Chapter # 9

ALGEBRAIC SENTENCES, MATRICES AND EQUATIONS

EXERCISE 9.1

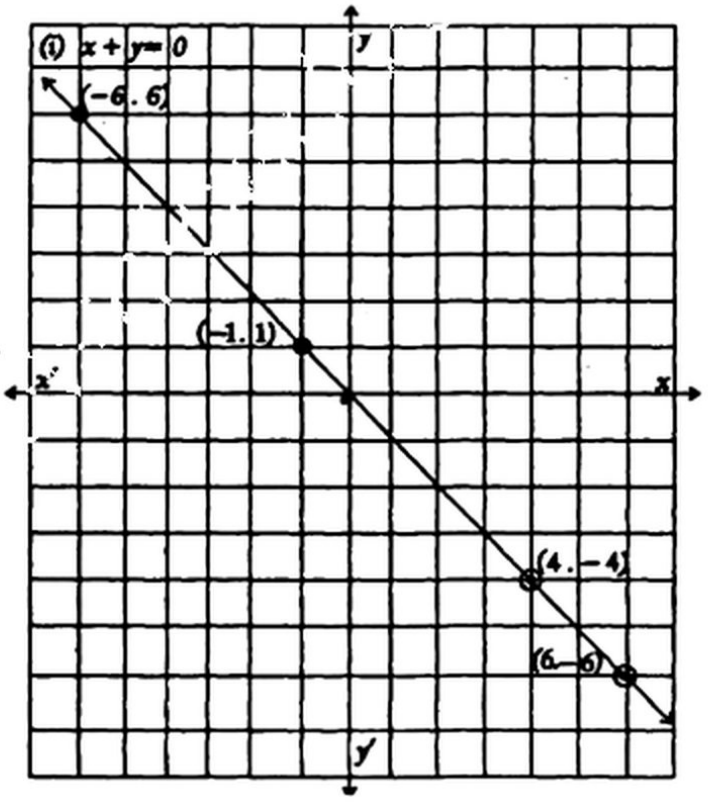
Find any ten members (ordered pairs) of the solution set of each of the following equaticns. Are the solution sets infinite sets:

Q.1 $x + y = 0$

$\therefore \quad y = -x$

x	0	1	−1	2	−2	3	−3	4	−4	5	...
y	0	−1	1	−2	2	−3	3	−4	4	−5	...

yes, the solution set is infinite.



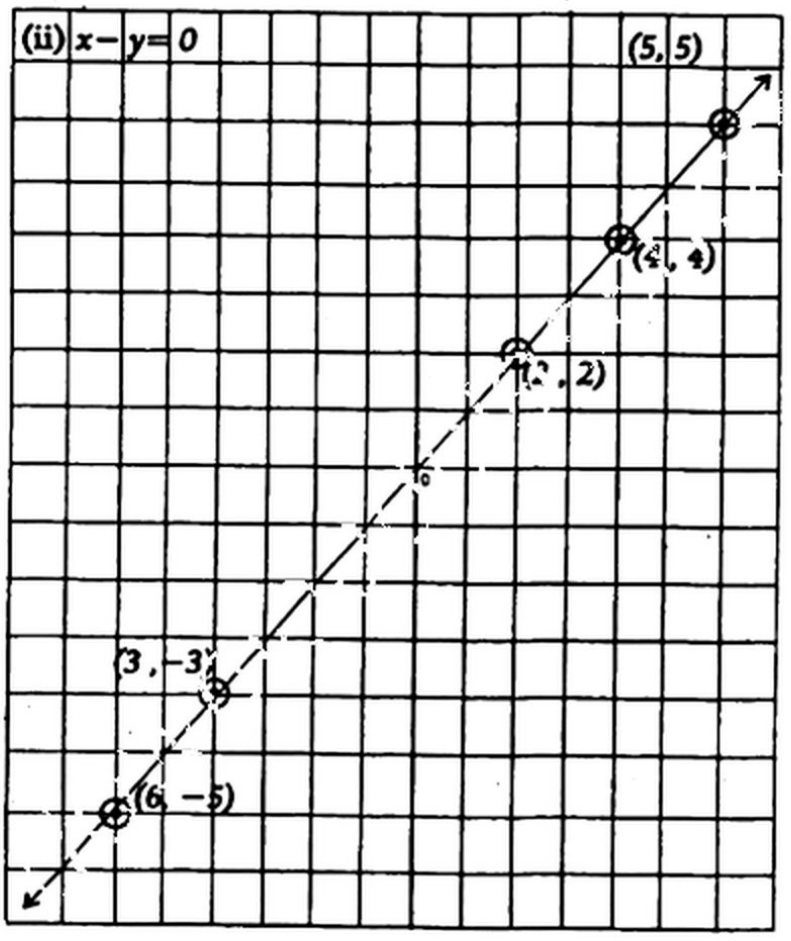
Q.2 $x - y = 0$

$\therefore \quad x - y = 0$

or $\quad y = x$

x	0	1	−1	2	−2	3	−3	4	−4	5	...
y	0	1	−1	2	−2	3	−3	4	−4	5	...

yes, the solution set is infinite.



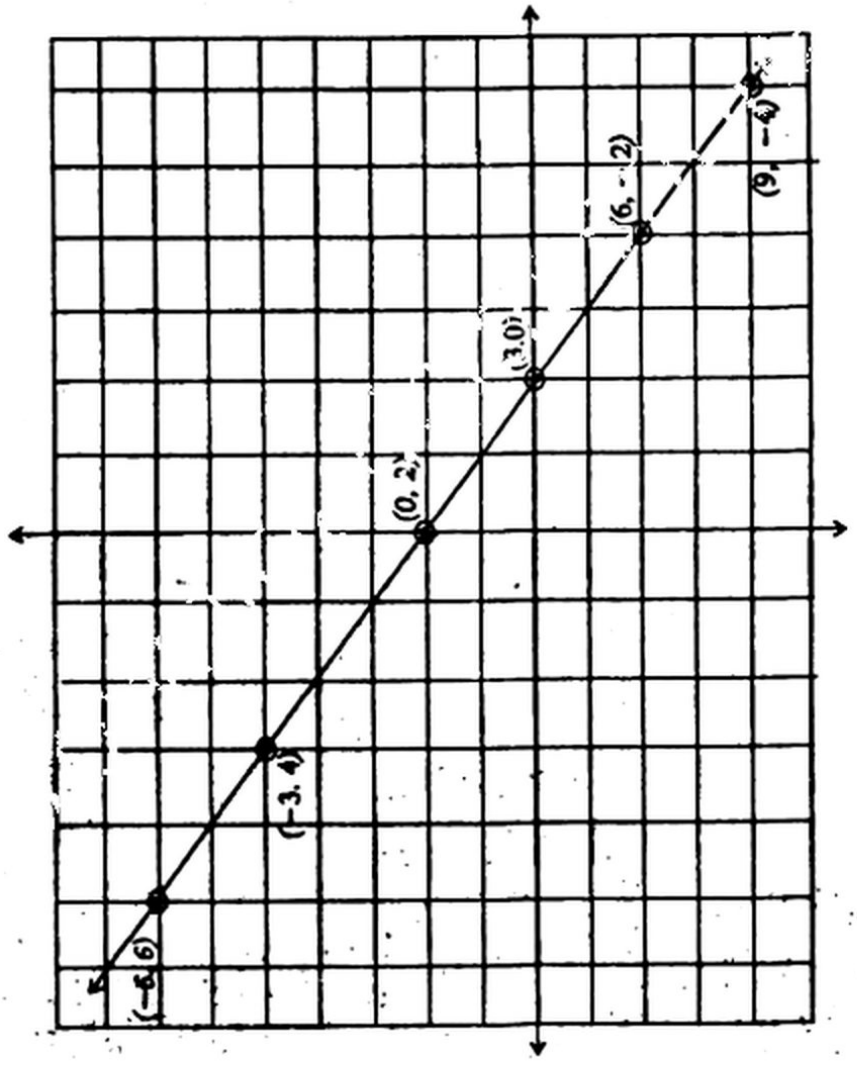
Q.3 $2x + 3y = 6$

$\therefore \quad 3y = 6 - 2x$

or $\quad y = \dfrac{6-2x}{3}$

x	0	−3	3	6	−6	9	−9	12	−12
y	2	4	0	−2	6	−4	8	−6	10

yes, the solution set is infinite.

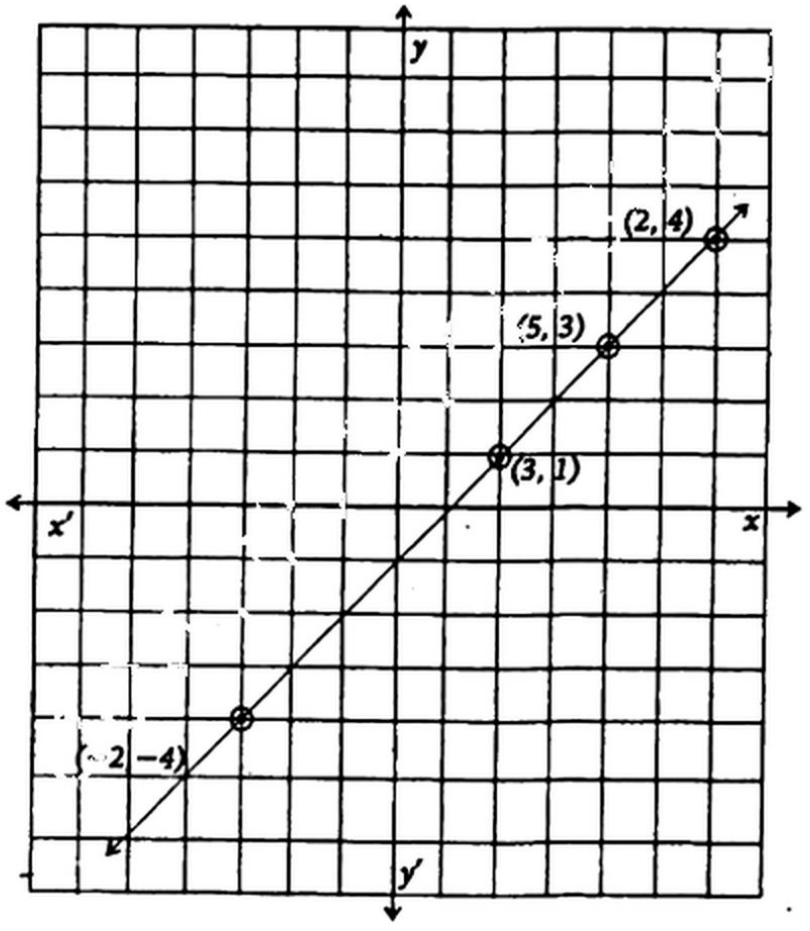


Q.4 $x = 2 = y$

or $y = x - 2$

x	0	1	−1	2	−2	3	−3	4	−4	5	...
y	−2	−1	−3	0	−4	1	−5	2	−6	3	...

yes, the solution set is infinite.



EXERCISE 9.2

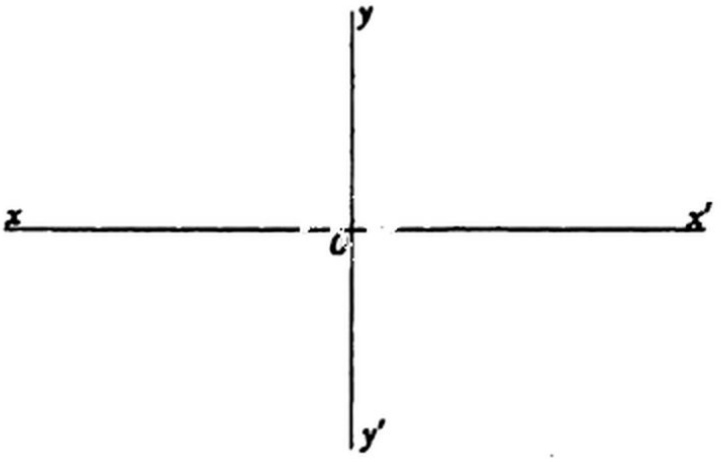
Q.1 ***Draw the graphs of questions given in Exercise 9.1.***
(Since the graph of a linear equation is always a line, for the sake of brevity, we call such equation a line.)

Q.2 ***Graph the lines:***

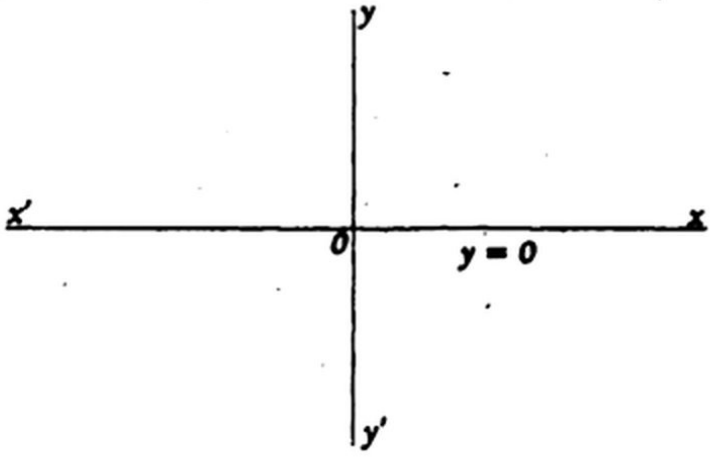
(i) $x = 0$ ***(ii)*** $y = 0$ ***(iii)*** $x = 3$
(iv) $y = -5$ ***(v)*** $3x + 5y = 8$
(vi) $6x + 10y - 16 = 0$

Solution:

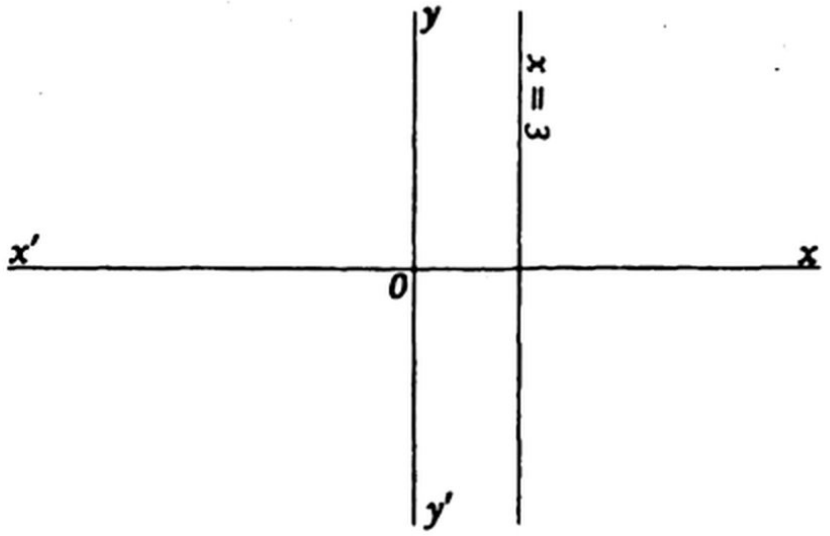
(i) $x = 0$ will represent a line lying on y-axis.



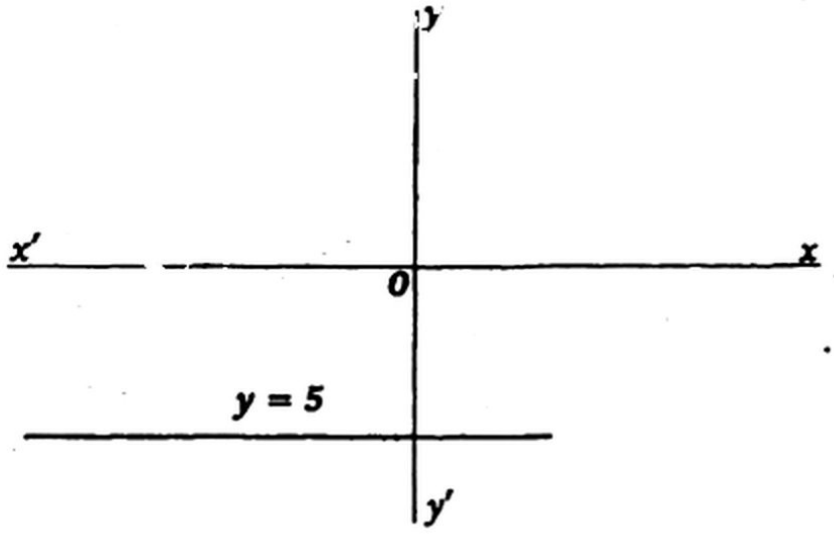
(ii) $y = 0$ will represent a line lying on x-axis.



(iii) $x = 3$ will represent a line parallel to y-axis and keeping a distance of 3 units from y-axis.



(iv) $y = -5$ will represent a line parallel to x-axis and keeping its distance -5 units from x-axis



(v) $3x + 5y = 8$

or $5y = 8 - 3x$

or $y = \frac{8 - 3x}{5}$

x	1	-4	6	-9
y	1	4	-2	7

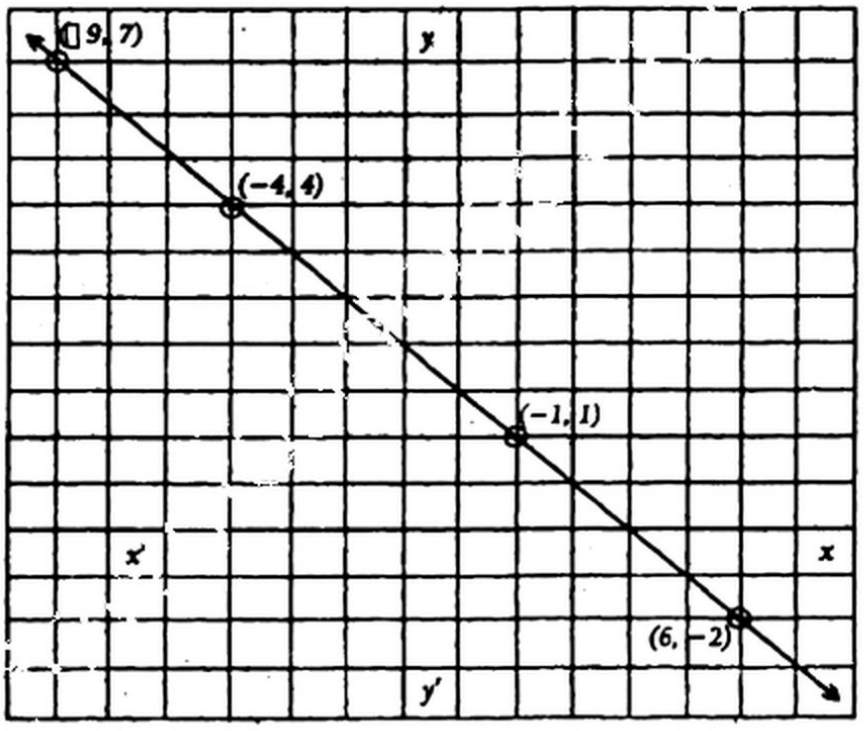
(vi) $6x + 10y - 16 = 0$

or $10y = 16 - 6x$

or $y = \frac{16 - 6x}{10}$

x	1	-4	6	-9
y	1	4	-2	7

(vi) $6x + 10y - 16 = 0$



Do the equation (v) and (vi) represent one and the same line.

Solution:

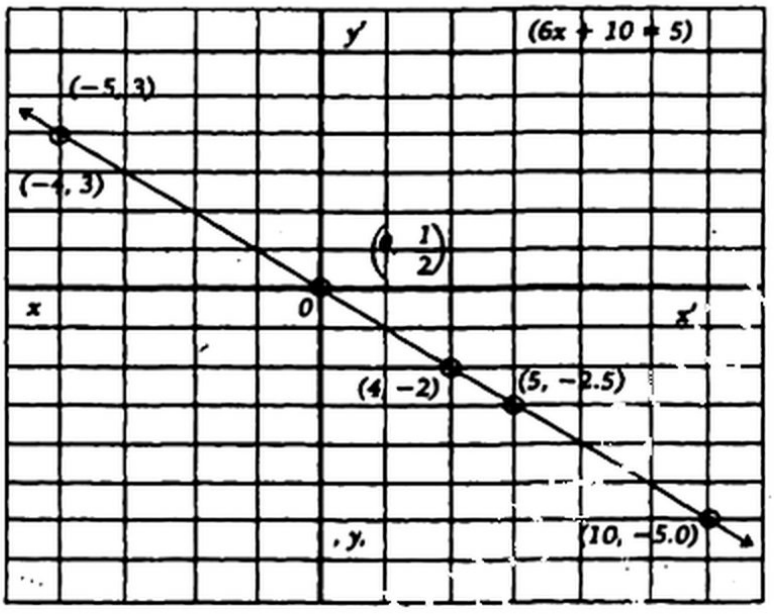
Yes,

(vii) $6x + 10y = 5$

or $10y = 5 - 6x$

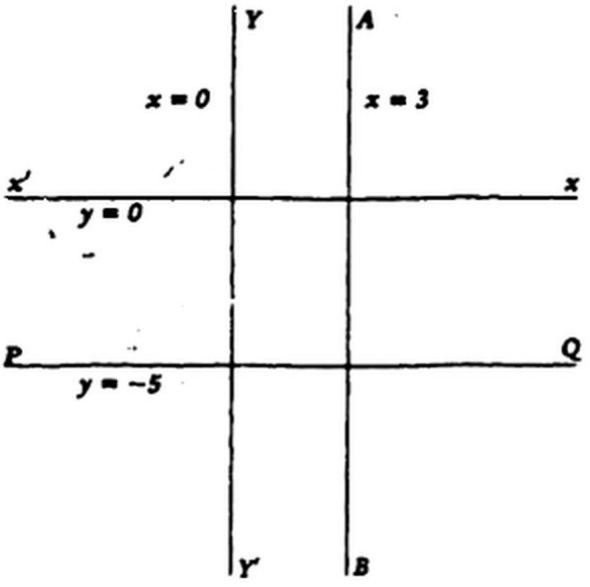
or $y = \frac{5 - 6x}{10}$

x	0	1	−1	+5	−5
y	$\frac{1}{2}$		$1\frac{1}{10}$	−2.5	3.5



Yes, line(i) is parallel to line (v).

(viii) Yes, the line (i) is parallel to line (iii).
Yes, the line (ii) is parallel to line (iv).



(ix) Draw the lines.

$$2x + 3y = 8$$

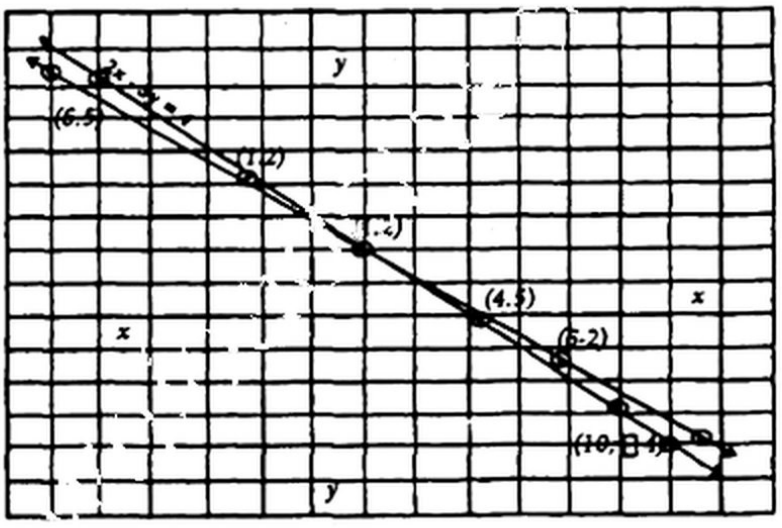
$$3x + 5y = 13$$

$$2x + 3y = 8$$

or $$3y = 8 - 2x$$

or $$y = \frac{8 - 2x}{3}$$

x	1	−2	4	−8
y	2	4	0	8

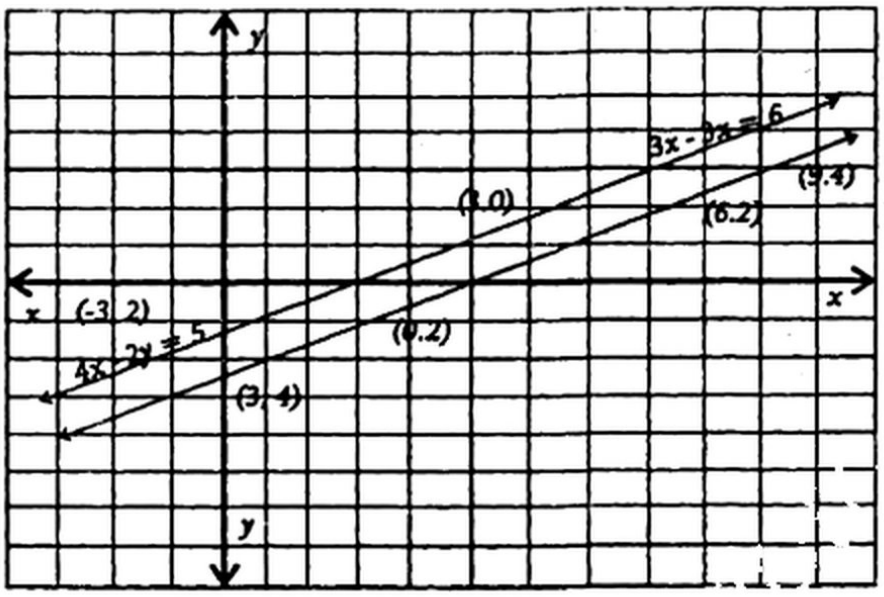


$$3x + 5y = 13$$

or $$5y = 13 - 3x$$

or $$y = \frac{13 - 3x}{5}$$

x	1	−4	6	11
y	2	5	−1	−4



Do these lines have a common point?

Solution:

Yes, they have common point, i.e, (1, 2).

Can the solution sets of these equations have more than one common order pair?

Solution:

No, as both the equations represent a straight line graphs and two straight lines can intersect at only one point.

(x) Does the point of intersection of the lines given in (ix) lie on the line $5x + 8 = 21$ as well?

Solution:

$$5x + 8y = 21$$

or $$8y = 21 - 5x$$

or $$y = \frac{21 - 5x}{8}$$

If $x = 1$, y will be equal to 2.

Hence the point of intersection of the line given

in (ix) also lies in the lines $5x + 8 = 21$.

(xi) Is any order pair common to the solution sets of the equations?

$$2x - 3y = 6$$
$$4x - 6y = 5$$

If not, why? Explain by drawing a graph.

Solution:

$$2x - 3y = 6$$

or $$-3y = +6 - 2x$$

or $$3y = 2x - 6$$

or $$y = \frac{2x-6}{3}$$

x	0	3	−3	6
y	−2	0	−4	2

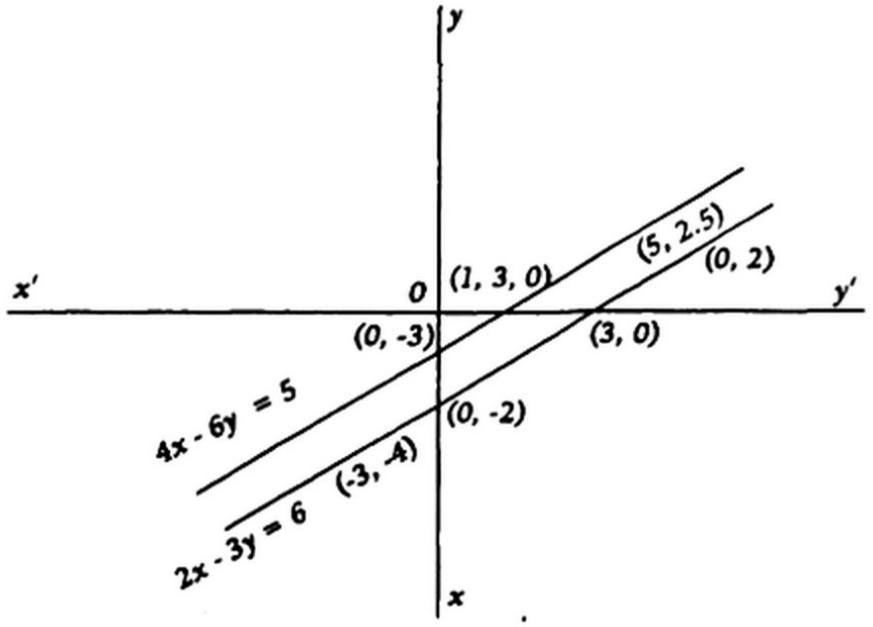
$$4y - 6y = 5$$

or $$-6y = 5 - 4x$$

or $$6y = 4z - 5$$

or $$y = \frac{4x-5}{6}$$

x	0	1.3	2	5
y	−8	0	0.5	2.5



The graph shows that both the lines are parallel to each other, hence there is no order pair common in the solution set of both the equation.

(xii) Do the equations.

$$3x + 5y = 9$$
$$5x - 2y = 9 + 2x - 7y$$

represent the same lines.

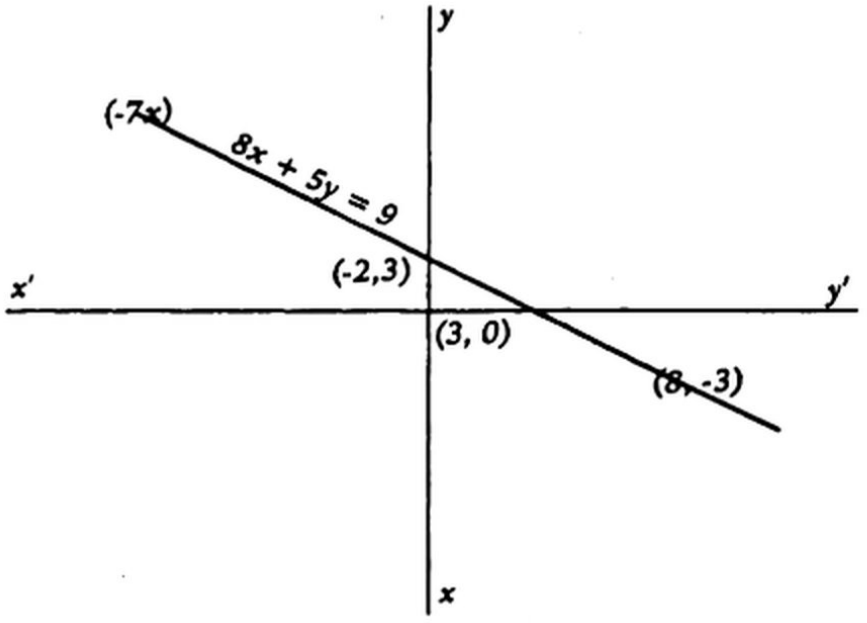
Solution:

$$3 + 5y = 9$$

or $$y = 9 - 3x$$

or $$y = \frac{9 - 3x}{5}$$

x	-2	3	-7	8
y	3	0	6	-3



$$5x - 2y = 9 + 2x - 7$$

or $$5x - 2x - 2y + 7y = 9$$

or $$3x + 5y = 9$$

Hence the equation is the same as the first one, so it represents the same line.

EXERCISE 9.3

Q.1 (i) **Add** $\begin{bmatrix} 1 & 2 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 0 & -2 \\ -2 & -4 \end{bmatrix}$

Solution:

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

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

(ii) **Add** $\begin{bmatrix} 3 & 4 \\ 6 & -7 \end{bmatrix} + \begin{bmatrix} 2 & 7 \\ 3 & 9 \end{bmatrix}$

Solution:

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

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

$$= \begin{bmatrix} 5 & 11 \\ 9 & 2 \end{bmatrix} \text{ Ans}$$

Q.2 **If** $A = \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix}$ **and**

$C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ ***Find the following matrics.***

(i) $A + B = \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 2 & -1 \\ 0 & +3 \end{bmatrix}$

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

$$= \begin{bmatrix} 1 & -1 \\ 2 & 8 \end{bmatrix} \text{ Ans}$$

(ii) $C + B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 2 & -1 \\ 0 & +3 \end{bmatrix}$

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

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

(iii) $A+C = \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

$$= \begin{bmatrix} 0 & 0 \\ 2 & 6 \end{bmatrix} \textit{Ans}$$

(iv) $B+B = \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix} + \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix}$

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

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

(v) $C = -1\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} -1\times 1 & -1\times 0 \\ -1\times 0 & -1\times 1 \end{bmatrix}$

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

(vi) $C-C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

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

(vii) $B - A = \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix} - \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix}$

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

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

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

(viii) $2A + 3B = 2\begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix} + 3\begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix}$

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

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

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

$= \begin{bmatrix} 4 & -3 \\ 4 & 19 \end{bmatrix}$ **Ans**

(ix) Is $C + A = A + C$ and $A + B = B + A$?

$L.H.S\ A + B = \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix}$

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

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

$R.H.S, B + A = \begin{bmatrix} 2 & -1 \\ 0 & 3 \end{bmatrix} + \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix}$

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

$\therefore$ $L.H.S = R.H.S$

or $A + B = B + A$

(x) *Is* $C + A = A + C$?

$$R.H.S = C + A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} -1 & 0 \\ 2 & 5 \end{bmatrix}$$

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

$\therefore$ $L.H.S = R.H.S$

or $B + A = C + A$

Q.3 ***Which of the following matrices are equal:***

$$A = \begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix} \qquad B = \begin{bmatrix} 1-1 & 0-3 \\ 4 & 10-5 \end{bmatrix}$$

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

$$E = \begin{bmatrix} 4+2 & 6(-1/2) \\ 3+1 & 5\times 1 \end{bmatrix}$$

Solution:

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

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

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

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

$$E = \begin{bmatrix} 4+2 & 6(-4) \\ 3+1 & 5\times 1 \end{bmatrix} = \begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix}$$

$\therefore$ $A = C = E = \begin{bmatrix} 2 & -3 \\ 4 & 5 \end{bmatrix}$

Similarly $B = D = \begin{bmatrix} 0 & -3 \\ 4 & 5 \end{bmatrix}$ ***Ans***

EXERCISE 9.4

Q.1 *If* $A = \begin{bmatrix} 1 & 5 \\ -3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix}$ *then find AB and BA.*

Solution:

$$AB = \begin{bmatrix} 1 & 5 \\ 3 & 2 \end{bmatrix} \times \begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} (1\times 2)+(5\times 3) & (1\times 3)+(5\times 2) \\ (3\times 2)+(2\times 3) & (3\times 3)+(2\times 2) \end{bmatrix}$$

$$= \begin{bmatrix} 2+15 & 3+10 \\ 6+6 & 9+4 \end{bmatrix}$$

$$= \begin{bmatrix} 17 & 13 \\ 12 & 13 \end{bmatrix} \text{ Ans}$$

$$BA = \begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix} \times \begin{bmatrix} 1 & 5 \\ 3 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} (2\times 1)+(3\times 3) & (2\times 5)+(3\times 2) \\ (3\times 1)+(2\times 3) & (3\times 5)+(2\times 2) \end{bmatrix}$$

$$= \begin{bmatrix} 2+9 & 10+6 \\ 3+6 & 15+4 \end{bmatrix}$$

$$= \begin{bmatrix} 11 & 16 \\ 9 & 19 \end{bmatrix}$$

Q.2 *If* $C = \begin{bmatrix} 5 & -3 \\ -3 & 2 \end{bmatrix}$ $D = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$ *then findout CD and DD.*

Solution:

$$CD = \begin{bmatrix} 5 & -3 \\ -2 & 12 \end{bmatrix} \times \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} (5\times 2)+(3\times 3) & (5\times 3)+(-3\times 5) \\ (13\times 2)+(2\times 3) & (13\times 3)+(2\times 5) \end{bmatrix}$$

$$= \begin{bmatrix} 10-9 & 15-15 \\ -6+6 & -9-10 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \textbf{Ans}$$

$$DD = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix} \times \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$$

$$= \begin{bmatrix} (2\times 2)+(3\times 3) & (2\times 3)+(3\times 5) \\ (3\times 2)+(5\times 3) & (5\times 5)+(3\times 3) \end{bmatrix}$$

$$= \begin{bmatrix} 4+9 & 6+15 \\ 6+15 & 9+25 \end{bmatrix} = \begin{bmatrix} 13 & 2 \\ 21 & 34 \end{bmatrix} \textbf{Ans}$$

Q.3 *If* $X = \begin{bmatrix} -1 & 2 \\ 2 & 0 \end{bmatrix}$, $Y = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$ *and* $Z = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

(i) $$XY = \begin{bmatrix} -1 & 2 \\ 2 & 0 \end{bmatrix} \times \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$$

$$= \begin{bmatrix} (-1\times 2)+(2\times 0) & (-1\times 0)+(2\times -2) \\ (2\times 4)+(0\times 0) & (2\times 0)+0\times(-2) \end{bmatrix}$$

$$= \begin{bmatrix} -2+0 & 0-4 \\ 4+0 & 0+(-0) \end{bmatrix} = \begin{bmatrix} -2 & -4 \\ 4 & 0 \end{bmatrix} \textbf{Ans}$$

(ii) $$YX = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix} \times \begin{bmatrix} -1 & 2 \\ 2 & 0 \end{bmatrix}$$

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

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

$$= \begin{bmatrix} -2 & 4 \\ -4 & 0 \end{bmatrix} \textbf{Ans}$$

(iii) $ZY = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$

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

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

$= \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$ ***Ans***

(iv) $YZ = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

$= \begin{bmatrix} 2+0 & 0+0 \\ 0+0 & 0-2 \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ ***Ans***

(v) $XZ = \begin{bmatrix} 1 & 2 \\ 2 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

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

(vi) $ZX = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} -1 & 2 \\ 2 & 0 \end{bmatrix}$

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

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

(vii) Is zx = xz?

Solution:

L.H.S

$ZX = \begin{bmatrix} -1 & 2 \\ 2 & 0 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$$= \begin{bmatrix} (-1\times1)+(2\times0) & (-1\times0)+(2\times1) \\ (2\times1)+(0\times0) & (2\times0)+(0\times1) \end{bmatrix}$$

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

$$R.H.S = zx = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} -1 & 2 \\ 2 & 0 \end{bmatrix}$$

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

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

$\therefore$ $L.H.S = R.H.S$

$\therefore$ $xz = zx$

(viii) Is $y = zy = yz$?

$$I = yz = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} (2\times1)+(0\times0) & (2\times0)+(0\times1) \\ (0\times1)+(2\times0) & (0\times0)+(-2\times1) \end{bmatrix}$$

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

$$II = zy = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$$

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

$$= \begin{bmatrix} 2+0 & 0-0 \\ 0+0 & 0-2 \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix} \textbf{Ans}$$

$$III = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$$

$\therefore$ $I - II = III$

$\therefore$ $y - yz = zy$

Q.4 *If* $A = \begin{bmatrix} 5 & -6 \\ 7 & 2 \end{bmatrix}$ *then prove that* $AO = OA$

where 0 is null Matrix.

Solution:

$$A = \begin{bmatrix} 5 & -6 \\ 7 & 2 \end{bmatrix} = \begin{bmatrix} (0 & 0) \\ (0 & 0) \end{bmatrix}$$

$$L.H.S = AO = \begin{bmatrix} 5 & -6 \\ 0 & 2 \end{bmatrix} \times \begin{bmatrix} (0 & 0) \\ (0 & 0) \end{bmatrix}$$

$$= \begin{bmatrix} (5\times 0)+(-6\times 0) & (5\times 0)+(-6\times 0,) \\ (7\times 0)+(2\times 0) & (7\times 0)+(2\times 0) \end{bmatrix}$$

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

$$R.H.S = OA = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} \times \begin{bmatrix} 5 & -6 \\ 7 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} (0\times 5)+(0\times 7) & (0\times -6)+(0\times 2) \\ (0\times 5)+(0\times 7) & (0\times -6)+(0\times 2) \end{bmatrix}$$

$$= \begin{bmatrix} 0\times 0 & -0+0 \\ (0\times 0 & -0+0) \end{bmatrix} = \begin{bmatrix} (0 & 0) \\ (0 & 0) \end{bmatrix}$$

$\therefore$ L.H.S = R.H.S

$\therefore$ $AO = OA$

Q.5 *If A is any 2 × 2 matrix, prove that OA and AO are both null matrices.*

Solution:

$$A = \begin{bmatrix} 1 & 1 \\ 3 & 4 \end{bmatrix} \text{ and}$$

$$O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

to prove that $AO = OA = 0$

$$A=\begin{bmatrix}1 & 1\\ 3 & 4\end{bmatrix} \text{ and}$$

$$O=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$$

I. $$AO=\begin{bmatrix}(1 & 2)\\ (3 & 4)\end{bmatrix}\times\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$$

$$=\begin{bmatrix}(1\times0)+(2\times0) & (1\times0)+(2\times0)\\ (3\times0)+(4\times0) & (3\times0)+(4\times0)\end{bmatrix}$$

$$=\begin{bmatrix}0+0 & 0+0\\ 0+0 & 0+0\end{bmatrix}=\begin{bmatrix}(0 & 0)\\ (0 & 0)\end{bmatrix}$$

II. $$OA=\begin{bmatrix}(0 & 0)\\ (0 & 0)\end{bmatrix}\times\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$$

$$=\begin{bmatrix}(0\times1)+(0\times3) & (0\times2)+(0\times4)\\ (0\times1)+(0\times3) & (0\times2)+(0\times4)\end{bmatrix}$$

$$=\begin{bmatrix}0+0 & 0+0\\ 0+0 & 0+0\end{bmatrix}=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$$

III. $$O=\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$$

Hence I = II = III

. $AO = OA$ prove that AO and OA.

Hence $BI = IB = B$

Q..6 *If* $B=\begin{bmatrix}0 & -1\\ 2 & 5\end{bmatrix}$ *and* $I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ *then*

prove that B = IB = BI.

Solution:

$$BI=\begin{bmatrix}0 & -1\\ 2 & 5\end{bmatrix}\times\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$$

$$BI = \begin{bmatrix} 0 & -1 \\ 2 & 5 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} (0\times 1)+(1-\times 0) & (0\times 0)+(-1\times 1) \\ (2\times 1)+(5\times 0) & (2\times 0)+(5\times 1) \end{bmatrix}$$

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

$$II.\ IB = \begin{bmatrix} (1 & 0) \\ (0 & 1) \end{bmatrix} = \begin{bmatrix} (0 & -1) \\ (2 & 5) \end{bmatrix}$$

$$= \begin{bmatrix} (1\times 0)+(0\times 2) & (1\times -2)+(0\times 5) \\ (0\times 0)+(1\times 2) & (0\times -1)+(1\times 5) \end{bmatrix}$$

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

$$III.\ B = \begin{bmatrix} (0 & -1) \\ (2 & 5) \end{bmatrix}$$

$\therefore\ I = II = III$

Hence $BI = IB = B$

Q.7 If A is any 2 × 2 matrix and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

show that AI = IA = A.

Solution:

$$I.\ AI = \begin{bmatrix} 5 & 3 \\ 2 & 5 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} (5\times 1)+(3\times 0) & (5\times 0)+(3\times 1) \\ (2\times 1)+(4\times 0) & (2\times 0)+(4\times 1) \end{bmatrix}$$

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

$$II.\ IB = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} 5 & 3 \\ 2 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} (1\times 5)+(0\times 2) & (1\times 3)+(0\times 4) \\ (0\times 5)+(1\times 2) & (0\times 3)+(1\times 4) \end{bmatrix}$$

$$= \begin{bmatrix} 5+0 & 3+0 \\ 0+2 & 0+4 \end{bmatrix} = \begin{bmatrix} (5 & 3) \\ (2 & 4) \end{bmatrix}$$

$$III = A = \begin{bmatrix} 5 & 3 \\ 2 & 4 \end{bmatrix}$$

$\therefore \quad I = II = III$

$\therefore \quad AI = IA = A$



EXERCISE 9.5

Q.1 ***Find singular and non-singular matrices from the following:***

(i) $\begin{bmatrix} 3 & 2 \\ -2 & 0 \end{bmatrix}$

Suppose $A = \begin{bmatrix} 3 & 2 \\ -2 & 0 \end{bmatrix}$

$\therefore \quad |A| = (3 \times 0) - 2(-2) = 0 + 4 = 4$

$\therefore \quad |A| \neq 0$ so it is non-singular matrix.

(ii) Suppose $A = \begin{bmatrix} 5 & 1 \\ 5 & 1 \end{bmatrix}$

$\therefore \quad |A| = (5 \times 1) - (5 \times 1) = 5 - 5 = 0$

$\therefore \quad$ It is sing.

(iii) Suppose $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$\therefore \quad |A| = -(3 \times 3) = 24 - 23 = 0$

So it is a singular matrix.

(iv) Suppose $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$|A| = (1 \times 1) = (0 \times 0) = 1 - 0 = 1$

$\therefore \quad |A| \neq 0$ so it is non singular matrix.

(v) Suppose $A = \begin{bmatrix} -3 & 2 \\ -9 & 6 \end{bmatrix}$

$|A| = (-3 \times -6) - 2 \times (-9)$

$= -18 + 18 = 0$

$\therefore \quad |A| = 0$

So it is a singular matrix.

Q.2 ***Find the inverses of the following matrices:***

(i) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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

$$|A| = (0 \times 0) = (1 \times 1) = 0 - 1 = -1$$

$$\therefore \quad A^{-1} = 1^1/|A| \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix} = 1/-1 \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

(ii) $\begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$

Suppose $|A| = \begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$

$$|A| = (1 \times 7) - (2 \times 3) = 7 - 6 = 1$$

$$A^{-1} = 1/|A| \begin{bmatrix} 7 & -2 \\ 2 & 1 \end{bmatrix} = 1/1 \begin{bmatrix} 7 & -2 \\ -3 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 7 & -2 \\ -3 & 1 \end{bmatrix}$$

(iii) $A = \begin{bmatrix} -2 & 4 \\ 3 & 8 \end{bmatrix}$

Suppose

$$|A| = (-2 \times 8) - (4 \times 3) = -16 - 12 = -28$$

$$A^{-1} = 1/|A| \begin{bmatrix} 8 & -4 \\ -3 & -2 \end{bmatrix} = 1/-28 \begin{bmatrix} 8 & -4 \\ -3 & -2 \end{bmatrix}$$

$$= \begin{bmatrix} (-8/28 & -4/28) \\ (-3/-28 & -2/-28) \end{bmatrix} = \begin{bmatrix} -2/7 & -1/7 \\ 3/28 & 1/14 \end{bmatrix}$$ ***Ans***

Q.3 ***Find the true and false statement from the following where A and B are 2 × 2 matrices.***

(i) Inverse of every matrix exit. False

(ii) Matrix A will be non-singular If $A \neq 0$ =. True

(iii) Matrix A will be singular if $|A| = 0$ =. True

(iv) Matrix A posses two inverses =. False

(v) AB and BA are always equal = . False

(vi) $A+B$ and $B+A$ are always equal = . True

(vii) $\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$ is called unit matrix. False

(viii) $A-A$ is always null matrix = . True

(ix) $(2 \quad 0)$ is called mint $(0 \quad 2)$ matrix = . False

(x) Addition of two matrices is commutative = . True

(xi) Addition of two matrices is commutative = . True

(xii) Multiplication of two matrices is commutative = False

Q.4 ***If*** $A = \begin{bmatrix} 1/2 & 3 \\ -4 & 5 \end{bmatrix}$ ***Find*** A^{-1}***?***

Solution:

$$|A| = (1/2 \times 5) - 3 \times (-4) = 5/2 + 12$$

$$= 5 + 24/2 = 29/2$$

$$\therefore \quad A^{-1} = 1/|A| \begin{bmatrix} (5 & -3) \\ (4 & 1/2 \end{bmatrix} = \frac{1}{29/2} \begin{bmatrix} 5 & -3 \\ 4 & 1/2 \end{bmatrix}$$

$$= \begin{bmatrix} 2/29 \times 5 & -3 \times 2/29 \\ 2/29 \times 4 & 1/2 \times 2/29 \end{bmatrix}$$

$$= \begin{bmatrix} 10/29 & -6/29 \\ 8/29 & 1/29 \end{bmatrix} \text{ Ans}$$

Q.5 *If* $B = \begin{bmatrix} 5 & -6 \\ -1 & 2 \end{bmatrix}$ *then find* B^{-1}. *Also prove that* $B^{-1}BB = B \times B^{-1} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Solution:

$$|B| = (5 \times 2) - (-6 \times -1)$$

$$= 10 - 6 = 4$$

I. $$B^{-1} = 1/|B| \begin{bmatrix} (2 & 6) \\ (1 & 5) \end{bmatrix} = 1/4 \begin{bmatrix} (2 & 6) \\ (1 & 5) \end{bmatrix}$$

$$= \begin{bmatrix} 2 \times 1/4 & 6 \times 1/4 \\ 1 \times 1/4 & 5 \times 1/4 \end{bmatrix} \times \begin{bmatrix} 1/2 & 3/2 \\ 1/4 & 5/4 \end{bmatrix}$$

II. $$B^{-1}B = \begin{bmatrix} (1/2 & 3/2) \\ (1/4 & 5/4) \end{bmatrix} \times \begin{bmatrix} (5 & -6) \\ (-1 & -2) \end{bmatrix}$$

$$= \begin{matrix} (1/2 \times 5) & (3/2 \times -1) & (1/2 \times -6) + (3/2 \times 2) \\ (1/4 \times 5) + (5/4 \times -1) & (1/4 \times -6) + (5/4 \times 2) \end{matrix}$$

$$= \begin{matrix} 5/2 & -3/2 & -3 \times 3) \\ (5/4 & -5/7) & (-3/2 + 5/2) \end{matrix} \quad + \frac{5-3}{2}$$

$$\frac{-3+5}{2}$$

$$= \begin{bmatrix} 2/2 & 0 \\ 0 & 2/2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

III. $$BB^{-1} = \begin{bmatrix} 5 & -6 \\ -1 & 2 \end{bmatrix} \times \begin{bmatrix} 1/2 & 3/2 \\ 1/4 & 5/4 \end{bmatrix}$$

$$= \begin{bmatrix} (5 \times 1/2) + (-6 \times 1/4) & (5 \times 3/2) + (-6 \times 5/4) \\ (-1 \times 1/2) + (2 \times 1/4) & (-1 \times 3/2) + (2 \times 5/4) \end{bmatrix}$$

$$= \begin{bmatrix} 5/2 & -3/2 & -5/2 & -15/2 \\ -1/2+1/2 & & -3/2 & 5/2 \end{bmatrix}$$

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

$$\therefore B^{-1}B = BB^{-1} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \textit{Ans}$$



EXERCISE 9.6

Q.1 ***Write co-efficient matrices of the following simultaneous equations. Also find which of these are singular and non-singular matrices:***

(i)

$$3x + 5y = 8$$
$$6x + 10y = 5$$

By writing in the form of matrices.

$$\begin{bmatrix} 3 & 5 \\ 6 & 10 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 8 \\ 5 \end{bmatrix}$$

where

$$A = \begin{bmatrix} 3 & 5 \\ 6 & 10 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 8 \\ 5 \end{bmatrix}$$

$$A = \begin{bmatrix} 3 & 5 \\ 6 & 10 \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} 8 \\ 5 \end{bmatrix}$$

$|A| = (3 \times 10) - (5 \times 6 = 30 - 30 = 0$

$\therefore \quad |A| = 0$

$\therefore$ It is singular matrix.

(ii)

$$1/2\, x - 3y = 4$$
$$x - 6y = 1$$

By writing in the form of matrices.

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

where

$$A = \begin{bmatrix} 1/2 & -3 \\ 1 & -6 \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$$

$|A| = (1/2 \times (-6) - (-3 \times 1) = -3 + 3 = 0$

$\therefore \quad |A| = 0$

As $|A|$ is equal to zero.

$\therefore$ It is also a singular matrix.

(iii) $3x - 5y = 0$

$4x - 7y = 1/2$

By writing in the form of matrices:

$$\begin{bmatrix} 3 & - & 5 \\ 4 & - & 7 \end{bmatrix} \begin{bmatrix} (x) \\ (y) \end{bmatrix} = \begin{bmatrix} 0 \\ 1/2 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} (3 & - & 5) \\ (4 & - & 7) \end{bmatrix}, \; X = \begin{bmatrix} (x) \\ (y) \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1/2 \end{bmatrix}$$

$|A| = 3x(-7) - 4x(-5) = -21 + 20 = -1$

$\therefore \quad |A| = -1$ or $|A| \neq 0$

$\therefore$ It is a non-singular matrix.

(iv) $3x = 2y$ $\quad$ **or** $\quad$ $3x - 2y = 0$

$-2y = 5x + 1$ $\quad$ $-5x - 2y = 1$

By writing in the form of matrices:

$$\begin{bmatrix} 3 & -2 \\ -5 & -2 \end{bmatrix} \begin{bmatrix} (x) \\ (y) \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} (3 & -2) \\ (-5 & -2) \end{bmatrix}, \; X = \begin{bmatrix} (x) \\ (y) \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$\therefore |A| = 3x(-2) - (-2)x(-5) = -6 - 10 = -16$

$\therefore |A| = -16$ As $|A| = -16$

$\therefore$ It is a non-singular matrix.

Q.2 ***By using matrices tell whether the solution of the following simultaneous equations is possible or not:***

(i) $x - y = 2$

$3x - 3y = 5$

By forming into matrices:

$$\begin{bmatrix} 1 & -1 \\ 3 & -3 \end{bmatrix} \begin{bmatrix} (x) \\ (y) \end{bmatrix} = \begin{bmatrix} 2 \\ 5 \end{bmatrix}$$

where,

$$A = \begin{bmatrix} 1 & -1 \\ 3 & -3 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}$$

$$B = \begin{bmatrix} 2 \\ 5 \end{bmatrix}$$

$$|A| = 1 \times (-3) - (-1 \times 3) = -3 + 3 = 0$$

$$|A| = 0$$

As A is a singular matrix by which $|A|$ is meaningless therefore A cannot be found and the solution set of the equations cannot be found.

(ii) $4x + 3y = 7$

$2x + 5y = 7$

By writing it in the form of matrices:

$$\begin{bmatrix} 3 & 3 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 7 \\ 7 \end{bmatrix}$$

When

$$A = \begin{bmatrix} 4 & 3 \\ 2 & 5 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}$$

$$B = \begin{bmatrix} 7 \\ 7 \end{bmatrix}$$

$$|A| = (4 \times 5) - (3 \times 2) = 20 - 6 = 14$$

As A is non-singular matrix therefore the solution set of the equations can be found out.

(iii) $x = 3$ $\quad y = 5$ $\quad$ *or* $\quad x + oy = 3$ $\quad ox + y = 5$

By writing it in the form of matrix:

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}$$

$$B = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$$

$$|A| = (1 \times 1) - (0 \times 0) = 1 - 0 = 1$$

As A is a non-singular matrix so the solution set of the equations can be found out.

(v) $$1/2x - y = 0$$

$$3x + y = 6$$

By writing it in the form of matrices.

$$\begin{bmatrix} 1/2 & -1 \\ 3 & +1 \end{bmatrix} \begin{bmatrix} (x) \\ (y) \end{bmatrix} = \begin{bmatrix} 0 \\ 6 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} 1/2 & -1) \\ 3 & +1 \end{bmatrix}, \quad X = \begin{bmatrix} x \\ y \end{bmatrix}$$

$$B = \begin{bmatrix} 0 \\ 6 \end{bmatrix}$$

$$|A| = (1/2 \times 1) - (-1 \times 3) = 1/2 + 3 = \frac{1+6}{2} = \frac{7}{2}$$

As A is a non-singular matrix so, the solution set of the equations can be found.

Q.3 *If* $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -3 \\ 4 \end{bmatrix}$, $C = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$

find AB and AC. Also tell whether BA and CA exist or not. Explain.

Solution:

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

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

$$= \begin{bmatrix} 1 \times (-3) & + & (2 \times 4) & (-3 + 8) = (5) \\ 3 \times (-3) & + & (4 \times 4) & (-9 + 16) = (7) \end{bmatrix}$$

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

(ii)
$$AC = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \times \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$
$$= \begin{bmatrix} (1\times 1) & + & (2\times 0) \\ (3\times 1) & + & (4\times 0) \end{bmatrix} = \begin{bmatrix} (1+0) \\ (3+0) \end{bmatrix} = \begin{bmatrix} (1) \\ (3) \end{bmatrix}$$

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

While multiplying two matrices you most take care of the points given below:

(1) If AB is under consideration then by multiplying the elements of As rows. with the corresponding elements of the columns respectively add them, separately.

(2) During this process of multiplication neither any of the elements of row will remain or any of the elements of the column. So in finding AB the number of columns of A will be the same of the number of the rows of B.

Hence the number of columns is matrix $B = 1$ and the number of rows in Matrix = 2. As the number of columns in B is not equal to the number of rows in A therefore multiciplication BA is not possible. Similarly the number of columns in $C = 1$, the number of rows in $A = 2$.

As the number of columns in C is not equal to the number of rows in A, therefore multiciplication of CA is not possible.

Q.4 ***Write the following simultaneous equations is the matrix form:***

Solution:

(i) $$4x - 3y = 7$$
$$2x + 5y = 7$$

Writing, in the form of matrices we have:

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

(ii) $$2x + 3y = 5$$
$$x - y = 0$$

Writing in the form of matrices we have:

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

(iii) $$ax + 3y = 1/2$$
$$bx - dy = f$$

Writing in the form of matrice we have:

$$\begin{bmatrix} (a & 3) \\ (b & d) \end{bmatrix} \begin{bmatrix} (x) \\ (y) \end{bmatrix} = \begin{bmatrix} 1/2 \\ f \end{bmatrix}$$

Q.5 ***Solve by using matrices:***

(i) $$2x + 3y = 5$$
$$x - y = 0$$

Writing in the form of matrices we have:

$$\begin{bmatrix} (2 & 3) \\ (1 & -1) \end{bmatrix} \begin{bmatrix} (x) \\ (y) \end{bmatrix} = \begin{bmatrix} 5 \\ 0 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} (2 & 3) \\ (1 & -1) \end{bmatrix}, X = \begin{bmatrix} (x) \\ (y) \end{bmatrix}, B = \begin{bmatrix} 5 \\ 0 \end{bmatrix}$$

$AX = B \quad \therefore X = B/A$ or $x = A^{-1} B$.

$$|A| = (2x - 1) - (3 \times 1) = -2 - 3 = -5$$

$$x = A^{-1}B \quad \therefore \quad \begin{bmatrix} x \\ y \end{bmatrix} = 1/|A| \begin{bmatrix} -1 & -3 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} 5 \\ 0 \end{bmatrix}$$

$$\begin{matrix}(x)\\(y)\end{matrix} = \frac{1}{-5}\begin{bmatrix}(-1\times5)+(-3\times0)\\(-1\times5)+(2\times0)\end{bmatrix}$$

$$= 1/-5\begin{bmatrix}-5 & -0\\15 & +0\end{bmatrix} = 1/-5\begin{bmatrix}-5\\-5\end{bmatrix}$$

$$(-5 \times L_{-5})$$

$$(-5 \times L_{-5})$$

$$\therefore \quad \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

Hence $x = 1$
$y = 1$

(ii) $3x + 5y = 2$

$2x + 4y = 2$

Writing in the form of matrices, we have

$$\begin{bmatrix}(3 & 5)\\(2 & 5)\end{bmatrix}\begin{bmatrix}(x)\\(y)\end{bmatrix} = \begin{bmatrix}(2)\\(3)\end{bmatrix}$$

Where

$$A = \begin{bmatrix}(3 & 5)\\(2 & 5)\end{bmatrix}, X = \begin{bmatrix}(x)\\(y)\end{bmatrix}, B = \begin{bmatrix}(2)\\(3)\end{bmatrix}$$

$AX = B$ or $X = B/A$ or $X = A^{-1}B$

$$|A| = (3\times4) - (5\times2) = 12 - 10 = 2$$

$$\therefore \quad X = A^{-1}B = 1/|A| \begin{bmatrix}(4 & -5)\\(-2 & 3)\end{bmatrix}$$

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

$$= 1/2\begin{bmatrix}(4\times2)+(-5\times3)\\(-2\times2)+(3\times3)\end{bmatrix}$$

$$\therefore \quad \begin{bmatrix}(x)\\(y)\end{bmatrix} = 1/2\begin{bmatrix}(8 - 15)\\(4 + 9)\end{bmatrix}$$

$$= \begin{bmatrix}(-7)\\(5)\end{bmatrix} = \begin{bmatrix}-7 \times 1/2\\5 \times 1/2\end{bmatrix}$$

$$= \begin{bmatrix}-7/2\\+5/2\end{bmatrix}$$

$\therefore \quad x = -7/2$ and $y = 5/2$

(iii) $$5x - 2y = 7$$

$$9x + 4y = 43$$

Writing in the form of matrices, we have

$$\begin{bmatrix}(5 & -2)\\(9 & +9)\end{bmatrix} = \begin{bmatrix}(x)\\(y)\end{bmatrix} = \begin{bmatrix}7\\43\end{bmatrix}$$

$\therefore \quad AX = B \times X = B/A$ or $X = A^{-1}B$.

$|A| = (5 \times 4) - (-2 \times 9) = 20 + 18 = 38$

$X = A^{-1}B$.

$$X = 1/|A| \begin{bmatrix}4 & 2\\9 & 5\end{bmatrix}\begin{bmatrix}7\\43\end{bmatrix}$$

$$= 1/38 \begin{bmatrix}(4 \times 7 + 2 \times 43)\\(9 \times 7 + 5 \times 43)\end{bmatrix}$$

$$\begin{matrix}(x)\\(y)\end{matrix} = 1/38\begin{bmatrix}(28 + 86)\\(-63 + 215)\end{bmatrix} = 1/38\begin{bmatrix}(114)\\(152)\end{bmatrix}$$

$$= \begin{bmatrix}114 \times 1/38\\152 \times 1/38\end{bmatrix} = \begin{bmatrix}3\\4\end{bmatrix}$$

$\therefore = x = 3$ and $y = 4$.

(iv) $$x + y = 4$$

$$2x - 3y = 13$$

Writing in the form of matrices we have:

$$\begin{bmatrix}(1 & 1)\\(1 & -3)\end{bmatrix}\begin{bmatrix}(x)\\(y)\end{bmatrix} = \begin{bmatrix}4\\13\end{bmatrix}$$

When

$$A = \begin{bmatrix} (1 & 1) \\ (2 & -3) \end{bmatrix}, \quad X = \begin{bmatrix} (x) \\ (y) \end{bmatrix}, \quad B = \begin{bmatrix} 4 \\ 13 \end{bmatrix}$$

$Ax = B$, $x = B/A$ or $x = A^{-1}B$.

$|A| = A^{-1}B$

$$\begin{matrix} (x) \\ (y) \end{matrix} = 1/-5 \begin{bmatrix} (-3\times 4) + (-1\times -3) \\ (-2\times 4) + (1\times 13) \end{bmatrix}$$

$$= 1/-5 \begin{bmatrix} -12 & -13 \\ -8 & +13 \end{bmatrix}$$

$$= 1/-5 \begin{bmatrix} -25 \\ 5 \end{bmatrix} = \begin{bmatrix} 25\times 1/-5 \\ 5\times 1/-5 \end{bmatrix} = \begin{bmatrix} 5 \\ -1 \end{bmatrix}$$

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

$\therefore \quad x = 5$

$y = -1$

Q.6 ***Two footballs and three balls costs Rs. 70, and 3 footballs and 2 balls cost. Rs. 80. Find the cost of a ball and football separately, also find the cost of 4 footballs and 2 balls.***

Solution:

Suppose one football cost Rs. x

and one ball cost Rs. y

by the question, we have:

$$2x + 3y = 70$$

$$3x + 2y = 80$$

$$\begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 70 \\ 80 \end{bmatrix}$$

where

$$A = \begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix}, x = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} 70 \\ 80 \end{bmatrix}$$

$Ax = B \quad \therefore \quad x = B/A \therefore x = A^{-1} B$

$|A| = (2\times2) - (3\times3) = 4-9 = -5$

As $x = A^{-1} B$

$$x = 1=|A| \begin{bmatrix} 2 & -3 \\ -3 & 2 \end{bmatrix} \times \begin{bmatrix} 70 \\ 80 \end{bmatrix}$$

$$= 1/-5 \begin{bmatrix} (2\times70) + (-3\times80) \\ (-3\times70) \quad (2\times80) \end{bmatrix}$$

$$\begin{matrix} (x) \\ (y) \end{matrix} = 1/-5 \begin{bmatrix} (140 - 240) \\ (210 + 60) \end{bmatrix}$$

$$= 1/-5 \begin{bmatrix} -100 \\ -50 \end{bmatrix}$$

$$= \begin{bmatrix} -100\times1/-5 \\ -50 \times 1/-5 \end{bmatrix} = \begin{bmatrix} 20 \\ 10 \end{bmatrix}$$

$\therefore \quad x = 20$

$y = 10$ **Ans**

Hence cost of one football = Rs. 20

and cost of one ball = Rs. 10

$\therefore$ Cost of 4 footballs = Rs. 80

Cost of 2 balls = Rs. 20

Q.7 A man says to his son, "7 years ago' 'I was 7 times as old as you and 3 years hence I shall be 3 times as old as you". What are their present ages?

Solution:

Suppose father's age = x

Present son's age = y

After seven years father's age = $(x-7)$ yrs

After seven years son's age $= (y-7)$ yrs

By the questions, we have.

$$x - 7 = 7(y - 7)$$

or $$x - 7 = 7y - 49$$

or $$x - 7y = -49 + 7$$

or $$x - 7y = -42 \quad \ldots\ldots \quad (1)$$

After 3 years father's age $= x + 3$ years

By the question, we have:

$$(x + 3) = 3(y = 3)$$

$$x + 3 = 3y + 9$$

or $$x - 3y = 9 - 3$$

or $$x - 3y = 6 \quad \ldots\ldots \quad (2)$$

Now, $$x - 7y = -42$$

Now $$x - 7y = -42$$

$$x - 3y = 6$$

Writing in the form of matrices:

$$\begin{bmatrix} 1 & -7 \\ 1 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -42 \\ 6 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} 1 & -7 \\ 1 & -3 \end{bmatrix}, \; X = \begin{bmatrix} x \\ y \end{bmatrix}, \; B = \begin{bmatrix} -42 \\ 6 \end{bmatrix}$$

$$|A| = (1 \times (-3) - (-7 \times 1) = -3 + 7 = 4$$

$$AX = B \text{ or } x = B/A \text{ or } x = A^{-1} B$$

$$\therefore \quad x = 1/4 \begin{bmatrix} -3 & 7 \\ -1 & 1 \end{bmatrix} \times \begin{bmatrix} -42 \\ 6 \end{bmatrix}$$

$$\begin{matrix} (x) \\ (y) \end{matrix} = 1/4 \begin{bmatrix} (-3 \times -42) + (7 \times 6) \\ (-1 \times -42) + (1 \times 6) \end{bmatrix}$$

$$= 1/4 \begin{bmatrix} 126 + 42 \\ 42 + 6 \end{bmatrix}$$

$$= 1/4 = \begin{bmatrix} 168 \\ 48 \end{bmatrix} = \begin{bmatrix} 168 \times 1/4 \\ 48 \times 1/4 \end{bmatrix} = \begin{bmatrix} 42 \\ 12 \end{bmatrix}$$

$\therefore \quad x = 42$ and $y = 12$

Father's age $= 42$ years

Son's age $= 12$ years

Q.8 Two persons A and B have certain amounts with them. If A gives 1 rupees to B, their amount will become equal. If B gives 4 rupees to A, his amount will become half of that of A. Find the amounts.

Solution:

Suppose A'a amount $=$ *Rs.* x

B's amount $=$ *Rs.* y

by the first condition $x - 1 = y + 1$

or $x - y = 1 + 1$

or $x - y = 2 \quad \ldots\ldots \quad (1)$

by the second condition

$x + y/2 = y - 4$ or $x + y = 2y - 2$

$\therefore \quad x - 2y = -8 - 4$

or $x - 2y = -12$

$x - y = 2$

Now $x - 2y = 12$

Writing in the form of matrice:

$$\begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 12 \end{bmatrix}$$

where;

$$A = \begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} 2 \\ 12 \end{bmatrix}$$

$Ax = B$ or $x = b/A$ or $x = bA^{-1}$

$= (1 \times -2) - (-1 \times 1) = -2 + 1 = -1$

$\therefore x = A^{-1} B$

or $x = 1/-1 \begin{bmatrix} -1 & 1 \\ -1 & 1 \end{bmatrix} \times \begin{bmatrix} 2 \\ 12 \end{bmatrix}$

$$\text{or } \begin{matrix}(x)\\(y)\end{matrix} = 1/-1 \begin{bmatrix}(-2\times 2)+(1\times -12)\\(-1\times 2)+(1\times -12)\end{bmatrix}$$

$$\therefore \begin{matrix}(x)\\(y)\end{matrix} = \begin{bmatrix}-4 & \times & -12\\-2 & \times & -12\end{bmatrix} = \begin{bmatrix}16\\14\end{bmatrix}$$

$\therefore \quad x = 16$ and $y = 14$

Q.9 ***If 1. is added to the numerator of a fraction it becomes 2/3 and if 2 is added to the denominator, it becomes,*** $\frac{1}{2}$ ***find the fraction.***

Solution:

Suppose the numerator $= x$

and denominator $= y$

By adding 1 in the numerator

$$x + 1/y = 2/3 \text{ or } 3x + 2 = 2y$$

or $3x - 2y = -3$ ..... (1)

By adding 2 in the denominator

$$x = y + 2 = 1/2 \quad \text{or} \quad 2x = y + 2$$

or $2x - 2y = 2$ ..... (2)

Now $3x - 2y = -3$

$2x - y = 2$

Writing in the form of matrices, we have:

$$\begin{bmatrix}(3 & -2)\\(2 & -1)\end{bmatrix} \begin{bmatrix}x\\y\end{bmatrix} = \begin{bmatrix}-3\\2\end{bmatrix}$$

where

$$A = \begin{bmatrix}(3 & -2)\\(2 & -1)\end{bmatrix}, X = \begin{bmatrix}x\\y\end{bmatrix}, B = \begin{bmatrix}-3\\2\end{bmatrix}$$

$Ax = B, x = B/A, x = A^{-1}B$

$|A| = (3\times -1) - (-2\times 2) = -3 + 4 = 1$

As $x = A^{-1}B$

$$\therefore\ x = 1/|A| \begin{bmatrix} -1 & 2 \\ -2 & 3 \end{bmatrix} \times \begin{bmatrix} -3 \\ 2 \end{bmatrix}$$

$$\begin{matrix} (x) \\ (y) \end{matrix} = 1/1 \begin{bmatrix} (-1\times -3) + (2\times 2) \\ (-2\times -3) + (3\times 2) \end{bmatrix} = \begin{bmatrix} (3 + 4) \\ (6 + 6) \end{bmatrix} = \begin{bmatrix} (7) \\ (12) \end{bmatrix}$$

$\therefore\ x = 7$ and $y = 12$

$\therefore$ the required fraction $= 7/12$ ***Ans***

Q10 The perimeter of a rectangle is 12 metre. If 3 times that of breadth is added to the 10 times that of length, the addition is 46 metre. Find length and breadth of the rectangle.

Solution:

Suppose length $= x$ y Rectangel y

breadth $= y$

By first condition,

we have

$$2x + 2y = 12 \quad \ldots\ldots \quad (1)$$

By second condition, we have

$$10x + 2y = 12 \quad \ldots\ldots \quad (2)$$

Writing (1) and (2) in the form of marices.

$$\begin{bmatrix} (2 & 2) \\ (10 & 3) \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} (12) \\ (46) \end{bmatrix}$$

where

$$A = \begin{bmatrix} (2 & 2) \\ (10 & 3) \end{bmatrix}, X = \begin{bmatrix} x \\ y \end{bmatrix}, B = \begin{bmatrix} (12) \\ (46) \end{bmatrix}$$

where $|A| = (2\times 3) - (2\times 10) = 6 - 20 = -14$

$$\therefore \quad x = 1/|A| \begin{bmatrix} (3 & -2) \\ (-10 & 3) \end{bmatrix} \times \begin{bmatrix} (12) \\ (46) \end{bmatrix}$$

$$\begin{matrix} (x) \\ (y) \end{matrix} = 1/-14 \begin{bmatrix} (3\times 12) + (-2\times 46) \\ (-10\times 12) + (2\times 46) \end{bmatrix}$$

$$\therefore \quad \begin{matrix}(x)\\(y)\end{matrix} = 1/-14 \begin{bmatrix}(36 - 92)\\(-120+92)\end{bmatrix}$$

$$= 1/-14 \begin{bmatrix}(-56)\\(-28)\end{bmatrix}$$

$$\begin{matrix}(x)\\(y)\end{matrix} = \begin{bmatrix}(-56\times 1/-14)\\(-28 \times 1/14)\end{bmatrix} = \begin{bmatrix}(4)\\(2)\end{bmatrix}$$

$\therefore \quad x = 4$ and $y = 2$

$\therefore$ The length of the rectangle = 4 meter the breadth of the rectangle = 2 meter.

EXERCISE 9.7

Solve the following simultaneous equations:

(1) $x + y = 4$ ..... (1)

$2x - y = 5$ ..... (2)

Writing in the form of matrices:

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

Where

$$A = \begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix}, X = \begin{bmatrix} (x) \\ (y) \end{bmatrix}, B = \begin{bmatrix} (4) \\ (5) \end{bmatrix}$$

$Ax = B$, $X = B/A$ or $x = A^{-1}B$

$|A| = (1 \times -1) - (1 \times 2) = -1-2 = -3$

$\therefore x = A^{-1}B$

$$x = 1/|A| \begin{bmatrix} (-1 & -1) \\ (-2 & 1) \end{bmatrix} \begin{bmatrix} (4) \\ (5) \end{bmatrix}$$

$$= \begin{bmatrix} \begin{bmatrix} (-1 & \times & 4) \\ (-2 & \times & 4) \end{bmatrix} + \begin{bmatrix} (-1 \times 5) \\ (-\times 5) \end{bmatrix} \end{bmatrix}$$

$$= 1/-3 \begin{bmatrix} (-4 & -5) \\ (-3 & +5) \end{bmatrix} = 1/-3 \begin{bmatrix} -9 \\ -3 \end{bmatrix}$$

$$\begin{matrix} (x) \\ (y) \end{matrix} = \begin{bmatrix} -3 & \times & 1/-3 \\ -3 & \times & 1/-3 \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$

$\therefore x = 3$ and $y = 1$

Q.2 ***Solve*** $3x - 2y = 5/2$

$2x - 3y = 0$

Solution:

Writing in the form of matrices:

$$\begin{bmatrix} 3 & -2 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \begin{bmatrix} (5/2) \\ (0) \end{bmatrix}$$

Where

$$A=\begin{bmatrix}3 & -2\\ 2 & -3\end{bmatrix},\quad X=\begin{bmatrix}x\\ y\end{bmatrix},\quad B=\begin{bmatrix}(5/2)\\ (0)\end{bmatrix}$$

but $Ax = B$ or $x = B/A$ or $x = A^{-1}B$

and $|A| = (3\times -3) - (-2\times 2) = -9\times 4 = -5$

$$\therefore \quad x\,1 = |A|\begin{bmatrix}-3 & 2\\ -2 & 3\end{bmatrix}\begin{bmatrix}(5/2)\\ (0)\end{bmatrix}$$

$$= 1/-5\begin{bmatrix}(-3\times 5/2) + (2\times 0)\\ (-2\times 5/2) + (3\times 0)\end{bmatrix}$$

$$= 1/-5\begin{bmatrix}(-15/2 + 0)\\ (-5 + 0)\end{bmatrix} = 1/-5\begin{bmatrix}(-15/2)\\ (-5)\end{bmatrix}$$

$$\begin{matrix}(x)\\ (y)\end{matrix} = \begin{bmatrix}(-15/2 + 1/-5)\\ (-5 + 1-5)\end{bmatrix}$$

Q.3 $9x + 4y = 43$

$5x - 2y = 7$

Solution:

Writing in the form of matrices:

$$\begin{bmatrix}9 & 4\\ 5 & -2\end{bmatrix}\begin{bmatrix}(x)\\ (y)\end{bmatrix}\begin{bmatrix}(43)\\ (7)\end{bmatrix}$$

$$A=\begin{bmatrix}9 & 4\\ 5 & -2\end{bmatrix},\quad X=\begin{bmatrix}(x)\\ (y)\end{bmatrix},\quad B=\begin{bmatrix}(43)\\ (7)\end{bmatrix}$$

$$x = 1/-38\begin{bmatrix}(-2\times 43) + (-4\times 7)\\ (-5\times 43) + (9\times 7)\end{bmatrix}$$

$$= 1/-38\begin{bmatrix}(-86 - 28\\ (-215 + 63\end{bmatrix}$$

$$\begin{matrix}(x)\\(y)\end{matrix} = 1/-38\begin{bmatrix}(-114)\\(-152)\end{bmatrix} = \begin{bmatrix}-114\times 1/-38\\-152\times 1/-38\end{bmatrix}$$

$$= \begin{matrix}(3)\\(4)\end{matrix} \quad \therefore\ x=3 \text{ and } y=0$$

Q.4 $3x + 4y = 0$

$x - 4y = 2/3$

Solution:

Writing in the form of matrices:

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

Where

$$A = \begin{bmatrix}3 & 4\\1 & -4\end{bmatrix},\ X\begin{bmatrix}x\\y\end{bmatrix},\ B = \begin{bmatrix}0\\2/3\end{bmatrix}$$

$\therefore \quad Ax = B$ or $x = B/A$ or $x = A^{-1}B$

and $|A| = (3\times -4) - (4\times 1) = -12 - 4 = -16$

$$\therefore\ x = 1/|A|\begin{bmatrix}(-4 & -4)\\(-1 & 3)\end{bmatrix}\times\begin{bmatrix}(0)\\(2/3)\end{bmatrix}$$

$$= 1/-16\begin{bmatrix}(0 & -8/3)\\(0 & +2)\end{bmatrix}$$

$$\begin{matrix}(x)\\(y)\end{matrix} = 1/-16\begin{bmatrix}(-8/3)\\(2)\end{bmatrix} = \begin{bmatrix}-8/3 & \times & 1/-16\\2 & \times & 1/-16\end{bmatrix}$$

$$\begin{matrix}(x)\\(y)\end{matrix} = \begin{bmatrix}(1/-16)\\(-1/8)\end{bmatrix} \quad \therefore \quad x = 1/6,\ y = -1/8 \quad \textbf{Ans}$$

Q.5 $3x = 5 - 4y$ $\quad$ $3x + 4y = 5$

$5y = 8 - 2x$ $\quad$ *or* $\quad$ $2x + 5y = 8$

Writing in the form of matrice, we have:

$$\begin{bmatrix} 3 & 4 \\ 2 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 8 \end{bmatrix}$$

Where

$$A = \begin{bmatrix} (3 & 4) \\ (2 & 5) \end{bmatrix}, \; X = \begin{bmatrix} (x) \\ (y) \end{bmatrix}, \; B \begin{bmatrix} (5) \\ (8) \end{bmatrix}$$

but $Ax = B$ or $X = B/A$ or $X = A^{-1} B$ and

$|A| = (3 \times 5) - (4 \times 2) = 15 - 8 = 7$

$$\therefore \quad x1/|A| \begin{bmatrix} (5 & -4) \\ (-2 & 3) \end{bmatrix} \times \begin{bmatrix} (5) \\ (8) \end{bmatrix}$$

$$\therefore \quad \begin{matrix} (x) \\ (y) \end{matrix} = 1/7 \begin{bmatrix} (5 \times 5) + (-4 \times 1) \\ (-2 \times 5) + (3 \times 8) \end{bmatrix}$$