X

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Here, $\frac{a_1}{a_2}=\frac{2}{3},\quad \frac{b_1}{b_2}=\frac{1}{2}$

Clearly, $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$

Hence, the given linear pair has a unique solution.

By cross-multiplication, we have

$$\begin{array}{cccc} & x & y & 1 \\ 1 & -5 & 2 & 1 \\ 2 & -8 & 3 & 2 \end{array}$$

$$\therefore \quad \frac{x}{-8+10}=\frac{y}{-15+16}=\frac{1}{4-3} \quad\Rightarrow\quad \frac{x}{2}=\frac{y}{1}=\frac{1}{1}$$

Hence, $x=2$ and $y=1$ is the required solution.

(iii) $\quad 3x-5y=20 \quad\Rightarrow\quad 3x-5y-20=0$

$\quad 6x-10y=40 \quad\Rightarrow\quad 3x-5y-20=0$

Here, $\frac{a_1}{a_2}=\frac{3}{3}=1,\quad \frac{b_1}{b_2}=\frac{-5}{-5}=1,\quad \frac{c_1}{c_2}=\frac{-20}{-20}=1 \quad\Rightarrow\quad \frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

Hence, the given linear pair of equations is *consistent* and *dependent i.e., it has infinitely many solutions*.

(iv) $\quad x-3y-7=0$

$\quad 3x-3y-15=0$

Here, $\frac{a_1}{a_2}=\frac{1}{3},\quad \frac{b_1}{b_2}=\frac{-3}{-3}=1,\quad \frac{c_1}{c_2}=\frac{-7}{-15}=\frac{7}{15} \quad\Rightarrow\quad \frac{a_1}{a_2}\neq\frac{b_1}{b_2}$

Hence, the given pair has a *unique solution*.

By cross-multiplication, we have

$$\begin{array}{cccc} & x & y & 1 \\ -3 & -7 & 1 & -3 \\ -3 & -15 & 3 & -3 \end{array}$$

$$\therefore \quad \frac{x}{45-21}=\frac{y}{-21+15}=\frac{1}{-3+9} \quad\Rightarrow\quad \frac{x}{24}=\frac{y}{-6}=\frac{1}{6} \quad\Rightarrow\quad \frac{x}{4}=\frac{y}{-1}=\frac{1}{1}$$

Hence, $x=4$ and $y=-1$ is the required solution.

Q2 **Example** (i) For which values of a and b does the following pair of linear equations have a infinite number of solutions ? [NCERT ; CCE

$$2x+3y=7, \qquad (a-b)x+(a+b)y=3a+b-2$$

(ii) For which values of k will the following pair of linear equations have no solution [NCERT ; CCE

$$3x+y=1, \qquad (2k-1)x+(k-1)y=2k+1$$

Solution.

(i) $\quad 2x+3y=7 \quad\Rightarrow\quad 2x+3y-7=0$

$(a-b)x+(a+b)y=3a+b-2 \quad\Rightarrow\quad (a-b)x+(a+b)y-(3a+b-2)=0$

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For infinitely many solutions,

$$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2} \Rightarrow \frac{2}{a-b}=\frac{3}{a+b}=\frac{7}{3a+b-2}$$

$$\frac{2}{a-b}=\frac{3}{a+b} \quad \text{and} \quad \frac{3}{a+b}=\frac{7}{3a+b-2}$$

$$\Rightarrow \quad 3a-3b=2a+2b \quad \text{and} \quad 9a+3b-6=7a+7b$$

$$\Rightarrow \quad a=5b \quad \text{and} \quad 2a-4b=6$$

$$\Rightarrow \quad 2(5b)-4b=6$$

$$\Rightarrow \quad 6b=6$$

$$\Rightarrow \quad b=1$$

Hence, $a=5\times1=5$ and $b=1$

(*ii*)

$$3x+y=1 \Rightarrow 3x+y-1=0$$

$$(2k-1)x+(k-1)y=2k+1 \Rightarrow (2k-1)+(k-1)y-(2k+1)=0$$

For no solution,

$$\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2} \Rightarrow \frac{3}{2k-1}=\frac{1}{k-1}\neq\frac{1}{2k+1}$$

$$\Rightarrow \quad \frac{3}{2k-1}=\frac{1}{k-1} \quad \text{and} \quad \frac{1}{k-1}\neq\frac{1}{2k+1}$$

$$\Rightarrow \quad 3k-3=2k-1 \quad \text{and} \quad 2k+1\neq k-1$$

$$\Rightarrow \quad k=-1+3=2 \quad \text{and} \quad k\neq-2$$

When $k=2$, $\quad \frac{1}{k-1}\neq\frac{1}{2k+1} \qquad \left[\because \frac{1}{2-1}\neq\frac{1}{4+1}\right]$

Thus, $\frac{3}{k-1}=\frac{1}{k-1}\neq\frac{1}{2k+1}$ holds when $k=2$

Hence, the given pair of linear equations has no solution when $k=2$.

Q1 Example 8. Which of the following pair of linear equations has unique solution, no solution or infinitely many solutions ? In case there is a unique solution, find it.

(i) $x - 3y = 3,\ 3x - 9y = 2$ (ii) $2x + y = 5,\ 3x + 2y = 8$

(iii) $3x - 5y = 20,\ 6x - 10y = 40$ (iv) $x - 3y - 7 = 0,\ 3x - 3y - 15 = 0$

Solution. (i) $x - 3y = 3 \Rightarrow x - 3y - 3 = 0$

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$$3x - 9y = 2 \Rightarrow 3x - 9y - 2 = 0$$

X

Here, $$\frac{a_1}{a_2} = \frac{1}{3},\ \frac{b_1}{b_2} = \frac{-3}{-9} = \frac{1}{3},\ \frac{c_1}{c_2} = \frac{-3}{-2} = \frac{3}{2}$$

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Clearly, $$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

Hence, the given pair of linear equations is *inconsistent* i.e., it has no solution.

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

$$3x + 2y = 8 \Rightarrow 3x + 2y - 8 = 0$$