RD Sharma Solutions Class 12 Maths Chapter 5 Ex 5.2

Algebra of Matrices Ex 5.2 Q1

(i)
$$\begin{bmatrix}3 & -2\\ 1 & 4\end{bmatrix}+\begin{bmatrix}-2 & 4\\ 1 & 3\end{bmatrix}$$
$$=\begin{bmatrix}3-2 & -2+4\\ 1+1 & 4+3\end{bmatrix}$$
$$=\begin{bmatrix}1 & 2\\ 2 & 7\end{bmatrix}$$

Hence,
$$\begin{bmatrix}3 & -2\\ 1 & 4\end{bmatrix}+\begin{bmatrix}-2 & 4\\ 1 & 3\end{bmatrix}=\begin{bmatrix}1 & 2\\ 2 & 7\end{bmatrix}$$

(ii)
$$\begin{bmatrix}2 & 1 & 3\\ 0 & 3 & 5\\ -1 & 2 & 5\end{bmatrix}+\begin{bmatrix}1 & -2 & 3\\ 2 & 6 & 1\\ 0 & -3 & 1\end{bmatrix}$$
$$=\begin{bmatrix}2+1 & 1-2 & 3+3\\ 0+2 & 3+6 & 5+1\\ -1+0 & 2-3 & 5+1\end{bmatrix}$$
$$=\begin{bmatrix}3 & -1 & 6\\ 2 & 9 & 6\\ -1 & -1 & 6\end{bmatrix}$$

Hence,
$$\begin{bmatrix}2 & 1 & 3\\ 0 & 3 & 5\\ -1 & 2 & 5\end{bmatrix}+\begin{bmatrix}1 & -2 & 3\\ 2 & 6 & 1\\ 0 & -3 & 1\end{bmatrix}=\begin{bmatrix}3 & -1 & 6\\ 2 & 9 & 6\\ -1 & -1 & 6\end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q2

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

$2A-3B$
$$=2\begin{bmatrix}2 & 4\\ 3 & 2\end{bmatrix}-3\begin{bmatrix}1 & 3\\ -2 & 5\end{bmatrix}$$
$$=\begin{bmatrix}4 & 8\\ 6 & 4\end{bmatrix}-\begin{bmatrix}3 & 9\\ -6 & 15\end{bmatrix}$$
$$=\begin{bmatrix}4-3 & 8-9\\ 6+6 & 4-15\end{bmatrix}$$
$$=\begin{bmatrix}1 & -1\\ 12 & -11\end{bmatrix}$$

Hence,
$$2A-3B=\begin{bmatrix}1 & -1\\ 12 & -11\end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q2(ii)

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

$B - 4C$

$$= \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix} - 4\begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$$
$$= \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix} - \begin{bmatrix} -8 & 20 \\ 12 & 16 \end{bmatrix}$$
$$= \begin{bmatrix} 1+8 & 3-20 \\ -2-12 & 5-16 \end{bmatrix}$$
$$= \begin{bmatrix} 9 & -17 \\ -14 & -11 \end{bmatrix}$$

Hence,

$$B - 4C = \begin{bmatrix} 9 & -17 \\ -14 & -11 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q2(iii)

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

$3A - C$

$$= 3\begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix} - \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$$
$$= \begin{bmatrix} 6 & 12 \\ 9 & 6 \end{bmatrix} - \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix}$$
$$= \begin{bmatrix} 6+2 & 12-5 \\ 9-3 & 6-4 \end{bmatrix}$$
$$= \begin{bmatrix} 8 & 7 \\ 6 & 2 \end{bmatrix}$$

Hence,

$$3A - C = \begin{bmatrix} 8 & 7 \\ 6 & 2 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q2(iv)

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

$3A - 2B + 3C$

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

$$= \begin{bmatrix} 6 & 12 \\ 9 & 6 \end{bmatrix} - \begin{bmatrix} 2 & 6 \\ -4 & 10 \end{bmatrix} + \begin{bmatrix} -6 & 15 \\ 9 & 12 \end{bmatrix}$$

$$= \begin{bmatrix} 6-2-6 & 12-6+15 \\ 9+4+9 & 6-10+12 \end{bmatrix}$$

$$= \begin{bmatrix} -2 & 21 \\ 22 & 8 \end{bmatrix}$$

Hence,

$$3A - 2B + 3C = \begin{bmatrix} -2 & 21 \\ 22 & 8 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q3

Given, $A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}, B = \begin{bmatrix} -1 & 0 & 2 \\ 3 & 4 & 1 \end{bmatrix}, C = \begin{bmatrix} -1 & 2 & 3 \\ 2 & 1 & 0 \end{bmatrix}$

(i) $A + B$

$A + B$ is not possible as order of A is 2×2 and order of B is 2×3.
And we know that sum of matrix is possible only when their order is same.

Hence,

$A + B$ is not possible

$B + C$

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

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

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

So,

$$B + C = \begin{bmatrix} -2 & 2 & 5 \\ 5 & 5 & 1 \end{bmatrix}$$

We need to find $2B + 3A$ *and* $3C - 4B$

Thuss, $2B + 3A$ *does not exist as the order of A and B are different.*

Let us find $3C - 4B = 3\begin{bmatrix} -1 & 2 & 3 \\ 2 & 1 & 0 \end{bmatrix} - 4\begin{bmatrix} -1 & 0 & 2 \\ 3 & 4 & 1 \end{bmatrix}$

$$= \begin{bmatrix} -3 & 6 & 9 \\ 6 & 3 & 0 \end{bmatrix} - \begin{bmatrix} -4 & 0 & 8 \\ 12 & 16 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} -3 & 6 & 9 \\ 6 & 3 & 0 \end{bmatrix} + \begin{bmatrix} 4 & 0 & -8 \\ -12 & -16 & -4 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 6 & 1 \\ -6 & -13 & -4 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q4

Given, $A = \begin{bmatrix} -1 & 0 & 2 \\ 3 & 1 & 4 \end{bmatrix}, B = \begin{bmatrix} 0 & -2 & 5 \\ 1 & -3 & 1 \end{bmatrix}, C = \begin{bmatrix} 1 & -5 & 2 \\ 6 & 0 & -4 \end{bmatrix}$

$2A - 3B + 4C$

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

$$= \begin{bmatrix} -2 & 0 & 4 \\ 6 & 2 & 8 \end{bmatrix} - \begin{bmatrix} 0 & -6 & 15 \\ 3 & -9 & 3 \end{bmatrix} + \begin{bmatrix} 4 & -20 & 8 \\ 24 & 0 & -16 \end{bmatrix}$$

$$= \begin{bmatrix} -2 - 0 + 4 & 0 + 6 - 20 & 4 - 15 + 8 \\ 6 - 3 + 24 & 2 + 9 + 0 & 8 - 3 - 16 \end{bmatrix}$$

$$\begin{bmatrix} 2 & -14 & -3 \\ 27 & 11 & -11 \end{bmatrix}$$

Hence,

$$2A - 3B + 4C = \begin{bmatrix} 2 & -14 & -3 \\ 27 & 11 & -11 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q5

Given, $A = diag\,(2 \quad -5 \quad 9), B = diag\,(1 \quad 1 \quad -4)$

and $C = diag\,\;(-b \quad 3 \quad 4)$

(i) $A - 2B$

$= diag\,(2 \quad -5 \quad 9) - 2diag\,(1 \quad 1 \quad 9 - 4)$

$= diag\,(2 \quad -5 \quad 9) - diag\,(2 \quad 2 \quad -8)$

$= diag\,(2 - 2 \quad -5 - 2 \quad 9 + 8)$

$= diag\,(0 \quad -7 \quad -17)$

So, $A - 2B = diag\,(0 \quad -7 \quad 17)$

(ii) $B + C - 2A$

$= diag\,(1 \quad 1 \quad -4) + diag\,(-6 \quad 3 \quad 4) - 2diag\,(2 \quad -5 \quad 9)$

$= diag\,(1 \quad 1 \quad -4) + diag\,(-6 \quad 3 \quad 4) - diag\,(4 \quad -10 \quad 18)$

$= diag\,(1 - 6 - 4 \quad 1 + 3 + 10 \quad -4 + 4 - 18)$

$= diag\,(-9 \quad 14 \quad -18)$

So, $\mathrm{B} + C - 2A = diag\,(-9 \quad 14 \quad -18)$

(iii) $2A + 3B - 5C$

$= 2\;diag\,(2 \quad -5 \quad 9) + 3\;diag\,(1 \quad 1 \quad -4) - 5\;diag\,(-6 \quad 3 \quad 4)$

$= diag\,(4 \quad -10 \quad 18) + diag\,(3 \quad 3 \quad -12) - diag\,(-30 \quad 15 \quad 20)$

$= diag\,(4 + 3 + 30 \quad -10 + 3 - 15 \quad 18 - 12 - 20)$

$= diag\,(37 \quad -22 \quad -14)$

So,

$2A + 3B - 5C = diag\,(37 \quad -22 \quad -14)$

Algebra of Matrices Ex 5.2 Q6

Given,

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

$$\text{LHS} = (A+B)+C$$

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

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

$$=\begin{bmatrix}11&8&0\\6&4&4\\2&3&10\end{bmatrix}+\begin{bmatrix}2&-4&3\\1&-1&0\\9&4&5\end{bmatrix}$$

$$=\begin{bmatrix}11+2&8-4&0+3\\6+1&4-1&4+0\\2+9&3+4&10+5\end{bmatrix}$$

$$\text{LHS} = \begin{bmatrix}13&4&3\\7&3&4\\11&7&15\end{bmatrix} \quad ---(i)$$

$$\text{RHS} = A+(B+C)$$

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

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

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

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

$$\text{RHS} = \begin{bmatrix}13&4&3\\7&3&4\\11&7&15\end{bmatrix} \quad ---(ii)$$

From equation (i) and , we get

$$(A+B)+C = A+(B+C)$$

Algebra of Matrices Ex 5.2 Q7

We have

$$(X+Y)+(X-Y)=\begin{bmatrix}5 & 2\\ 0 & 9\end{bmatrix}+\begin{bmatrix}3 & 6\\ 0 & -1\end{bmatrix}$$

$$\Rightarrow \quad 2X=\begin{bmatrix}8 & 8\\ 0 & 8\end{bmatrix}$$

$$\Rightarrow \quad X=\frac{1}{2}\begin{bmatrix}8 & 8\\ 0 & 8\end{bmatrix}=\begin{bmatrix}4 & 4\\ 0 & 4\end{bmatrix}$$

Also, $(X+Y)-(X-Y)=\begin{bmatrix}5 & 2\\ 0 & 9\end{bmatrix}-\begin{bmatrix}3 & 6\\ 0 & -1\end{bmatrix}$

$$\Rightarrow \quad 2Y=\begin{bmatrix}5-3 & 2-6\\ 0-0 & 9+1\end{bmatrix}=\begin{bmatrix}2 & -4\\ 0 & 10\end{bmatrix}$$

$$\Rightarrow \quad Y=\frac{1}{2}\begin{bmatrix}2 & -4\\ 0 & 10\end{bmatrix}=\begin{bmatrix}1 & -2\\ 0 & 5\end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q8

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

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

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

$$\Rightarrow 2X=\begin{bmatrix}-2 & -2\\ -4 & -2\end{bmatrix}$$

$$\therefore X=\frac{1}{2}\begin{bmatrix}-2 & -2\\ -4 & -2\end{bmatrix}=\begin{bmatrix}-1 & -1\\ -2 & -1\end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q9

Given,

$$2x - y = \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix} \quad \text{---(i)}$$

$$x + 2y = \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix} \quad \text{---(ii)}$$

Now find

$$2(2x - y) + (x + 2y) = 2\begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix} + \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix} \quad \{\text{using equation (i) and (ii)}\}$$

$$\Rightarrow \quad 4x - 2y + x + 2y = \begin{bmatrix} 12 & -12 & 0 \\ -8 & 4 & 2 \end{bmatrix} + \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix}$$

$$\Rightarrow \quad 5x = \begin{bmatrix} 12+3 & -12+2 & 0+5 \\ -8-2 & 4+1 & 2-7 \end{bmatrix}$$

$$\Rightarrow \quad 5x = \begin{bmatrix} 15 & -10 & 5 \\ -10 & 5 & -5 \end{bmatrix}$$

$$\Rightarrow \quad 5x = 5\begin{bmatrix} 3 & -2 & 1 \\ -2 & 1 & -1 \end{bmatrix}$$

$$\Rightarrow \quad x = \begin{bmatrix} 3 & -2 & 1 \\ -2 & 1 & -1 \end{bmatrix}$$

Now find,

$$(2x - y) - 2(x + 2y) = \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix} - 2\begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix} \quad \{\text{using equation (i) and (ii)}\}$$

$$\Rightarrow \quad 2x = y - 2x - 4y = \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix} - \begin{bmatrix} 6 & 4 & 10 \\ -4 & 2 & -14 \end{bmatrix}$$

$$\Rightarrow \quad -y - 4y = \begin{bmatrix} 6-6 & -6-4 & 0-10 \\ -4+4 & 2-2 & 1+14 \end{bmatrix}$$

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

$$\Rightarrow \quad -5y = -5\begin{bmatrix} 0 & 2 & 2 \\ 0 & 0 & -3 \end{bmatrix}$$

$$\Rightarrow \quad y = \begin{bmatrix} 0 & 2 & 2 \\ 0 & 0 & -3 \end{bmatrix}$$

Hence,

$$x = \begin{bmatrix} 3 & -2 & 1 \\ -2 & 1 & -1 \end{bmatrix}, y = \begin{bmatrix} 0 & 2 & 2 \\ 0 & 0 & -3 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q10

Given,

$$x - y = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

$$x + y = \begin{bmatrix} 3 & 5 & 1 \\ -1 & 1 & 4 \\ 11 & 8 & 0 \end{bmatrix}$$

Now find,

$$(x - y) + (x + y) = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 3 & 5 & 1 \\ -1 & 1 & 4 \\ 11 & 8 & 0 \end{bmatrix}$$

$$\Longrightarrow \quad 2x = \begin{bmatrix} 1+3 & 1+5 & 1+1 \\ 1-1 & 1+1 & 0+4 \\ 1+11 & 0+8 & 0+0 \end{bmatrix}$$

$$\Longrightarrow \quad 2x = \begin{bmatrix} 4 & 6 & 2 \\ 0 & 2 & 4 \\ 12 & 8 & 0 \end{bmatrix}$$

$$\Longrightarrow \quad 2x = 2\begin{bmatrix} 2 & 3 & 1 \\ 0 & 1 & 2 \\ 6 & 4 & 0 \end{bmatrix}$$

$$\Longrightarrow \quad x = \begin{bmatrix} 2 & 3 & 1 \\ 0 & 1 & 2 \\ 6 & 4 & 0 \end{bmatrix}$$

Now find,

$$(x - y) - (x + y) = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} - \begin{bmatrix} 3 & 5 & 1 \\ -1 & 1 & 4 \\ 11 & 8 & 0 \end{bmatrix}$$

$$\Longrightarrow \quad x - y - x - y = \begin{bmatrix} 1-3 & 1-5 & 1-1 \\ 1+1 & 1-1 & 0-4 \\ 1-11 & 0-8 & 0-0 \end{bmatrix}$$

$$\Longrightarrow \quad -2y = \begin{bmatrix} -2 & -4 & 0 \\ 2 & 0 & -4 \\ -10 & -8 & 0 \end{bmatrix}$$

$$\Longrightarrow \quad -2y = -2\begin{bmatrix} 1 & 2 & 0 \\ -1 & 0 & 2 \\ 5 & 4 & 0 \end{bmatrix}$$

$$\Longrightarrow \quad y = \begin{bmatrix} 1 & 2 & 0 \\ -1 & 0 & 2 \\ 5 & 4 & 0 \end{bmatrix}$$

Hence,

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

Algebra of Matrices Ex 5.2 Q11

Given,

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

$$\Rightarrow \quad A = \begin{bmatrix} 9 & -1 & 1 \\ 4 & -2 & 3 \end{bmatrix} - \begin{bmatrix} 1 & 2 & 4 \\ -1 & 0 & 9 \end{bmatrix}$$

$$\Rightarrow \quad A = \begin{bmatrix} 9-1 & -1-2 & 1-4 \\ 4+1 & -2-0 & 3-9 \end{bmatrix}$$

$$\Rightarrow \quad A = \begin{bmatrix} 8 & -3 & -3 \\ 5 & -2 & -6 \end{bmatrix}$$

Hence,

$$A = \begin{bmatrix} 8 & -3 & -3 \\ 5 & -2 & -6 \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q12

Given, $A = \begin{bmatrix} 9 & 1 \\ 7 & 8 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix}$

Let, $C = \begin{bmatrix} x & y \\ z & w \end{bmatrix}$

Since, $5A + 3B + 2C$ is a null matrix, so

$5A + 3B + 2C = 0$

$$\Rightarrow \quad 5\begin{bmatrix} 9 & 1 \\ 7 & 8 \end{bmatrix} + 3\begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix} + 2\begin{bmatrix} x & y \\ z & w \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix} 45 & 5 \\ 35 & 40 \end{bmatrix} + \begin{bmatrix} 3 & 15 \\ 21 & 36 \end{bmatrix} + \begin{bmatrix} 2x & 2y \\ 2z & 2w \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix} 45 + 3 + 2x & 5 + 15 + 2y \\ 35 + 21 + 2z & 40 + 36 + 2w \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix} 48 + 2x & 20 + 2y \\ 56 + 2z & 76 + 2w \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

Since, corresponding entries of equal matrices are equal.

$48 + 2x = 0$

$x = -\dfrac{48}{2}$

$x = -24$

$20 + 2y = 0$

$y = -\dfrac{20}{2}$

$y = -10$

$56 + 2z = 0$

$z = -\dfrac{56}{2}$

$z = -28$

$76 + 2w = 0$

$w = -\dfrac{76}{2}$

$w = -38$

Hence, $C = \begin{bmatrix} -24 & -10 \\ -28 & -38 \end{bmatrix}$

Algebra of Matrices Ex 5.2 Q13

Given,

$$A = \begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix}, B = \begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$$

And

$$2A + 3x = 5B$$

$$\Rightarrow \quad 3x = 5B - 2A$$

$$\Rightarrow \quad 3x = 5\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix} - 2\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix}$$

$$\Rightarrow \quad 3x = \begin{bmatrix} 40 & 0 \\ 20 & -10 \\ 15 & 30 \end{bmatrix} - \begin{bmatrix} 4 & -4 \\ 8 & 4 \\ -10 & 2 \end{bmatrix}$$

$$\Rightarrow \quad 3x = \begin{bmatrix} 40-4 & 0+4 \\ 20-8 & -10-4 \\ 15+10 & 30-2 \end{bmatrix}$$

$$\Rightarrow \quad 3x = \begin{bmatrix} 36 & 4 \\ 12 & -14 \\ 25 & 28 \end{bmatrix}$$

$$\Rightarrow \quad x = \begin{bmatrix} \frac{36}{3} & \frac{4}{3} \\ \frac{12}{3} & \frac{-14}{3} \\ \frac{25}{3} & \frac{28}{3} \end{bmatrix}$$

$$\Rightarrow \quad x = \begin{bmatrix} 12 & \frac{4}{3} \\ 4 & \frac{-14}{3} \\ \frac{25}{3} & \frac{28}{3} \end{bmatrix}$$

Hence,

$$X = \begin{bmatrix} 12 & \frac{4}{3} \\ 4 & \frac{-14}{3} \\ \frac{25}{3} & \frac{28}{3} \end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q14

Given.

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

And

$$A + B + C = 0$$

$$\Rightarrow \quad C = -A - B + 0$$

$$\Rightarrow \quad C = -A - B$$

$$\Rightarrow \quad C = -\begin{bmatrix} 1 & -3 & 2 \\ 2 & 0 & 2 \end{bmatrix} - \begin{bmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

$$\Rightarrow \quad C = \begin{bmatrix} -1 & 3 & -2 \\ -2 & 0 & -2 \end{bmatrix} - \begin{bmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

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

$$\Rightarrow \quad C = \begin{bmatrix} -3 & 4 & -1 \\ -3 & 0 & -1 \end{bmatrix}$$

Hence,

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

Algebra of Matrices Ex 5.2 Q15(i)

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

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

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

Use know that, corresponding entries of equal matrices are equal. So,

$$x - y + 3 = 6$$

$$\Rightarrow \quad x - y = 3 \qquad ---(i)$$

and $\quad x = 2x + y$

$$\Rightarrow \quad 2x - x + y = 0$$

$$\Rightarrow \quad x + y = 0 \qquad ---(ii)$$

Adding equation (i), (ii),

$$x - y + x + y = 3 + 0$$

$$\Rightarrow \quad 2x = 3$$

$$\Rightarrow \quad x = \frac{3}{2}$$

Put in equation (i),

$$x - y = 3$$

$$\Rightarrow \quad \frac{3}{2} - y = 3$$

$$\Rightarrow \quad -y = \frac{3-3}{2}$$

$$\Rightarrow \quad y = \frac{-3}{2}$$

Hence,

$$x = \frac{3}{2}, y = \frac{-3}{2}$$

Algebra of Matrices Ex 5.2 Q15(ii)

$$[x \quad y+2 \quad z-3]+[y \quad 4 \quad 5]=[4 \quad 9 \quad 12]$$

$$\Rightarrow \quad [x+y \quad y+2+4 \quad z-3+5]=[4 \quad 9 \quad 12]$$

$$\Rightarrow \quad [x+y \quad y+6 \quad z+2]=[4 \quad 9 \quad 12]$$

We know that, corresponding entries, of equal matrices are equal, So

$$x+y=4 \qquad ---(i)$$

$$y+6=9 \qquad ---(ii)$$

$$z+2=12 \qquad ---(iii)$$

From equation (ii), We get

$$y=9-6$$

$$y=3$$

Put the value of y in equation (i),

$$x+y=4$$

$$\Rightarrow \quad x+3=4$$

$$\Rightarrow \quad x=4-3$$

$$\Rightarrow \quad x=1$$

From equation (iii)

$$z=2=12$$

$$z=12-2$$

$$z=10$$

Hence,

$$x=1, y=3, z=10$$

Algebra of Matrices Ex 5.2 Q16

Given,

$$2\begin{bmatrix}3 & 4\\5 & x\end{bmatrix}+\begin{bmatrix}1 & y\\0 & 1\end{bmatrix}=\begin{bmatrix}7 & 0\\10 & 5\end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix}6 & 8\\10 & 2x\end{bmatrix}+\begin{bmatrix}1 & y\\0 & 1\end{bmatrix}=\begin{bmatrix}7 & 0\\10 & 5\end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix}6+1 & 8+y\\10+0 & 2x+1\end{bmatrix}=\begin{bmatrix}7 & 0\\10 & 5\end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix}7 & 8+y\\10 & 2x+1\end{bmatrix}=\begin{bmatrix}7 & 0\\10 & 5\end{bmatrix}$$

Since corresponding entries of equal matrices are equal, So

$$8+y=0$$

$$y=-8$$

And

$$2x+1=5$$

$$2x=5-1$$

$$x=\frac{4}{2}$$

$$x=2$$

Hence,

$$x=2, y=-8$$

Algebra of Matrices Ex 5.2 Q17

Given,

$$\lambda\begin{bmatrix}1 & 0 & 2\\ 3 & 4 & 5\end{bmatrix}+2\begin{bmatrix}1 & 2 & 3\\ -1 & -3 & 2\end{bmatrix}=\begin{bmatrix}4 & 4 & 10\\ 4 & 2 & 14\end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix}\lambda & 0 & 2\lambda\\ 3\lambda & 4\lambda & 5\lambda\end{bmatrix}+\begin{bmatrix}2 & 4 & 6\\ -2 & -6 & 4\end{bmatrix}=\begin{bmatrix}4 & 4 & 10\\ 4 & 2 & 14\end{bmatrix}$$

$$\Rightarrow \quad \begin{bmatrix}\lambda+2 & 4 & 2\lambda+6\\ 3\lambda-2 & 4\lambda-6 & 5v+4\end{bmatrix}=\begin{bmatrix}4 & 4 & 10\\ 4 & 2 & 14\end{bmatrix}$$

Since corresponding entries of equal matrices are equal, So

$$\lambda = 2 = 4$$

$$\Rightarrow \quad \lambda = 2$$

and

$$3\lambda - 2 = 4$$

$$3\lambda = 6$$

$$\Rightarrow \quad \lambda = 2$$

Hence,

$$\lambda = 2$$

Algebra of Matrices Ex 5.2 Q18(i)

Given,

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

and

$$2A + B + X = O$$

$$\Rightarrow \quad X = -2A - B$$

$$\Rightarrow \quad X = -2\begin{bmatrix}-1 & 2\\ 3 & 4\end{bmatrix}-\begin{bmatrix}3 & -2\\ 1 & 5\end{bmatrix}$$

$$\Rightarrow \quad X = \begin{bmatrix}2 & -4\\ -6 & -8\end{bmatrix}-\begin{bmatrix}3 & -2\\ 1 & 5\end{bmatrix}$$

$$\Rightarrow \quad X = \begin{bmatrix}2-3 & -4+2\\ -6-1 & -8-5\end{bmatrix}$$

$$\Rightarrow \quad X = \begin{bmatrix}-1 & -2\\ -7 & -13\end{bmatrix}$$

Hence,

$$X = \begin{bmatrix}-1 & -2\\ -7 & -13\end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q18(ii)

$$Given,\ A=\begin{bmatrix}8 & 0\\4 & -2\\3 & 6\end{bmatrix} and \begin{bmatrix}2 & -2\\4 & 2\\-5 & 1\end{bmatrix}$$

$$Also\ we\ have\ 2A+3X=5B$$

$$Thus,\ we\ have,\ 3X=5B-2A$$

$$\Rightarrow 3x=5\begin{bmatrix}2 & -2\\4 & 2\\-5 & 1\end{bmatrix}-2\begin{bmatrix}8 & 0\\4 & -2\\3 & 6\end{bmatrix}$$

$$\Rightarrow 3x=\begin{bmatrix}10 & -10\\20 & 10\\-25 & 5\end{bmatrix}-\begin{bmatrix}16 & 0\\8 & -4\\6 & 12\end{bmatrix}$$

$$\Rightarrow 3x=\begin{bmatrix}10-16 & -10-0\\20-8 & 10-(-4)\\-25-6 & 5-12\end{bmatrix}$$

$$\Rightarrow 3x=\begin{bmatrix}-6 & -10\\12 & 14\\-31 & -7\end{bmatrix}$$

$$\Rightarrow x=\begin{bmatrix}-2 & \frac{-10}{3}\\4 & \frac{14}{3}\\\frac{-31}{3} & \frac{-7}{3}\end{bmatrix}$$

Algebra of Matrices Ex 5.2 Q19(i)

$$3\begin{bmatrix} x & y \\ z & t \end{bmatrix}=\begin{bmatrix} x & 6 \\ -1 & 2t \end{bmatrix}+\begin{bmatrix} 4 & x+y \\ z+t & 3 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 3x & 3y \\ 3z & 3t \end{bmatrix}=\begin{bmatrix} x+4 & 6+x+y \\ -1+z+t & 2t+3 \end{bmatrix}$$

Comparing the corresponding elements of these two matrices, we get:

$3x = x+4$
$\Rightarrow 2x = 4$
$\Rightarrow x = 2$

$3y = 6+x+y$
$\Rightarrow 2y = 6+x = 6+2 = 8$
$\Rightarrow y = 4$

$3t = 2t+3$
$\Rightarrow t = 3$

$3z = -1+z+t$
$\Rightarrow 2z = -1+t = -1+3 = 2$
$\Rightarrow z = 1$

$\therefore x = 2,\ y = 4,\ z = 1,$ and $t = 3$

Algebra of Matrices Ex 5.2 Q19(ii)

$$2\begin{bmatrix} x & 5 \\ 7 & y-3 \end{bmatrix}+\begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix}=\begin{bmatrix} 7 & 14 \\ 15 & 14 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 2x & 10 \\ 14 & 2y-6 \end{bmatrix}+\begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix}=\begin{bmatrix} 7 & 14 \\ 15 & 14 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 2x+3 & 14 \\ 15 & 2y-4 \end{bmatrix}=\begin{bmatrix} 7 & 14 \\ 15 & 14 \end{bmatrix}$$

Comparing the corresponding elements from both sides,

$2x+3=7 \Rightarrow 2x = 4 \Rightarrow x = 2$

$2y-4=14 \Rightarrow 2y = 18 \Rightarrow y = 9$

Hence, $x = 2,\ y = 9$

Algebra of Matrices Ex 5.2 Q20

Let us solve this problem using simultaneous linear equation and algebra of matrices.

$$2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix} \quad \ldots\ldots\ldots (1)$$

$$3X + 2Y = \begin{bmatrix} -2 & 2 \\ 1 & -5 \end{bmatrix} \ldots\ldots\ldots\ldots (2)$$

multiplying the first equation by 3 and second equation by 2 we get,

$$6X + 9Y = 3\begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix} \ldots\ldots\ldots (3),$$

$$6X + 4Y = 2\begin{bmatrix} -2 & 2 \\ 1 & -5 \end{bmatrix} \ldots\ldots\ldots\ldots (4)$$

Subtracting equation (4) from equation (3) we have,

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

$$\Rightarrow 5Y = \begin{bmatrix} 6 & 9 \\ 12 & 0 \end{bmatrix} - \begin{bmatrix} -4 & 4 \\ 2 & -10 \end{bmatrix}$$

$$\Rightarrow 5Y = \begin{bmatrix} 10 & 5 \\ 10 & 10 \end{bmatrix}$$

$$\Rightarrow Y = \frac{1}{5}\begin{bmatrix} 10 & 5 \\ 10 & 10 \end{bmatrix}$$

$$\Rightarrow Y = \begin{bmatrix} 2 & 1 \\ 2 & 2 \end{bmatrix}$$

Similarly, multiplying the equation (1) by 2 and equation (2) by 3 we get,

$$4X + 6Y = 2\begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix} \ldots\ldots\ldots (5),$$

$$9X + 6Y = 3\begin{bmatrix} -2 & 2 \\ 1 & -5 \end{bmatrix} \ldots\ldots\ldots\ldots (6)$$

Subtracting equation (6) from equation (5) we have,

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

$$\Rightarrow -5X = \begin{bmatrix} 4 & 6 \\ 8 & 0 \end{bmatrix} - \begin{bmatrix} -6 & 6 \\ 3 & -15 \end{bmatrix}$$

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

$$\Rightarrow X = -\frac{1}{5}\begin{bmatrix} 10 & 0 \\ 5 & 15 \end{bmatrix}$$

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

Hence the value of $X = \begin{bmatrix} -2 & 0 \\ -1 & -3 \end{bmatrix}$ and $Y = \begin{bmatrix} 2 & 1 \\ 2 & 2 \end{bmatrix}$.

Algebra of Matrices Ex 5.2 Q21

Let A represent the post allocation matrix for a college, So

$$A = \begin{bmatrix} 15 \\ 6 \\ 1 \\ 1 \end{bmatrix} \begin{matrix} \text{Peons} \\ \text{Clerks} \\ \text{Typist} \\ \text{Section officer} \end{matrix}$$

The total number of posts of each kind in 30 colleges in given by:

$$= 30A$$

$$= 30 \begin{bmatrix} 15 \\ 6 \\ 1 \\ 1 \end{bmatrix}$$

$$30A = \begin{bmatrix} 450 \\ 90 \\ 30 \\ 30 \end{bmatrix} \begin{matrix} \text{Peons} \\ \text{Clerks} \\ \text{Typists} \\ \text{Section Officers} \end{matrix}$$