Linear Algebra

ASSIGNMENT 01

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~~ROO~~ ROLL NO: 20K-0183 SEC: B

Q1.

a) $\underline{BA}$

$4\times\boxed{5 \quad 4}\times 5$

B A

$\boxed{BA \text{ is defined}}$

b) $\underline{AB^T}$

$4\times 5 \qquad (4\times 5)^T$

$4\times\boxed{5 \quad 5}\times 4$

$\boxed{AB^T \text{ is defined}}$

c) $\underline{AC+D}$

$4\times\boxed{5 \quad 5}\times 2 \rightarrow 4\times 2 + 4\times 2$

A C AC + D

$\boxed{AC+D \text{ is defined}}$

d) $\underline{E(AC)}$

$4\times\boxed{5 \quad 5}\times 2 \rightarrow 4\times 2$

A C AC

$E(AC)$

$5\times\boxed{4 \quad 4}\times 2$

$\boxed{E(AC) \text{ is defined}}$

e) $\underline{A-3E^T}$

$(5\times 4)^T - 4\times 5$

$E^T \quad E^T$

$A - 3E^T$

$\boxed{4\times 5 - 4\times 5}$ same

$\boxed{A-3E^T \text{ is defined}}$

f) $\underline{E(5B+A)}$

↳ $5B+A$

$4\times 5 + 4\times 5$ = defined

↳ $E(5B+A)$

$5\times\boxed{4 \quad 4}\times 5$ defined

$\boxed{E(5B+A) \text{ is defined}}$

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QUESTION 02

a) CD^T

$5 \times 2 \qquad (4 \times 2)^T$

$5 \times 2 \qquad 2 \times 4$

$\boxed{CD^T \text{ is defined}}$ Ans

b) DC

$4 \times 2 \qquad 4 \times 2$

$\boxed{DC \text{ is NOT-defined}}$ Ans

c) $BC - 3D$

$B \qquad C \qquad BC - 3D$

$4 \times 5 \qquad 5 \times 2 \rightarrow 4 \times 2 \qquad 4 \times 2$ same

$\boxed{BC - 3D \text{ is defined}}$

d) $D^T(BE)$

$4 \times 5 \qquad 5 \times 4 \rightarrow 4 \times 4$

$B \qquad E \qquad BE$

$(4 \times 2)^T \rightarrow 2 \times 4 \quad \times \quad 4 \times 4$

$D^T \qquad D^T \qquad BE$

$\boxed{D^T(BE) \text{ is defined}}$

e) $B^TD + ED$

$E \qquad D \rightarrow ED$

$5 \times 4 \qquad 4 \times 2 \qquad 5 \times 2$

$B^T \qquad D \rightarrow B^T \qquad D \rightarrow B^TD$

$(4 \times 5)^T \qquad 4 \times 2 \qquad 5 \times 4 \qquad 4 \times 2 \qquad 5 \times 2$

$B^TD + ED$

$5 \times 2 \qquad 5 \times 2$ same

$\boxed{B^TD + ED \text{ is defined}}$

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f) $B^T D + ED$

$$\underset{(4\times 5)^T}{B^T} \quad \underset{4\times 2}{D} \rightarrow \underset{5\times 4}{B^T} \quad \underset{4\times 2}{D} \rightarrow \underset{5\times 2}{B^T D}$$

$$\underset{5\times 4}{E} \quad \underset{4\times 2}{D} \rightarrow \underset{5\times 2}{ED}$$

$$\underset{5\times 2}{B^T D} + \underset{5\times 2}{ED}$$

$\boxed{B^T D + ED \text{ is defined}}$

x —— x —— x

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QUESTION 03

a) D+E

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

$$\boxed{D+E = \begin{bmatrix} 7 & 6 & 5 \\ -2 & 1 & 3 \\ 7 & 3 & 7 \end{bmatrix}}$$ Ans

b) D-E

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

$$\boxed{D-E = \begin{bmatrix} -5 & 4 & -1 \\ 0 & -1 & -1 \\ -1 & 1 & 1 \end{bmatrix}}$$ Ans

c) 5A

$$= 5 \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} = \boxed{\begin{bmatrix} 15 & 0 \\ -5 & 10 \\ 5 & 5 \end{bmatrix} = 5A}$$ Ans

d) -7C

$$= -7 \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix} = \boxed{\begin{bmatrix} -7 & -28 & -14 \\ -2 & -7 & -35 \end{bmatrix}}$$

Ans

e) 2B - C

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

$\boxed{\text{Not possible}}$ Ans

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f) $4E - 2D$

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

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

$$= \begin{bmatrix} 22 & -6 & 8 \\ -2 & 4 & 6 \\ 10 & 0 & 4 \end{bmatrix}$$ Ans

g) $-3(D+2E)$

$$2E = 2\begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix} = \begin{bmatrix} 12 & 2 & 6 \\ -2 & 2 & 4 \\ 8 & 2 & 6 \end{bmatrix}$$

$$D + 2E = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} + \begin{bmatrix} 12 & 2 & 6 \\ -2 & 2 & 4 \\ 8 & 2 & 6 \end{bmatrix}$$

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

$$-3(D+2E) = -3\begin{bmatrix} 13 & 7 & 8 \\ -3 & 2 & 5 \\ 11 & 4 & 10 \end{bmatrix}$$

$$-3(D+2E) = \begin{bmatrix} -39 & -21 & -24 \\ 9 & -6 & -15 \\ -33 & -12 & -30 \end{bmatrix}$$ Ans

h) $A - A = \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix} - \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$

$$A - A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix}$$ Ans

i) $tr(D)$

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

$tr(D) = 1 + 0 + 4$

$tr(D) = 5$

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j) $tr(D-3E)$

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

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

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

$tr(D-3E) = -17-3-5$

$\boxed{tr(D-3E) = -25}$ Ans

k) $4\,tr(7B)$

$$7B = 7\begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}$$

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

$\boxed{tr(7B) = 28+14 = 42}$

$\boxed{4\,tr(7B) = 168}$ Ans

l) $tr(A)$

$tr(A)$ is not possible cuz its not a square matrix.

x —— x —— x

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Q4

a) $2A^T + C$

$$2A^T + C = \begin{bmatrix} 6 & -2 & 2 \\ 0 & 4 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$\boxed{2A^T + C = \begin{bmatrix} 7 & 2 & 4 \\ 3 & 5 & 7 \end{bmatrix}}$$ Ans

b) $D^T - E^T$

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

$$\boxed{D^T - E^T = \begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & -1 & 1 \end{bmatrix}}$$ Ans

c) $(D-E)^T$

$$D - E = \begin{bmatrix} -5 & 4 & -1 \\ 0 & -1 & -1 \\ -1 & 1 & 1 \end{bmatrix}$$

$$\boxed{(D-E)^T = \begin{bmatrix} -5 & 0 & -1 \\ 4 & -1 & 1 \\ -1 & -1 & 1 \end{bmatrix}}$$ Ans

d)

Undefined $B^T(2\times2)$ cannot be multiplied by $C^T(3\times2)$ matrix

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

$$\frac{1}{2}C^T - \frac{1}{4}A = \begin{bmatrix} \frac{1}{2} & 3/2 \\ 2 & 1/2 \\ 1 & 5/2 \end{bmatrix} - \begin{bmatrix} 3/24 & 0 \\ -1/4 & 1/2 \\ 1/4 & 1/4 \end{bmatrix}$$

$$\boxed{1/2\, C^T - \frac{1}{4}A = \begin{bmatrix} -1/4 & 3/2 \\ 9/4 & 0 \\ 3/4 & 9/24 \end{bmatrix}}$$ Ans

f) $B - B^T$

$$B - B^T = \begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix} - \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$$

$$\boxed{B - B^T = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}}$$ Ans.

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

$$2E^T - 3D^T = \begin{bmatrix} 12 & -2 & 8 \\ 2 & 2 & 2 \\ 6 & 4 & 6 \end{bmatrix} - \begin{bmatrix} +3 & -3 & 9 \\ 15 & 0 & 6 \\ 6 & 3 & 12 \end{bmatrix}$$

$$\boxed{2E^T - 3D^T = \begin{bmatrix} 9 & 1 & -1 \\ -13 & 2 & -4 \\ 0 & 1 & -6 \end{bmatrix}}$$

h) $(2E^T - 3D^T)^T$

$$2E^T - 3D^T = \begin{bmatrix} 12 & -2 & 8 \\ 2 & 2 & 2 \\ 6 & 4 & 6 \end{bmatrix} - \begin{bmatrix} 3 & -3 & 9 \\ 15 & 0 & 6 \\ 6 & 3 & 12 \end{bmatrix}$$

$$\boxed{2E^T - 3D^T = \begin{bmatrix} 9 & 1 & -1 \\ -13 & 2 & -4 \\ 0 & 1 & -6 \end{bmatrix}}$$

$$\boxed{(2E^T - 3D^T)^T = \begin{bmatrix} 9 & -13 & 0 \\ 1 & 2 & 1 \\ -1 & -4 & -6 \end{bmatrix}}$$

i) $(CD)E$

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

$$= \begin{bmatrix} 1-4+6 & 5+0+4 & 2+4+8 \\ 3-1+15 & 15+0+10 & 6+1+20 \end{bmatrix}$$

$$\boxed{CD = \begin{bmatrix} 3 & 9 & 14 \\ 17 & 25 & 27 \end{bmatrix}}$$

$$(CD)E = \begin{bmatrix} 3 & 9 & 14 \\ 17 & 25 & 27 \end{bmatrix} \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 18-9+56 & 3+9+14 & 9+18+42 \\ 102-25+108 & 17+25+27 & 51+50+81 \end{bmatrix}$$

$$\boxed{(CD)E = \begin{bmatrix} 65 & 26 & 69 \\ 185 & 69 & 182 \end{bmatrix}}$$

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j) $C(BA)$

$\boxed{\text{Undefined}}$ Ans

k) $tr(DE^T)$

$$DE^T = \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix} \times \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

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

$tr(DE^T) = 17 + 3 + 26$

$\boxed{tr(DE^T) = 46}$ Ans

l) $tr(BC)$

$\boxed{\text{Undefined}}$ Ans

Q5

a) AB

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

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

b) BA

Undefined Ans

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c) (3E)D

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

$$= \begin{bmatrix} 18-3+27 & 90+0+18 & 36+3+36 \\ -3-3+18 & -15+0+12 & -6+3+24 \\ 12-3+27 & 60+0+18 & 24+3+36 \end{bmatrix}$$

$$\boxed{(3E)D = \begin{bmatrix} 42 & 108 & 75 \\ 12 & -3 & 21 \\ 36 & 78 & 63 \end{bmatrix}}$$

d) (AB)C

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

$$\boxed{AB = \begin{bmatrix} 12 & -3 \\ -4 & 5 \\ 4 & 1 \end{bmatrix}}$$

$$(AB)C = \begin{bmatrix} 12 & -3 \\ -4 & 5 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} 1 & 4 & 2 \\ 3 & 1 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} 12-9 & 48-3 & 24-15 \\ -4+15 & -16+5 & -8+25 \\ 4+3 & 16+1 & 8+5 \end{bmatrix}$$

$$\boxed{(AB)C = \begin{bmatrix} 3 & 45 & 9 \\ 11 & -11 & 17 \\ 7 & 17 & 13 \end{bmatrix}}$$

e) A(BC)

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

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

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

$$\boxed{A(BC) = \begin{bmatrix} 3 & 45 & 9 \\ 11 & -11 & 17 \\ 7 & 17 & 13 \end{bmatrix}}$$

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f) CC^T

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

$$= \begin{bmatrix} 1+16+4 & 3+4+10 \\ 3+4+10 & 9+1+25 \end{bmatrix}$$

$$\boxed{CC^T = \begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix}}$$

g) $(DA)^T$

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

$$= \begin{bmatrix} 3-5+2 & 0+10+2 \\ -3+0+1 & 0+0+1 \\ 9-2+4 & 0+4+4 \end{bmatrix}$$

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

$$\boxed{(DA)^T = \begin{bmatrix} 0 & -2 & 11 \\ 12 & 1 & 8 \end{bmatrix}}$$

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

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

$$C^TB = \begin{bmatrix} 4 & 5 \\ 16 & -2 \\ 8 & 8 \end{bmatrix}$$

$$(C^TB)A^T = \underset{3\times 2}{\begin{bmatrix} 4 & 5 \\ 16 & -2 \\ 8 & 8 \end{bmatrix}} \underset{2\times 3}{\begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}}$$

$$= \begin{bmatrix} 12+0 & -4+10 & 4+5 \\ 48-2 & -16-4 & 16-2 \\ 24 & -8+16 & 8+8 \end{bmatrix}$$

$$\boxed{(C^TB)A^T = \begin{bmatrix} 12 & 6 & 9 \\ 46 & -20 & 14 \\ 24 & 8 & 16 \end{bmatrix}}$$

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i) $tr(DD^T)$

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

$$DD^T = \begin{bmatrix} 30 & 1 & 21 \\ 1 & 2 & 1 \\ 21 & 1 & 29 \end{bmatrix}$$

$tr(DD^T) = 30 + 2 + 29$

$$\boxed{tr(DD^T) = 61}$$

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

$$4E^T - D = \begin{bmatrix} 24 & 4 & 12 \\ -4 & 4 & 8 \\ 16 & 4 & 12 \end{bmatrix} - \begin{bmatrix} 1 & 5 & 2 \\ -1 & 0 & 1 \\ 3 & 2 & 4 \end{bmatrix}$$

$$4E^T - D = \begin{bmatrix} 23 & -9 & 14 \\ 5 & 4 & 3 \\ 9 & 6 & 8 \end{bmatrix}$$

$tr(4E^T - D) = 23 + 4 + 8$

$$\boxed{tr(4E^T - D) = 35}$$

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

$$C^TA^T = \underset{3\times 2}{\begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix}} \underset{2\times 3}{\begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}}$$

$$C^TA^T = \begin{bmatrix} 3 & 5 & 4 \\ 12 & -2 & 5 \\ 6 & 8 & 7 \end{bmatrix}$$

$$C^TA^T + 2E^T = \begin{bmatrix} 3 & 5 & 4 \\ 12 & -2 & 5 \\ 6 & 8 & 7 \end{bmatrix} + \begin{bmatrix} 12 & -2 & 8 \\ 2 & 2 & 2 \\ 6 & 4 & 6 \end{bmatrix}$$

$$C^TA^T + 2E^T = \begin{bmatrix} 15 & 3 & 12 \\ 14 & 0 & 7 \\ 12 & 12 & 13 \end{bmatrix}$$

$$\boxed{tr(C^TA^T + 2E^T) = 15 + 13 = 28}$$

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l) tr $((EC^T)^T A)$

$$EC^T = \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 4 & 1 \\ 2 & 5 \end{bmatrix}$$

$$\boxed{EC^T = \begin{bmatrix} 16 & 34 \\ 7 & 8 \\ 14 & 28 \end{bmatrix}}$$

$$(EC^T)^T A = \begin{bmatrix} 16 & 7 & 8 \\ 34 & 14 & 28 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$\boxed{(EC^T)^T A = \begin{bmatrix} 55 & 28 \\ 122 & 44 \end{bmatrix}}$$

$$\boxed{\text{tr}((EC^T)A) = 55 + 44 = 99}$$

Ans

x — x — x

Q6

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

$$2D^T - E = \begin{bmatrix} 2 & -2 & 6 \\ 10 & 0 & 4 \\ 4 & 2 & 8 \end{bmatrix} - \begin{bmatrix} 6 & 1 & 3 \\ -1 & 1 & 2 \\ 4 & 1 & 3 \end{bmatrix}$$

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

$$(2D^T - E)A = \begin{bmatrix} -4 & -3 & 3 \\ 11 & -1 & 2 \\ 0 & 1 & 5 \end{bmatrix} \begin{bmatrix} -3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$\boxed{(2D^T - E)A = \begin{bmatrix} -6 & -3 \\ 36 & 0 \\ 4 & 7 \end{bmatrix}}$$

Ans

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

$\underset{(2\times3)}{(4B)C}$ cant be added in $\underset{(2\times2)}{2B}$

Hence undefined.

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

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

$$\boxed{(-AC)^T = \begin{bmatrix} -3 & -5 & -4 \\ -12 & 2 & -5 \\ -6 & -8 & -7 \end{bmatrix}}$$

$$(-AC)^T + 5D^T = \begin{bmatrix} -3 & -5 & -4 \\ -12 & 2 & -5 \\ -6 & -8 & -7 \end{bmatrix} + \begin{bmatrix} 5 & -5 \\ 25 & 0 \\ 10 & 5 \end{bmatrix}$$

$$\boxed{(-AC)^T + 5D^T = \begin{bmatrix} 2 & -10 & 11 \\ 13 & 2 & 5 \\ 4 & -3 & 13 \end{bmatrix}}$$

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

$$BA^T = \underset{2\times2}{\begin{bmatrix} 4 & -1 \\ 0 & 2 \end{bmatrix}}\underset{2\times3}{\begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix}}$$

$$\boxed{BA^T = \begin{bmatrix} 12 & -6 & 3 \\ 0 & 4 & 2 \end{bmatrix}}$$

$$BA^T - 2C = \begin{bmatrix} 12 & -6 & 3 \\ 0 & 4 & 2 \end{bmatrix} - \begin{bmatrix} 2 & 8 & 4 \\ 6 & 2 & 10 \end{bmatrix}$$

$$BA^T - 2C = \begin{bmatrix} 10 & -14 & -1 \\ -6 & 2 & -8 \end{bmatrix}$$

$$\boxed{(BA^T - 2C)^T = \begin{bmatrix} 10 & -6 \\ -14 & 2 \\ -1 & -8 \end{bmatrix}}$$

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

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

$$\boxed{CC^T = \begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix}}$$

$$A^TA = \begin{bmatrix} 3 & -1 & 1 \\ 0 & 2 & 1 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & 2 \\ 1 & 1 \end{bmatrix}$$

$$\boxed{A^TA = \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix}}$$

$$CC^T - A^TA = \begin{bmatrix} 21 & 17 \\ 17 & 35 \end{bmatrix} - \begin{bmatrix} 11 & -1 \\ -1 & 5 \end{bmatrix}$$

$$\boxed{CC^T - A^TA = \begin{bmatrix} 10 & 18 \\ 18 & 30 \end{bmatrix}}$$

$$B^T(CC^T - A^TA) = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} 10 & 18 \\ 18 & 30 \end{bmatrix}$$

$$\boxed{B^T(CC^T - A^TA) = \begin{bmatrix} 40 & 72 \\ 26 & 42 \end{bmatrix}}$$

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

$$D^TE^T = \begin{bmatrix} 1 & -1 & 3 \\ 5 & 0 & 2 \\ 2 & 1 & 4 \end{bmatrix} \begin{bmatrix} 6 & -1 & 4 \\ 1 & 1 & 1 \\ 3 & 2 & 3 \end{bmatrix}$$

$$\boxed{D^TE^T = \begin{bmatrix} 14 & 4 & 12 \\ 36 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix}}$$

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

$$= \left[\begin{bmatrix} 14 & 36 & 25 \\ 4 & -1 & 7 \\ 12 & 26 & 21 \end{bmatrix}\right]^T$$

$$\boxed{(ED)^T = \begin{bmatrix} 14 & 4 & 12 \\ 36 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix}}$$

$$D^TE^T - (ED)^T = \begin{bmatrix} 14 & 4 & 12 \\ 36 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix} - \begin{bmatrix} 14 & 4 & 12 \\ 36 & -1 & 26 \\ 25 & 7 & 21 \end{bmatrix}$$

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$$\boxed{D^T E^T = (ED)^T = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}}$$

x —x —x

Q7

a)

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

$$= \begin{bmatrix} 18+0+49 & -6-2+49 & 12-6+35 \end{bmatrix}$$

$$\boxed{= \begin{bmatrix} 67 & 41 & 41 \end{bmatrix}}$$

b)

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

$$= \begin{bmatrix} 0+0+63 & 0+4+63 & 0+12+45 \end{bmatrix}$$

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

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c)

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

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

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

d)

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

$$= \begin{bmatrix} -18-12+0 \\ 0+6+0 \\ 21+42+0 \end{bmatrix}$$

$$= \begin{bmatrix} 6 \\ 6 \\ 63 \end{bmatrix}$$ Ans

e)

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

$$= \begin{bmatrix} 0+24 & 0+10+36 & 0+16+81 \end{bmatrix}$$

$$= \begin{bmatrix} 24 & 46 & 97 \end{bmatrix}$$ Ans

f)

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

$$= \begin{bmatrix} 21-16+63 \\ 42+20+36 \\ 0+16+81 \end{bmatrix}$$

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

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Q8

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

$= \begin{bmatrix} 18+49 \\ 36+28 \\ 63 \end{bmatrix}$

$= \begin{bmatrix} 67 \\ 64 \\ 63 \end{bmatrix}$ Ans

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

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

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

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

$= \begin{bmatrix} 0+0+21 & 0+1+21 & 0+3+15 \end{bmatrix}$

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

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

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

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

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

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

$= \begin{bmatrix} 41 \\ 59 \\ 57 \end{bmatrix}$ Ans

f) $= [6 \quad -2 \quad 4] \begin{bmatrix} 3 & -2 & 7 \\ 6 & 5 & 4 \\ 0 & 4 & 9 \end{bmatrix}$

$= [18-12+0 \quad -12-10+16 \quad 42-8+36]$

$= [6 \quad -6 \quad 70]$

Ans.

x —— x —— x

Q9

a) 1st column of $AA = 3\begin{bmatrix} 3 \\ 6 \\ 0 \end{bmatrix} + 6\begin{bmatrix} -2 \\ 5 \\ 4 \end{bmatrix} + 0\begin{bmatrix} 7 \\ 4 \\ 9 \end{bmatrix}$

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

$\boxed{\text{1st column of } AA = \begin{bmatrix} -3 \\ 48 \\ 24 \end{bmatrix}}$

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

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

$\boxed{\text{2nd column of } AA = \begin{bmatrix} 12 \\ 29 \\ 56 \end{bmatrix}}$

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

$= \begin{bmatrix}21\\42\\0\end{bmatrix} + \begin{bmatrix}-8\\20\\16\end{bmatrix} + \begin{bmatrix}63\\36\\81\end{bmatrix}$

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

b)

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

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

$\boxed{\text{1st column} = \begin{bmatrix}64\\21\\77\end{bmatrix}}$

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

$= \begin{bmatrix}-12\\0\\-14\end{bmatrix} + \begin{bmatrix}-2\\1\\7\end{bmatrix} + \begin{bmatrix}28\\21\\35\end{bmatrix}$

$\boxed{\text{2nd column} = \begin{bmatrix}14\\22\\28\end{bmatrix}}$

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

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

$\boxed{\text{3rd Column} = \begin{bmatrix}38\\18\\74\end{bmatrix}}$ Ans

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Q10

a). 1st column $= 6\begin{bmatrix}3\\6\\0\end{bmatrix} + 0\begin{bmatrix}-2\\5\\4\end{bmatrix} + 7\begin{bmatrix}7\\4\\9\end{bmatrix}$

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

$\boxed{\text{1st column} = \begin{bmatrix}67\\64\\63\end{bmatrix}}$

2nd column $= -2\begin{bmatrix}3\\6\\0\end{bmatrix} + 1\begin{bmatrix}-2\\5\\4\end{bmatrix} + 7\begin{bmatrix}7\\4\\9\end{bmatrix}$

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

$\boxed{\text{2nd column} = \begin{bmatrix}41\\21\\67\end{bmatrix}}$

3rd column $= 4\begin{bmatrix}3\\6\\0\end{bmatrix} + 3\begin{bmatrix}-2\\5\\4\end{bmatrix} + 5\begin{bmatrix}7\\4\\9\end{bmatrix}$

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

$\boxed{\text{3rd column} = \begin{bmatrix}41\\59\\57\end{bmatrix}}$ Ans

b) 1st column $= 3\begin{bmatrix}6\\0\\7\end{bmatrix} + 6\begin{bmatrix}-2\\1\\7\end{bmatrix} + 0\begin{bmatrix}4\\3\\5\end{bmatrix}$

$= \begin{bmatrix}18\\0\\21\end{bmatrix} + \begin{bmatrix}-12\\6\\42\end{bmatrix} + \begin{bmatrix}0\\0\\0\end{bmatrix}$

$\boxed{\text{1st column} = \begin{bmatrix}6\\6\\63\end{bmatrix}}$

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2nd column: $-2\begin{bmatrix}6\\0\\7\end{bmatrix}+5\begin{bmatrix}-2\\1\\7\end{bmatrix}+4\begin{bmatrix}7\\3\\5\end{bmatrix}$

$=\begin{bmatrix}-12\\0\\-14\end{bmatrix}+\begin{bmatrix}-10\\5\\35\end{bmatrix}+\begin{bmatrix}16\\12\\20\end{bmatrix}$

2nd column: $\begin{bmatrix}-6\\17\\41\end{bmatrix}$

3rd column: $7\begin{bmatrix}6\\0\\7\end{bmatrix}+4\begin{bmatrix}-2\\1\\7\end{bmatrix}+9\begin{bmatrix}7\\3\\5\end{bmatrix}$

$=\begin{bmatrix}42\\0\\49\end{bmatrix}+\begin{bmatrix}-8\\4\\28\end{bmatrix}+\begin{bmatrix}36\\27\\45\end{bmatrix}$

3rd column: $\begin{bmatrix}70\\31\\122\end{bmatrix}$

Q11

a) $A=\begin{bmatrix}2&-3&5\\7&-1&1\\1&5&4\end{bmatrix}$; $X=\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}$; $B=\begin{bmatrix}7\\-1\\0\end{bmatrix}$

$AX=B$

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

b) $A=\begin{bmatrix}4&0&-3&1\\5&1&0&-8\\2&-5&9&-1\\0&3&-1&7\end{bmatrix}$; $X=\begin{bmatrix}x_1\\x_2\\x_3\\x_4\end{bmatrix}$; $B=\begin{bmatrix}1\\3\\0\\2\end{bmatrix}$

$AX=B$

$$\begin{bmatrix}4&0&-3&1\\5&1&0&-8\\2&-5&9&-1\\0&3&-1&7\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\\x_4\end{bmatrix}=\begin{bmatrix}1\\3\\0\\2\end{bmatrix}$$

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Q12

a) $A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 1 & 0 \\ 0 & -3 & 4 \\ 1 & 0 & 1 \end{bmatrix}$; $B = \begin{bmatrix} -3 \\ 0 \\ 1 \\ 5 \end{bmatrix}$; $X = \begin{bmatrix} x_1 \\ x_3 \\ x_3 \end{bmatrix}$

$AX = B$

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

b) $A = \begin{bmatrix} -3 & 3 & 3 \\ -1 & -5 & -2 \\ 0 & -4 & 1 \end{bmatrix}$ $X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ $B = \begin{bmatrix} -3 \\ 3 \\ 0 \end{bmatrix}$

$AX = B$

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

Q13

a)

$5x_1 + 6x_2 - 2x_3 = 2$
$-x_1 - 2x_2 + 3x_3 = 0$
$0 + 4x_2 - x_3 = 3$

B)

$x + y + z = 2$
$2x + 3y + 0 = 2$
$5x - 3y - 6z = -9$

Q14

a)

$3x_1 - x_2 + 2x_3 = 2$
$4x_1 + 3x_2 + 7x_3 = -1$
$-2x_2 + x_2 + 5x_3 = 4$

B)

$3w - 2x + 0 + z = 0$
$5w + 0 + 4y - 2z = 0$
$3w + x + 4y + 7z = 0$
$-2w + 5x + y + 6z = 0$

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Q15

$$\begin{bmatrix} K & 1 & 1 \end{bmatrix} \underset{3\times 3}{\begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 2 \\ 0 & 2 & -3 \end{bmatrix}} \underset{3\times 1}{\begin{bmatrix} K \\ 1 \\ 1 \end{bmatrix}} = 0$$

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

$$K^2 + K + K + 2 - 1 = 0$$

$$K^2 + 2K + 1 = 0$$

$$(K+1)^2 = 0$$

$$\boxed{K = -1}$$ Ans

Q16 $$\underset{1\times 3}{\begin{bmatrix} 2 & 2 & K \end{bmatrix}} \underset{3\times 3}{\begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 3 \\ 0 & 3 & 1 \end{bmatrix}} \underset{3\times 1}{\begin{bmatrix} 2 \\ 2 \\ K \end{bmatrix}} = 0$$

$$\begin{bmatrix} 2+4 & 4+0+3K & 0+6+K \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ K \end{bmatrix} = 0$$

$$\begin{bmatrix} 6 & 4+3K & 6+K \end{bmatrix} \begin{bmatrix} 2 \\ 2 \\ K \end{bmatrix} = 0$$

$$12 + 8 + 6K + 6K + K^2 = 0$$

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$\cancel{K^2+12+20}$

$K^2+12K+20 = 0$

$\boxed{K=-2}$ or $\boxed{K=-10}$

Q17

$C_1 = \begin{bmatrix} 4 \\ 2 \end{bmatrix}$; $C_2 = \begin{bmatrix} -3 \\ -1 \end{bmatrix}$

$R_1 = [0 \quad 1 \quad 2]$; $R_2 = [-2 \quad 3 \quad 1]$

$$= \underset{2\times1}{\begin{bmatrix} 4 \\ 2 \end{bmatrix}} \underset{1\times3}{[0 \quad 1 \quad 2]} + \underset{2\times1}{\begin{bmatrix} -3 \\ -1 \end{bmatrix}} \underset{1\times3}{[-2 \quad 3 \quad 1]}$$

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

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

Q18 $C_1 = \begin{bmatrix} 0 \\ 4 \end{bmatrix}$; $C_2 \begin{bmatrix} -2 \\ -3 \end{bmatrix}$

$R_1 = [1 \quad 4 \quad 1]$; $R_2 = [-3 \quad 0 \quad 2]$

$$= \underset{2\times1}{\begin{bmatrix} 0 \\ 4 \end{bmatrix}} \underset{1\times3}{[1 \quad 4 \quad 1]} + \begin{bmatrix} -2 \\ -3 \end{bmatrix} [-3 \quad 0 \quad 2]$$

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

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

Q19 $C_1 = \begin{bmatrix} 1 \\ 4 \end{bmatrix}$; $C_2 = \begin{bmatrix} 2 \\ 5 \end{bmatrix}$; $C_3 \begin{bmatrix} 3 \\ 6 \end{bmatrix}$

$R_1 = [1 \quad 2]$; $R_2 = [3 \quad 4]$; $R_3 = [5 \quad 6]$

$$= \begin{bmatrix} 1 \\ 4 \end{bmatrix} [1 \quad 2] + \begin{bmatrix} 2 \\ 5 \end{bmatrix} [3 \quad 4] + \begin{bmatrix} 3 \\ 6 \end{bmatrix} [5 \quad 6]$$

$$= \begin{bmatrix} 1 & 2 \\ 4 & 8 \end{bmatrix} + \begin{bmatrix} 6 & 8 \\ 15 & 20 \end{bmatrix} + \begin{bmatrix} 15 & 18 \\ 30 & 36 \end{bmatrix}$$

$$\boxed{= \begin{bmatrix} 22 & 28 \\ 49 & 64 \end{bmatrix} \text{ Ans}}$$

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Q20.

$$C_1 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}; \quad C_2 = \begin{bmatrix} 4 \\ -2 \end{bmatrix}; \quad C_3 = \begin{bmatrix} 2 \\ 5 \end{bmatrix}$$

$$R_1 = \begin{bmatrix} 2 & -1 \end{bmatrix}; \quad R_2 = \begin{bmatrix} 4 & 0 \end{bmatrix}; \quad R_3 = \begin{bmatrix} 1 & -1 \end{bmatrix}$$

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

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

$$= \boxed{\begin{bmatrix} 18 & -2 \\ -1 & -6 \end{bmatrix}}$$

x —— x —— x

End of assignment

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