

# Linear Inequations

## EXERCISE-4.1

Q1. Solve the inequations  $3x - 11 < 3$ , where  $x \in \{1, 2, 3, \dots, 10\}$   
Also represent the solution on a number line.

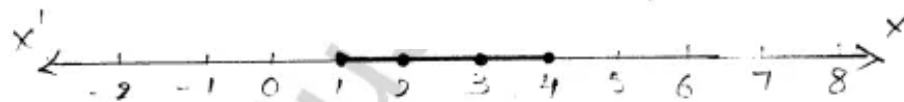
Sol.

$$\begin{aligned} 3x - 11 &< 3 \\ \Rightarrow 3x &< 3 + 11 \\ \Rightarrow 3x &< 14 \\ \Rightarrow x &< 14/3 \end{aligned}$$

But  $x \in \{1, 2, 3, \dots, 10\}$

$\therefore$  solution set is  $\{1, 2, 3, 4\}$

Solution set on number line



Q2. Solve  $2(x-3) < 1$ ,  $x \in \{1, 2, 3, \dots, 10\}$

Sol.

$$\begin{aligned} 2(x-3) &< 1 \\ \Rightarrow x-3 &< \frac{1}{2} \\ \Rightarrow x &< \frac{1}{2} + 3 \\ \Rightarrow x &< 3\frac{1}{2} \end{aligned}$$

But  $x \in \{1, 2, 3, \dots, 10\}$

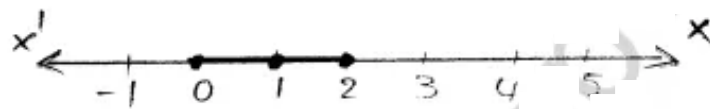
$\therefore$  solution set =  $\{1, 2, 3\}$

Q3. solve  $5-4x > 2-3x$ ,  $x \in W$ . Also represents its Solution on the number Line.

sol.

$$\begin{aligned}5-4x &> 2-3x \\ \Rightarrow -4x+3x &> 2-5 \\ \Rightarrow -x &> -3 \\ \Rightarrow x &< 3 \quad (\because x \in W)\end{aligned}$$

$\therefore$  solution set  $\{0, 1, 2\}$   
Solution set on number Line:



Q4. List the Solution set of  $30-4(2x-1) < 30$ , given that  $x$  is a positive integer.

sol.

$$\begin{aligned}30-4(2x-1) &< 30 \\ \Rightarrow 30-8x+4 &< 30 \\ \Rightarrow -8x &< 30-30-4 \\ \Rightarrow -8x &< -4 \\ \Rightarrow x &> \frac{-4}{-8} \\ \Rightarrow x &> \frac{1}{2}\end{aligned}$$

$\therefore x$  is a positive integer

$$\therefore x = \{1, 2, 3, 4, \dots\}$$

Q5. solve  $2(x-2) < 3x-2$ ,  $x \in \{-3, -2, -1, 0, 1, 2, 3\}$

sol.

$$\begin{aligned}2(x-2) &< 3x-2 \\ \Rightarrow 2x-4 &< 3x-2 \\ \Rightarrow -x &< 2 \\ \Rightarrow x &> -2\end{aligned}$$

$\therefore$  solution set =  $\{-1, 0, 1, 2, 3\}$

Q6. If  $x$  is a negative integer, find the solution set of  $\frac{2}{3} + \frac{1}{3}(x+1) > 0$

sol.  $\frac{2}{3} + \frac{1}{3}x + \frac{1}{3} > 0$

$$\Rightarrow \frac{1}{3}x + 1 > 0$$

$$\Rightarrow \frac{1}{3}x > -1$$

$$\Rightarrow x > -1 \times \frac{3}{1}$$

$$\Rightarrow x > -3$$

$\therefore x$  is a negative integer

$$\therefore \text{solution set} = \{-2, -1\}$$

Q7. solve  $\frac{2x-3}{4} > \frac{1}{2}$ ,  $x \in \{0, 1, 2, \dots, 8\}$

sol.  $\frac{2x-3}{4} > \frac{1}{2}$

$$\Rightarrow 2x-3 > \frac{4}{2}$$

$$\Rightarrow 2x > 5$$

$$\Rightarrow x > \frac{5}{2}$$

$$\therefore x \in \{0, 1, 2, \dots, 8\}$$

$$\therefore \text{solution set} = \{3, 4, 5, 6, 7, 8\}$$

Q8. solve  $x-3(2+x) > 2(3x-1)$ ,  $x \in \{-3, -2, -1, 0, 1, 2\}$   
also represent its solution on the number line.

sol.  $x-3(2+x) > 2(3x-1)$

$$\Rightarrow x-6-3x > 6x-2$$

$$\Rightarrow x-3x-6x > -2+6$$

$$\Rightarrow -8x > 4$$

$$\Rightarrow x < -\frac{1}{2}$$

$$\therefore x \in \{-3, -2, -1, 0, 1, 2\}$$

$$\text{solution set} = \{-3, -2, -1\}$$

Solution set on number line:



Q9. Given  $x \in \{1, 2, 3, 4, 5, 6, 7, 9\}$ , solve  $x - 3 < 2x - 1$

sol.  $x - 3 < 2x - 1$

$$\Rightarrow x - 2x < -1 + 3$$

$$\Rightarrow -x < 2$$

$$\Rightarrow x > -2$$

$$\therefore \text{But } x \in \{1, 2, 3, 4, 5, 6, 7, 9\}$$

$$\therefore \text{solution set} = \{1, 2, 3, 4, 5, 6, 7, 9\}$$

Q10. Given  $A = \{x; x \in \mathbb{I}, -4 \leq x \leq 4\}$ , solve  $2x - 3 < 3$  where  $x$  has the domain  $A$ . Graph the solution set on the number line.

sol.  $2x - 3 < 3$

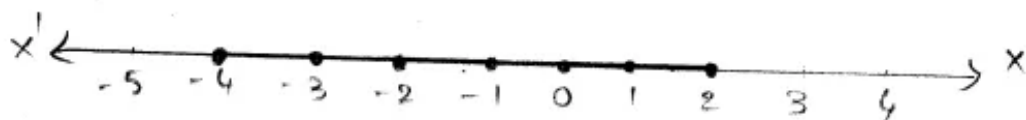
$$\Rightarrow 2x < 3 + 3$$

$$\Rightarrow x < 3$$

But  $x$  has the domain  $A = \{x; x \in \mathbb{I}, -4 \leq x \leq 4\}$

$$\therefore \text{solution set} = \{-4, -3, -2, -1, 0, 1, 2\}$$

solution set on number line:



Q11. List the solution set of the inequation

$$\frac{1}{2} + 8x > 5x - \frac{3}{2} - x \in \mathbb{Z}$$

Sol.

$$\frac{1}{2} + 8x > 5x - \frac{3}{2}$$

$$\Rightarrow 8x - 5x > -\frac{3}{2} - \frac{1}{2}$$

$$\Rightarrow 3x > -2$$

$$\Rightarrow x > -\frac{2}{3}$$

$$\therefore x \in \mathbb{Z}$$

$$\therefore \text{solution set} = \{0, 1, 2, 3, \dots\}$$

Q12. list the solution set of  $\frac{11-2x}{5} \geq \frac{9-3x}{8} + \frac{3}{4} - x \in \mathbb{N}$

Sol.

$$\frac{11-2x}{5} \geq \frac{9-3x}{8} + \frac{3}{4}$$

$$\Rightarrow 88 - 16x \geq 45 - 15x + 30$$

$$\{\therefore \text{L.C.M of } 8, 5, 4 = 40\}$$

$$\Rightarrow -16x + 15x \geq 45 + 30 - 88$$

$$\Rightarrow -x \geq -13$$

$$\Rightarrow x \leq 13$$

$$\therefore x \in \mathbb{N}$$

$$\therefore \text{solution set} = \{1, 2, 3, 4, 5, \dots, 13\}$$

Q13. find the values of  $x$ , which satisfy the inequation:

$$-2 \leq \frac{1}{2} - \frac{2x}{3} \leq 1\frac{5}{6} - x \in \mathbb{N}. \text{ Graph the solution}$$

Set on the number line.

Sol.

$$-2 \leq \frac{1}{2} - \frac{2x}{3} \leq 1\frac{5}{6}$$

$$\Rightarrow -2 \leq \frac{1}{2} - \frac{2x}{3} \leq \frac{11}{6}$$

$$\Rightarrow -12 \leq 3 - 4x \leq 22 \quad \{\therefore \text{LCM of } 2, 3, 6 = 6\}$$

$$-12 \leq 3-4x \text{ and } 3-4x \leq 22$$

$$\Rightarrow 4x \leq 3+12 \text{ and } -4x \leq 22-3$$

$$\Rightarrow 4x \leq 15 \text{ and } -4x \leq 19$$

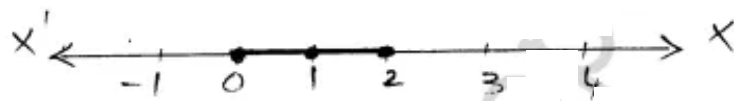
$$\Rightarrow x \leq \frac{15}{4} \text{ and } +x \geq \frac{-19}{4}$$

$$\Rightarrow \frac{-19}{4} \leq x \leq \frac{15}{4}$$

$$\therefore x \in \mathbb{N}$$

$$\therefore \text{solution set} = \{1, 2, 3\}$$

solution set on number line



Q14. If  $x \in \mathbb{W}$ , find the solution set of  $\frac{3}{5}x - \frac{2x-1}{3} > 1$ . Also graph the solution set on the number line, if possible.

Sol.

$$\frac{3}{5}x - \frac{2x-1}{3} > 1$$

$$\Rightarrow 9x - (10x - 5) > 15$$

$$\left\{ \because \text{LCM of } 5, 3 = 15 \right\}$$

$$\Rightarrow 9x - 10x + 5 > 15$$

$$\Rightarrow -x > 10$$

$$\Rightarrow x < -10$$

But  $x \in \mathbb{W}$

$$\frac{x}{2} - \frac{4}{3} < \frac{1}{6}$$

Solution set =  $\emptyset$

Hence it can't be represented on number line.

Q15.

Solve :

$$(i) \frac{x}{2} + 5 \leq \frac{x}{3} + 6, \text{ where } x \text{ is a positive } \overset{\text{odd}}{\times} \text{ integer}$$

$$(ii) \frac{2x+3}{3} \geq \frac{3x-1}{4}, \text{ where } x \text{ is positive even integer.}$$

sol:

$$(i) \frac{x}{2} + 5 \leq \frac{x}{3} + 6$$

$$\Rightarrow \frac{x}{2} - \frac{x}{3} \leq 6 - 5$$

$$\Rightarrow \frac{3x - 2x}{6} \leq 1$$

$$\Rightarrow \frac{x}{6} \leq 1$$

$$\Rightarrow x \leq 6$$

$\therefore x$  is a positive odd integer

$$\therefore x = \{1, 3, 5\}$$

$$(ii) \frac{2x+3}{3} \geq \frac{3x-1}{4}$$

$$\Rightarrow \frac{2x}{3} + \frac{3}{3} \geq \frac{3x}{4} - \frac{1}{4}$$

$$\Rightarrow \frac{2x}{3} - \frac{3x}{4} \geq -\frac{1}{4} - 1$$

$$\Rightarrow \frac{8x - 9x}{12} \geq -\frac{5}{4}$$

$$\Rightarrow \frac{-x}{12} \geq -\frac{5}{4}$$

$$\Rightarrow \frac{x}{12} \leq \frac{5}{4}$$

$$\Rightarrow x \leq \frac{5}{4} \times 12$$

$$\Rightarrow x \leq 15$$

$\therefore x$  is positive even integer.

$$\therefore x = \{2, 4, 6, 8, 10, 12, 14\}$$

Q16. Given that  $x \in \mathbb{I}$ , solve the inequation and graph the solution on the number line:  $3 \geq \frac{x-4}{2} + \frac{x}{3} \geq 2$

sol.  $3 \geq \frac{x-4}{2} + \frac{x}{3}$  and  $\frac{x-4}{2} + \frac{x}{3} \geq 2$

$$3 \geq \frac{3x-12+2x}{6} \quad \text{and} \quad \frac{3x-12+2x}{6} \geq 2$$

$$\Rightarrow 3 \geq \frac{5x-12}{6} \quad \text{and} \quad \frac{5x-12}{6} \geq 2$$

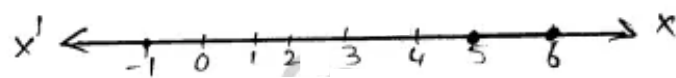
$$\Rightarrow 5x-12 \leq 18 \quad \text{and} \quad 5x-12 \geq 12$$

$$\Rightarrow 5x \leq 30 \quad \text{and} \quad 5x \geq 24$$

$$\Rightarrow x \leq 6 \quad \text{and} \quad x \geq \frac{24}{5} \Rightarrow x \geq 4\frac{4}{5}$$

$$\therefore x = \left\{ 5, 6 \right\}$$

solution set on number line



Q17. Given  $x \in \{1, 2, 3, 4, 5, 6, 7, 9\}$ , find the values of  $x$  which  $-3 < 2x-1 < x+4$ .

sol.  $-3 < 2x-1$  and  $2x-1 < x+4$

$$\Rightarrow -2x < -1+3 \quad \text{and} \quad 2x-x < 4+1$$

$$\Rightarrow -2x < 2 \quad \text{and} \quad x < 5$$

$$\Rightarrow -x < 1$$

$$\Rightarrow x > -1$$

$$\therefore -1 < x < 5$$

$$\therefore x \in \{1, 2, 3, 4, 5, 6, 7, 9\}$$

$$\therefore \text{Solution set} = \{1, 2, 3, 4\}$$



Q18. Solve  $1 \geq 15 - 7x > 2x - 27, x \in \mathbb{N}$

sol.  $1 \geq 15 - 7x > 2x - 27$

$$\Rightarrow 1 \geq 15 - 7x \text{ and } 15 - 7x > 2x - 27$$

$$\Rightarrow 7x \geq 15 - 1 \text{ and } -7x - 2x > -27 - 15$$

$$\Rightarrow 7x \geq 14 \text{ and } -9x > -42$$

$$\Rightarrow x \geq 2 \text{ and } -x > -\frac{42}{9}$$

$$\Rightarrow 2 \leq x \text{ and } -x > -\frac{14}{3}$$

$$x < \frac{14}{3}$$

$$\therefore 2 \leq x < \frac{14}{3}$$

But  $x \in \mathbb{N}$

$$\therefore \text{solution set} = \{2, 3, 4\}$$

Q19. If  $x \in \mathbb{Z}$ , solve  $2 + 4x < 2x - 5 \leq 3x$ . Also represents its solution on the number line.

sol.  $2 + 4x < 2x - 5 \leq 3x$

$$2 + 4x < 2x - 5 \text{ and } 2x - 5 \leq 3x$$

$$\Rightarrow 4x - 2x < -5 - 2 \text{ and } 2x - 3x \leq 5$$

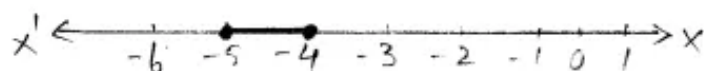
$$\Rightarrow 2x < -7 \text{ and } -x \leq 5$$

$$\Rightarrow x < -\frac{7}{2} \text{ and } x \geq -5$$
$$-5 \leq x$$

$$\therefore -5 \leq x < -\frac{7}{2}$$

$\therefore x \in \mathbb{Z}$

$$\therefore \text{solution set} = \{-5, -4\}$$



Q20. Solve the inequality  $12 + 1\frac{5}{6}x \leq 5 + 3x$ ,  $x \in \mathbb{R}$ . Represent the solution on a number line.

sol.

$$12 + 1\frac{5}{6}x \leq 5 + 3x$$

$$\Rightarrow 12 + \frac{11}{6}x \leq 5 + 3x$$

$$\Rightarrow 72 + 11x \leq 30 + 18x \quad \{ \text{Multiplying by 6} \}$$

$$\Rightarrow 11x - 18x \leq 30 - 72$$

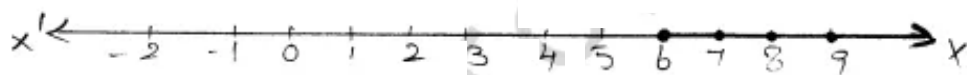
$$\Rightarrow -7x \leq -42$$

$$\Rightarrow x \geq 6$$

$$\therefore x \in \mathbb{R}$$

$$\text{solution set} = \{x; x \in \mathbb{R}, x \geq 6\}$$

solution set on number line



Q21. Solve  $\frac{4x-10}{3} \leq \frac{5x-7}{2}$ ,  $x \in \mathbb{R}$  and represent the solution set on the number line.

sol.

$$\frac{4x-10}{3} \leq \frac{5x-7}{2}$$

$$\Rightarrow 8x - 20 \leq 15x - 21 \quad \{ \text{LCM of 2, 3} = 6 \}$$

$$\Rightarrow 8x - 15x \leq -21 + 20$$

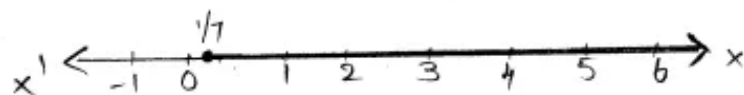
$$\Rightarrow -7x \leq -1$$

$$\Rightarrow x \geq \frac{1}{7}$$

$$\therefore x \in \mathbb{R}$$

$$\text{solution set} = \{x; x \in \mathbb{R}, x \geq \frac{1}{7}\}$$

solution set on Number Line



Q22. Solve  $\frac{3x}{5} - \frac{2x-1}{3} > 1$ ,  $x \in \mathbb{R}$  and represent the solution set on the number line.

Sol.

$$\frac{3x}{5} - \frac{2x-1}{3} > 1$$

$$\Rightarrow 9x - (10x - 5) > 15$$

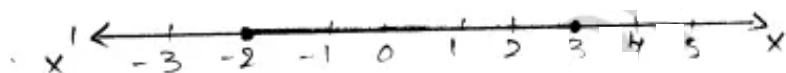
$$\Rightarrow -x > 15 - 5$$

$$\Rightarrow x < -10$$

$$\therefore x \in \mathbb{R}$$

$$\text{solution set} = \{x : x \in \mathbb{R}, x < -10\}$$

Solution set on the Number Line.



Q23. solve the inequation  $-3 \leq 3 - 2x < 9$ ,  $x \in \mathbb{R}$ . Represent the solution on a number line.

Sol.

$$-3 \leq 3 - 2x < 9$$

$$-3 \leq 3 - 2x \quad \text{and} \quad 3 - 2x < 9$$

$$\Rightarrow 2x \leq 3 + 3 \quad \text{and} \quad -2x < 9 - 3$$

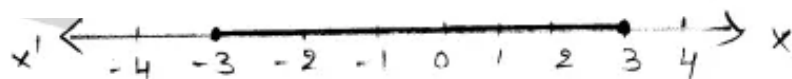
$$\Rightarrow 2x \leq 6 \quad \text{and} \quad -2x < 6$$

$$\Rightarrow x \leq 3 \quad \text{and} \quad -3 < x$$

$$\therefore -3 < x \leq 3$$

$$\text{solution set} = \{x : x \in \mathbb{R}, -3 < x \leq 3\}$$

Solution number line



Q24. Solve  $2 \leq 2x - 3 \leq 5$ ,  $x \in \mathbb{R}$  and mark it on number line.

Sol.  $2 \leq 2x - 3 \leq 5$

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

$$2 \leq 2x - 3 \quad \text{and} \quad 2x - 3 \leq 5$$

$$2 + 3 \leq 2x \quad \text{and} \quad 2x \leq 5 + 3$$

$$5 \leq 2x \quad \text{and} \quad 2x \leq 8$$

$$\frac{5}{2} \leq x \quad \text{and} \quad x \leq 4$$

$$\therefore \frac{5}{2} \leq x \leq 4$$

$$\therefore \text{solution set} = \left\{ x; x \in \mathbb{R}, \frac{5}{2} \leq x \leq 4 \right\}$$

solution set on number line



Q25. Given that  $x \in \mathbb{R}$ , solve the following inequality and graph the solution on the number line:  
 $-1 \leq 3 + 4x < 23$

Sol. Given  $-1 \leq 3 + 4x < 23$ ,  $x \in \mathbb{R}$

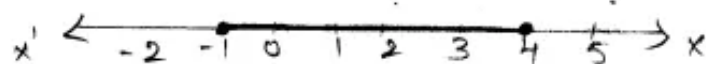
$$\Rightarrow -1 - 3 \leq 4x \leq 23 - 3$$

$$\Rightarrow -4 \leq 4x \leq 20$$

$$\Rightarrow -1 \leq x \leq 5$$

$$\therefore \text{The solution set} = \left\{ x; x \in \mathbb{R}, -1 \leq x \leq 5 \right\}$$

solution set on number line



Q26. Solve the following inequality and represent the solution on the number line:  $-2\frac{2}{3} \leq x + \frac{1}{3} < 3 + \frac{1}{3}$ ,  $x \in \mathbb{R}$ .

Sol.

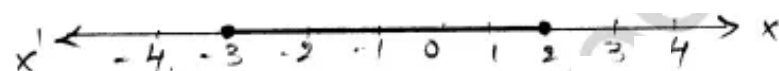
$$-2\frac{2}{3} \leq x + \frac{1}{3} < 3 + \frac{1}{3}$$

$$\Rightarrow -\frac{8}{3} \leq x + \frac{1}{3} < 3 + \frac{1}{3}$$

$$\Rightarrow -\frac{8}{3} - \frac{1}{3} \leq x < 3 + \frac{1}{3} - \frac{1}{3}$$

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

$\therefore$  The solution set =  $\{x : x \in \mathbb{R}, -3 \leq x < 3\}$   
 solution set on number line



Q27. Solve the inequality and represent the solution on the number line:  $-\frac{2}{3} < -\frac{x}{3} + 1 \leq \frac{2}{3}$ ,  $x \in \mathbb{R}$

Sol.

$$-\frac{2}{3} < -\frac{x}{3} + 1 \leq \frac{2}{3}$$

$$-\frac{2}{3} < -\frac{x}{3} + 1 \quad \text{and} \quad -\frac{x}{3} + 1 \leq \frac{2}{3}$$

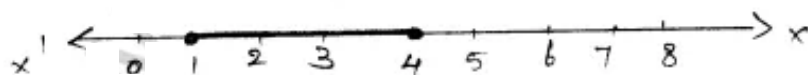
$$-2 < -x + 3 \quad \text{and} \quad -x + 3 \leq 2$$

$$x < 2 + 3 \quad \text{and} \quad -x \leq 2 - 3$$

$$x < 5 \quad \text{and} \quad 1 \leq x$$

$$\therefore 1 \leq x < 5$$

solution set =  $\{x : x \in \mathbb{R}, 1 \leq x < 5\}$



Q28. Solve  $\frac{2x+1}{2} + 2(3-x) \geq 7$ ,  $x \in \mathbb{R}$ . Also graph the solution set on number line.

Sol.

$$\frac{2x+1}{2} + 2(3-x) \geq 7$$

$$\Rightarrow \frac{2x+1}{2} + 6 - 2x \geq 7$$

$$\Rightarrow \frac{2x+1}{2} - 2x \geq 7-6$$

$$\Rightarrow \frac{2x+1-4x}{2} \geq 1$$

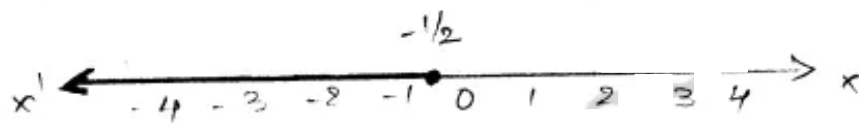
$$\Rightarrow -2x \geq 2-1$$

$$\Rightarrow -x \geq \frac{1}{2}$$

$$\Rightarrow x \leq -\frac{1}{2}$$

$$\text{Solution set} = \left\{ x : x \in \mathbb{R}, x \leq -\frac{1}{2} \right\}$$

Solution on number line



Q29. Find the range of values of  $x$ , which satisfy  $-\frac{1}{3} \leq \frac{x}{2} - 1 \frac{1}{3} < \frac{1}{6}$ ,  $x \in \mathbb{R}$ . Graph the values of  $x$  on the real number line.

Sol.

$$-\frac{1}{3} \leq \frac{x}{2} - 1 \frac{1}{3} < \frac{1}{6}$$

$$\Rightarrow -\frac{1}{3} \leq \frac{x}{2} - 1 \frac{1}{3} \text{ and } \frac{x}{2} - 1 \frac{1}{3} < \frac{1}{6}$$

$$\Rightarrow -\frac{1}{3} \leq \frac{x}{2} - \frac{4}{3} \text{ and } \frac{x}{2} - \frac{4}{3} < \frac{1}{6}$$

$$\Rightarrow -2 \leq 3x - 8 \text{ and } 3x - 8 < 1$$

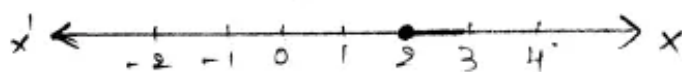
$$\Rightarrow -3x \leq -8 + 2 \text{ and } 3x < 1 + 8$$

$$\Rightarrow x \geq 2 \text{ and } x < 3$$

$$\therefore 2 \leq x < 3$$

$$\text{Solution set} = \left\{ x : x \in \mathbb{R}, 2 \leq x < 3 \right\}$$

Solution set on number line



Q30. solve the inequation:  $-2\frac{1}{2} + 2x \leq \frac{4x}{3} \leq \frac{4}{3} + 2x$ ,  $x \in \mathbb{W}$   
 Graph the solution set on the number line.

Sol.  $-2\frac{1}{2} + 2x \leq \frac{4x}{3} \leq \frac{4}{3} + 2x$

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

$$-\frac{5}{2} + 2x \leq \frac{4x}{3} \quad \text{and} \quad \frac{4x}{3} \leq \frac{4}{3} + 2x$$

$$2x - \frac{4x}{3} \leq \frac{5}{2} \quad \text{and} \quad \frac{4x}{3} - 2x \leq \frac{4}{3}$$

$$12x - 8x \leq 15 \quad \text{and} \quad 4x - 6x \leq 4$$

$$4x \leq 15 \quad \text{and} \quad -2x \leq 4$$

$$x \leq \frac{15}{4} \quad \text{and} \quad x \geq -2$$

$$\therefore -2 \leq x \leq \frac{15}{4}$$

Solution set =  $\{x : x \in \mathbb{W}, x \leq 3\}$

solution set on number line



Q31. If  $x \in \mathbb{I}$ , A is the solution set of  $2(x-1) < 3x-1$  and B is the solution set of  $4x-3 \leq 8+x$ , find  $A \cap B$ .

$$2(x-1) < 3x-1$$

$$2x - 2 < 3x - 1$$

$$-x < 1 \Rightarrow x > -1$$

$\therefore$  solution set of A =  $\{0, 1, 2, 3, \dots\}$

$$4x - 3 \leq 8 + x$$

$$3x \leq 11 \Rightarrow x \leq \frac{11}{3}$$

solution set of B =  $\{3, 2, 1, 0, -1, \dots\}$

$$\therefore A \cap B = \{0, 1, 2, 3\}$$



Q32. If  $x \in \mathbb{N}$ , P is the solution set of  $5x-2 > 3x+4$  and Q is the solution set of  $3x+1 \geq 19-x$ , find  $P \cap Q$ .

Sol.

$$\begin{array}{ll} 5x-2 > 3x+4 & 3x+1 \geq 19-x \\ 2x > 6 & 4x \geq 18 \\ x > 3 & x \geq \frac{9}{2} \end{array}$$

Solution set  $P = \{4, 5, 6, 7, \dots\}$  solution set  $Q = \{5, 6, 7, 8, \dots\}$   
 $\therefore P \cap Q = \{5, 6, 7, 8, \dots\}$

Q33. If P is the solution set of  $-3x+4 < 2x-3$ ,  $x \in \mathbb{N}$  and Q is the solution set of  $4x-5 < 12$ ,  $x \in \mathbb{W}$ , find (i)  $P \cap Q$  (ii)  $Q - P$

Sol.

$$\begin{array}{ll} -3x+4 < 2x-3 & 4x-5 < 12 \\ -5x < -7 & 4x < 17 \\ x > \frac{7}{5} & x < \frac{17}{4} \\ P = \{2, 3, 4, \dots\} & Q = \{0, 1, 2, 3\} \end{array}$$

(i)  $P \cap Q = \{2, 3\}$  (ii)  $Q - P = \{0, 1\}$

Q34.  $A = \{x : 11x-5 > 7x+3, x \in \mathbb{R}\}$  and  $B = \{x : 18x-9 \geq 15+12x, x \in \mathbb{R}\}$ . find the range of set  $A \cap B$  and represent it on a number line.

Sol.

$$\begin{array}{ll} A: 11x-5 > 7x+3 & B: 18x-9 \geq 15+12x \\ 4x > 8 & 18x \geq 24 \\ x > 2 & 6x \geq 24 \\ & x \geq 4 \end{array}$$

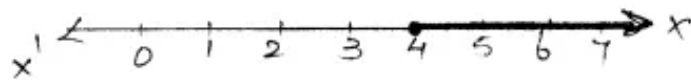
$\therefore A \cap B$   
 $A = \{3, 4, 5, 6, \dots\}$   $B = \{4, 5, 6, 7, \dots\}$



$$\therefore A \cap B = \{4, 5, 6, \dots\}$$

$$\Rightarrow A \cap B = \{x : x \in \mathbb{R}, x \geq 4\}$$

solution set on number line



Q35. Given  $P = \{x : x \in \mathbb{R}, 5 < 2x - 1 \leq 11\}$

$Q = \{x : x \in \mathbb{I}, -1 \leq 3 + 4x < 23\}$  where  
 $\mathbb{R}$  = Real numbers,  $\mathbb{I}$  = Integers. Represent  
 $P$  and  $Q$  on number lines. Write down the  
 elements of  $P \cap Q$ .

sol.

$$P = 5 < 2x - 1 \leq 11$$

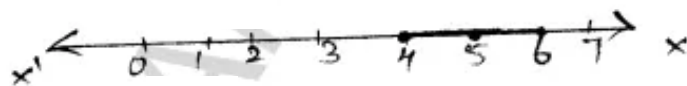
$$5 < 2x - 1 \quad \text{and} \quad 2x - 1 \leq 11$$

$$-2x < -6 \quad \text{and} \quad 2x \leq 12$$

$$x > 3 \quad \text{and} \quad x \leq 6$$

$$\text{solution set } 3 < x \leq 6 = \{4, 5, 6\}$$

solution set on number line:



$$Q = -1 \leq 3 + 4x < 23$$

$$-1 \leq 3 + 4x \quad \text{and} \quad 3 + 4x < 23$$

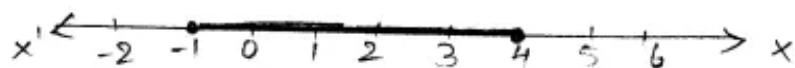
$$-4x \leq 4 \quad \text{and} \quad 4x < 20$$

$$x \geq -1 \quad \text{and} \quad x < 5$$

$$-1 \leq x < 5$$

$$\text{solution set} = \{-1, 0, 1, 2, 3, 4\}$$

solution set on number line



$$\therefore P \cap Q = \{4\}$$

Q36. If  $x \in \mathbb{I}$ , find the smallest value of  $x$  which satisfies the inequality  $2x + \frac{5}{2} > \frac{5x}{3} + 2$ .

Sol.

$$\begin{aligned} 2x + \frac{5}{2} &> \frac{5x}{3} + 2 \\ \Rightarrow 2x - \frac{5x}{3} &> 2 - \frac{5}{2} \\ \Rightarrow 12x - 10x &> 12 - 15 \\ \Rightarrow 2x &> -3 \\ \Rightarrow x &> -\frac{3}{2} \end{aligned}$$

$\therefore$  smallest value of  $x = -1$   $\{ \because x \in \mathbb{I} \}$

Q37. Given  $20 - 5x < 5(x + 8)$ , find the smallest value of  $x$ , when (i)  $x \in \mathbb{I}$ , (ii)  $x \in \mathbb{W}$ , (iii)  $x \in \mathbb{N}$ .

Sol.

$$\begin{aligned} 20 - 5x &< 5(x + 8) \\ \Rightarrow 20 - 5x &< 5x + 40 \\ \Rightarrow -10x &< 20 \\ \Rightarrow -x &< 2 \\ \Rightarrow x &> -2 \end{aligned}$$

(i) when  $x \in \mathbb{I}$ , then smallest value = -1

(ii) when  $x \in \mathbb{W}$ , then smallest value = 0

(iii) when  $x \in \mathbb{N}$ , then smallest value = 1

Q38. solve the given inequality and graph the solution on the number line:  $2y - 3 < y + 1 \leq 4y + 7$ ;  $y \in \mathbb{R}$

$$2y - 3 < y + 1 \leq 4y + 7$$

$$\begin{aligned} 2y - 3 < y + 1 & \text{ and } y + 1 \leq 4y + 7 \\ y < 4 & \text{ and } -3y \leq 6 \end{aligned}$$

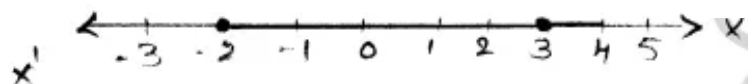
$$-y \leq 2$$

$$y \geq -2$$

$$\therefore -2 \leq y < 4$$

$\therefore$  The solution set =  $\{y: y \in \mathbb{R}, -2 \leq y < 4\}$

solution set on Number Line



Q39. find the greatest integer which is such that if 7 are added to its double, the resulting number becomes greater than three times the integer.

sol. let the integer be  $x$   
Now, according to the question

$$2x + 7 > 3x$$

$$\Rightarrow -x > -7$$

$$\Rightarrow x < 7$$

$\therefore$  The greatest integer will be 6 which is less than 7.

Q40. one-third of a bamboo pole buried is mud, one-sixth of it is in water and part above the water is greater than or equal to 3 meters. find the length of the shortest pole.

sol. let the length of the pole be  $x$  m.

Now according to the question

$$\frac{1}{3}x + \frac{1}{6}x = \text{part buried in mud} + \text{part in water}$$

$$\Rightarrow \frac{3}{6}x = \frac{x}{2} = \text{half part of pole is in mud \& water}$$

Now according to the question remaining part i.e., half above the water is greater than or equal to 3 meters.

$$\Rightarrow \frac{x}{2} \geq 3$$

$$\Rightarrow x \geq 6$$

$\therefore$  The length of the shortest pole is 6 meters.