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(Affiliated to CBSE up to +2 Level)

CLASS: X

SUB.: MATHS

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(i) For which values of a and b does the following pair of linear equations have an infinite number of solutions?

$$2x + 3y = 7$$

$$(a - b)x + (a + b)y = 3a + b - 2$$

(ii) For which value of k will the following pair of linear equations have no solution?

$$3x + y = 1$$

$$(2k - 1)x + (k - 1)y = (2k + 1)$$

Solution:

(i) Equations are

$$2x + 3y = 7 \quad \dots (i)$$

$$(a - b)x + (a + b)y = 3a + b - 2 \quad \dots (ii)$$

For infinitely many solutions,

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

Now, on comparing

$$\frac{2}{a-b} = \frac{3}{a+b} \Rightarrow 2(a+b) = 3(a-b) \Rightarrow 2a + 2b = 3a - 3b$$

$$\Rightarrow a - 5b = 0 \quad \dots (iii)$$

and on comparing

$$\frac{3}{a+b} = \frac{7}{3a+b-2} \Rightarrow 3(3a+b-2) = 7(a+b)$$

$$\Rightarrow 9a + 3b - 6 = 7a + 7b \Rightarrow 2a - 4b = 6$$

$\Rightarrow a - 2b = 3$ Solving (iii) and (iv) for a and b

By cross multiplication method.

$$\begin{array}{ccccc}
 & a & & b & & -1 \\
 -5 & & 0 & & 1 & & -5 \\
 & -2 & & 3 & & 1 & & -2
 \end{array}$$

$$\frac{a}{-15-0} = \frac{b}{0-3} = \frac{-1}{-2+5} \Rightarrow \frac{a}{-15} = \frac{b}{-3} = \frac{-1}{3} \Rightarrow \boxed{a=5} \text{ and } \boxed{b=1}$$

(ii) Equations are

$$3x + y = 1 \text{ and } (2k - 1)x + (k - 1)y = 2k + 1$$

For no solution

$$\frac{3}{2k-1} = \frac{1}{k-1} \neq \frac{1}{2k+1} \Rightarrow 3(k-1) = 2k-1$$

$$\Rightarrow 3k-3 = 2k-1 \Rightarrow k=2$$

and $\frac{1}{k-1} \neq \frac{1}{2k+1} \Rightarrow 2k+1 \neq k-1 \Rightarrow k \neq -2$

$$\boxed{k=2} \text{ and } \boxed{k \neq -2}$$