & 3 & 1 \end{bmatrix}$

$= \begin{bmatrix} 0 & 4 & 8 \\ 0 & 2 & 4 \end{bmatrix} + \begin{bmatrix} -6 & -9 & -3 \\ 2 & -3 & -1 \end{bmatrix}$.

$= \begin{bmatrix} -6 & -5 & 5 \\ 2 & -1 & 3 \end{bmatrix}$ Ans

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(18) $A = \begin{bmatrix} 0 & -2 \\ 4 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 4 & 1 \\ -3 & 0 & 2 \end{bmatrix}$

Solv

$\Rightarrow \begin{bmatrix} 0 \\ 4 \end{bmatrix} \begin{bmatrix} 1 & 4 & 1 \end{bmatrix} + \begin{bmatrix} -2 \\ -3 \end{bmatrix} \begin{bmatrix} -3 & 0 & 2 \end{bmatrix}$.

$\begin{bmatrix} 0 & 0 & 0 \\ 4 & 16 & 4 \end{bmatrix} + \begin{bmatrix} 6 & 0 & -4 \\ 9 & 0 & -6 \end{bmatrix}$.

$= \begin{bmatrix} 6 & 0 & -4 \\ 13 & 16 & -2 \end{bmatrix}$ Ans

(19) $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$.

Solv

$\Rightarrow \begin{bmatrix} 1 \\ 4 \end{bmatrix} \begin{bmatrix} 1 & 2 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix} \begin{bmatrix} 3 & 4 \end{bmatrix} + \begin{bmatrix} 3 \\ 6 \end{bmatrix} \begin{bmatrix} 5 & 6 \end{bmatrix}$.

$= \begin{bmatrix} 1 & 2 \\ 4 & 8 \end{bmatrix} + \begin{bmatrix} 6 & 8 \\ 15 & 8 \end{bmatrix} + \begin{bmatrix} 15 & 18 \\ 30 & 36 \end{bmatrix}$

$= \begin{bmatrix} 7 & 10 \\ 19 & 16 \end{bmatrix} + \begin{bmatrix} 15 & 18 \\ 30 & 36 \end{bmatrix} = \begin{bmatrix} 22 & 28 \\ 49 & 64 \end{bmatrix}$ Ans

(20) $A = \begin{bmatrix} 0 & 4 & 2 \\ 1 & -2 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 \\ 4 & 0 \\ 1 & -1 \end{bmatrix}$.

Sol:-

$$\begin{bmatrix} 0 \\ 1 \end{bmatrix}\begin{bmatrix} 2 & -1 \end{bmatrix} + \begin{bmatrix} 4 \\ -2 \end{bmatrix}\begin{bmatrix} 4 & 0 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix}\begin{bmatrix} 1 & -1 \end{bmatrix}.$$

$$= \begin{bmatrix} 0 & 0 \\ 2 & -1 \end{bmatrix} + \begin{bmatrix} 16 & 0 \\ -8 & 0 \end{bmatrix} + \begin{bmatrix} 2 & -2 \\ 5 & -5 \end{bmatrix}.$$

$$= \begin{bmatrix} 16 & 0 \\ -6 & -1 \end{bmatrix} + \begin{bmatrix} 2 & -2 \\ 5 & -5 \end{bmatrix}.$$

$$\Rightarrow \begin{bmatrix} 18 & -2 \\ -1 & -6 \end{bmatrix}$$ Ans

The End.