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J.Sc. class - XI

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Linear inequalities

Ex. 6.3

Q.15. $x+2y \leq 10$, $x+y \geq 1$, $x-y \leq 0$, $x \geq 0$, $y \geq 0$

Soln. The given system of inequalities

- $x+2y \leq 10$ — (i)
- $x+y \geq 1$ — (ii)
- $x-y \leq 0$ — (iii)
- $x \geq 0$, $y \geq 0$ — (iv)

Here, there are four cases arise

Case I. Let us consider the given equation as strict equations i.e.

$$x+2y=10, x+y=1, x-y=0$$

$$\text{and } x=0, y=0$$

Case II. For $x+2y=10$

x	0	10
y	5	0

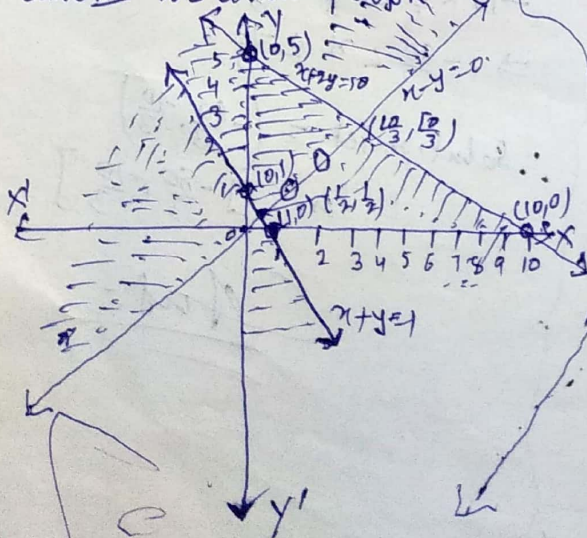
and $x+y=1$

x	0	1
y	1	0

For $x-y=0$

x	1	2	0
y	1	2	0

Case III. We draw graph



Case IV. Take a point (0,0) and put it in the inequalities (i) and (ii)

$0+0 \leq 10$ which is true. So, the shaded region will be towards origin.

And $0+0 \geq 1$, which is false. So, the shaded region will be away from the origin.

Again, take a point (2,2) and put it in the inequality (iii). We get

$$2-2 \leq 0, 2-2 \leq 0, \text{ which is true.}$$

So, the shaded region will be towards origin.

And take a point (0,1) and put it in the inequality (iii). We get

$$0-1 \leq 0 \text{ which is true.}$$

So, the shaded region will be towards origin.

Solve the inequalities.

Q.1. $2 \leq 3x-4 \leq 5$

Soln. The given inequality

$$2 \leq 3x-4 \leq 5$$

$$\Rightarrow 2+4 \leq 3x-4+4 \leq 5+4$$

$$\Rightarrow 6 \leq 3x \leq 9$$

Dividing by 3 in each term

$$\frac{6}{3} \leq \frac{3x}{3} \leq \frac{9}{3}$$

$$\Rightarrow 2 \leq x \leq 3$$

$\therefore$ Solution set $[2, 3]$ Ans.

Q.2. $6 \leq -3(2x-4) < 12$

Soln. The given inequality

$$6 \leq -3(2x-4) < 12$$

$$\Rightarrow 6 \leq -6x+12 < 12$$

Adding -12 to each term

$$6-12 \leq -6x+12-12 < 12-12$$

$$\Rightarrow -6 \leq -6x < 0$$

Dividing by -6 to each term

$$\frac{-6}{-6} \geq \frac{-6x}{-6} > \frac{0}{-6}$$

$$\Rightarrow 1 \geq x > 0 \Rightarrow 0 < x \leq 1$$

$\therefore$ Solution set = $(0, 1]$ or $]0, 1]$

Q.3. $-3 \leq 4 - \frac{7x}{2} \leq 18$

Soln. The given inequality

$$-3 \leq 4 - \frac{7x}{2} \leq 18$$

Adding -4 to each term,

$$-3-4 \leq 4 - \frac{7x}{2} - 4 \leq 18-4$$

$$\Rightarrow -7 \leq -\frac{7x}{2} \leq 14$$

Multiplying by $-\frac{2}{7}$ to each term

$$-7 \times (-\frac{2}{7}) \geq -\frac{7x}{2} \times (-\frac{2}{7}) \leq 14 \times (-\frac{2}{7})$$

$$\Rightarrow 2 \geq x \geq -4 \Rightarrow -4 \leq x \leq 2$$

$\therefore$ Solution set = $[-4, 2]$

Q.4. $-15 < \frac{3(x-2)}{5} \leq 0$

Soln. The given inequality

$$-15 < \frac{3(x-2)}{5} \leq 0$$

Multiplying by 5 to each term,

$$-15 \times 5 < \frac{3(x-2)}{5} \times 5 \leq 0 \times 5$$

$$\Rightarrow -75 < 3x-6 \leq 0$$

Adding 6 to each term

$$\Rightarrow -75+6 < 3x-6+6 \leq 0+6$$

$$\Rightarrow -69 < 3x \leq 6$$

Dividing by 3 in each term,

$$\frac{-69}{3} < \frac{3x}{3} \leq \frac{6}{3}$$

$$\Rightarrow -23 < x \leq 2$$

$\therefore$ Solution set = $(-23, 2]$ or $] -23, 2]$

Q.5. $-12 < 4 - \frac{3x}{5} \leq 2$

Soln. The given inequality

$$-12 < 4 - \frac{3x}{5} \leq 2$$

$$\Rightarrow -12 < 4 + \frac{3x}{5} \leq 2$$

Adding -4 to each term

$$-12-4 < 4 + \frac{3x}{5} - 4 \leq 2-4$$

$$\Rightarrow -16 < \frac{3x}{5} \leq -2$$

Multiplying by $\frac{5}{3}$ to each term

$$-16 \times \frac{5}{3} < \frac{3x}{5} \times \frac{5}{3} \leq -2 \times \frac{5}{3}$$

$$\Rightarrow -\frac{80}{3} < x \leq -\frac{10}{3}$$

$\therefore$ Solution set = $(-\frac{80}{3}, -\frac{10}{3})$

or $]-\frac{80}{3}, -\frac{10}{3}]$

Ans-