

EXERCISE- 4 (A)**Question 1:**

State, true or false:

- (i) $x < -y \Rightarrow -x > y$
- (ii) $-5x \geq 15 \Rightarrow x \geq -3$
- (iii) $2x \leq -7 \Rightarrow \frac{2x}{-4} \geq \frac{-7}{-4}$
- (iv) $7 > 5 \Rightarrow \frac{1}{7} < \frac{1}{5}$

Solution 1:

- (i) $x < -y \Rightarrow -x > y$

The given statement is true.

- (ii) $-5x \geq 15 \Rightarrow \frac{-5x}{5} \geq \frac{15}{5} \Rightarrow x \leq -3$

The given statement is false

- (iii) $2x \leq -7 \Rightarrow \frac{2x}{-4} \geq \frac{-7}{-4}$

The given statement is true

- (iv) $7 > 5 \Rightarrow \frac{1}{7} < \frac{1}{5}$

The given statement is true.

Question 2:

- (i) $a < b \Rightarrow a - c < b - c$
- (ii) If $a > b \Rightarrow a + c > b + c$
- (iii) If $a < b \Rightarrow ac < bc$
- (iv) If $a > b \Rightarrow \frac{a}{c} > \frac{b}{c}$
- (v) If $a - c > b - d \Rightarrow a + d > b + c$
- (vi) If $a < b \Rightarrow a - c < b - c$ (Since, $c > 0$)

Where a, b, c and d are real numbers and $c \neq 0$.

Solution 2:

- (i) $a < b \Rightarrow a - c < b - c$

The given statement is true.

- (ii) If $a > b \Rightarrow a + c > b + c$

The given statement is true.

- (iii) If $a < b \Rightarrow ac < bc$

The given statement is false.

(iv) If $a > b \Rightarrow \frac{a}{c} > \frac{b}{c}$

The given statement is false.

(v) If $a - c > b - d \Rightarrow a + d > b + c$

The given statement is true.

(vi) If $a < b \Rightarrow a - c < b - c$ (Since, $c > 0$)

The given statement is false.

Question 3:

If $x \in \mathbb{N}$, find the solution set of in-equations.

(i) $5x + 3 \leq 2x + 18$

(ii) $3x - 2 < 19 - 4x$

Solution 3:

(i) $5x + 3 \leq 2x + 18$

$$5x - 2x \leq 18 - 3$$

$$3x \leq 15$$

$$x \leq 5$$

Since, $x \in \mathbb{N}$, therefore solution set is $\{1, 2, 3, 4, 5\}$

(ii) $3x - 2 < 19 - 4x$

$$3x + 4x < 19 + 2$$

$$7x < 21$$

$$x < 3$$

Since, $x \in \mathbb{N}$, therefore solution set is $\{1, 2\}$.

Question 4:

If the replacement set is the set of whole numbers, solve:

(i) $x + 7 \leq 11$

(ii) $3x - 1 > 8$

(iii) $8 - x > 5$

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

(v) $x - \frac{3}{2} < \frac{3}{2} - x$

(vi) $18 \leq 3x - 2$

Solution 4:

(i) $x + 7 \leq 11$

$$x \leq 11 - 7$$

$$x \leq 4$$

Since, the replacement set = $\mathbb{W}$ (set of whole numbers)

$\Rightarrow$ Solution set = $\{0, 1, 2, 3, 4\}$

(ii) $3x - 1 > 8$

$3x > 8 + 1$

$x > 3$

Since, the replacement set = W (Set of whole numbers)

 $\Rightarrow$ Solution set = $\{4, 5, 6, \dots\}$

(iii) $8 - x > 5$

$-x > 5 - 8$

$-x > -3$

$x < 3$

Since, the replacement set = W (Set of whole numbers)

 $\Rightarrow$ Solution set = $\{0, 1, 2, \dots\}$

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

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

$-3x \geq -\frac{15}{2}$

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

Since, the replacement set = W (set of whole numbers)

 $\therefore$ Solution set = $\{0, 1, 2\}$

(v) $x - \frac{3}{2} < \frac{3}{2} - x$

$x + x < \frac{3}{2} + \frac{3}{2}$

$2x < 3$

$x < \frac{3}{2}$

Since, the replacement set = W (set of whole numbers)

 $\therefore$ Solution set = $\{0, 1\}$

(vi) $18 \leq 3x - 2$

$18 + 2 \leq 3x$

$20 \leq 3x$

$x \geq \frac{20}{3}$

Since, the replacement set = W (set of whole numbers)

 $\therefore$ Solution set = $\{7, 8, 9, \dots\}$ **Question 5:**

Solve the in-equation:

$3 - 2x \geq x - 12$ given that $x \in \mathbb{N}$

Solution 5:

$3 - 2x \geq x - 12$

$$- 2x - x \geq -12 - 3$$

$$- 3x \geq -15$$

$$X \leq 5$$

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

Solution set = $\{1, 2, 3, 4, 5\}$

Question 6:

If $25 - 4x \leq 16$, find:

(i) the smallest value of x , when x is a real number,

(ii) the smallest value of x , when x is an integer.

Solution 6:

$$25 - 4x \leq 16$$

$$- 4x \leq 16 - 25$$

$$- 4x \leq -9$$

$$X \geq \frac{9}{4}$$

$$X \geq 2.25$$

(i) The smallest value of x , when x is a real number, is 2.25.

(ii) The smallest value of x , when x is an integer, is 3.

Question 7:

If the replacement set is the set of real number, solve:

(i) $4x \geq -16$

(ii) $8 - 3x \leq 20$

(iii) $5 + \frac{x}{4} > \frac{x}{5} + 9$

(iv) $\frac{x+3}{8} < \frac{x-3}{5}$

Solution 7:

(i) $-4x \geq -16$

$$X \leq 4$$

Since, the replacement set of real numbers.

$\therefore$ solution set = $\{x : x \in \mathbb{R} \text{ and } x \leq 4\}$

(ii) $8 - 3x \leq 20$

$$- 3x \leq 20 - 8$$

$$- 3x \leq 12$$

$$X \geq -4$$

Since the replacement set of real numbers.

$\therefore$ solution set = $\{x : x \in \mathbb{R} \text{ and } x \geq -4\}$

(iii) $5 + \frac{x}{4} > \frac{x}{5} + 9$

$$\frac{x}{4} - \frac{x}{5} > 9 - 5$$

$$\frac{x}{20} > 4$$

$$x > 80$$

Since the replacement set of real numbers.

$\therefore$ solution set = $\{x : x \in \mathbb{R} \text{ and } x > 80\}$

$$(iv) \frac{x+3}{8} < \frac{x-3}{5}$$

$$5x + 15 < 8x - 24$$

$$5x - 8x < -24 - 15$$

$$-3x < -39$$

$$x > 13$$

Since the replacement set of real numbers.

$\therefore$ solution set = $\{x : x \in \mathbb{R} \text{ and } x > 13\}$

Question 8:

Find the smallest value of x for which $5 - 2x < 5\frac{1}{2} - \frac{5}{3}x$, where x is an integer.

Solution 8:

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

$$-2x + \frac{5}{3}x < \frac{11}{2} - 5$$

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

$$-x < \frac{3}{2}$$

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

$$x > -1.5$$

Thus, the required smallest value of x is -1.

Question 9:

Find the largest value of x for which

$$2(x - 1) \leq 9 - x \text{ and } x \in \mathbb{W}.$$

Solution 9:

$$2(x - 1) \leq 9 - x$$

$$2x - 2 \leq 9 - x$$

$$2x + x \leq 9 + 2$$

$$3x \leq 11$$

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

$$x \leq 3.67$$

Since, $x \in \mathbb{W}$, thus the required largest value of x is 3.

Question 10:

Solve the in-equation:

$$12 + 1\frac{5}{6}x \leq 5 + 3x \text{ and } x \in \mathbb{R}.$$

Solution 10:

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

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

$$\frac{-7}{6}x \leq -7$$

$$x \geq 6$$

$$\therefore \text{solution set} = \{x : x \in \mathbb{R} \text{ and } x \geq 6\}$$

Question 11:

Given $x \in \{\text{Integers}\}$, find the solution set of : $-5 \leq 2x - 3 < x + 2$

Solution 11:

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

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

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

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

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

$$\Rightarrow -2 \leq 2x$$

$$\text{and } x < 5$$

$$\Rightarrow x \geq -1$$

$$\text{and } x < 5$$

Since, $x \in \{\text{integers}\}$

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

Question 12:

Given $x \in \{\text{whole numbers}\}$, find the solution set of : $-1 \leq 3 + 4x < 23$

Solution 12:

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

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

$$\text{and } 3 + 4x < 23$$

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

$$\text{and } 4x < 20$$

$$\Rightarrow x \geq -1$$

$$\text{and } x < 5$$

Since, $x \in \{\text{Whole numbers}\}$

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

EXERCISE 4(B)**Question 1:**

Represent the following in-equalities on real number lines:

- (i) $2x - 1 < 5$
- (ii) $3x + 1 \geq -5$
- (iii) $2(2x - 3) \leq 6$
- (iv) $-4 < x < 4$
- (v) $-2 \leq x < 5$
- (vi) $8 \geq x > -3$
- (vii) $-5 < x \leq -1$

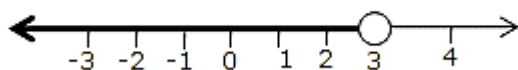
Solution 1:

- (i) $2x - 1 < 5$

$$2x < 6$$

$$x < 3$$

Solution on number line is:

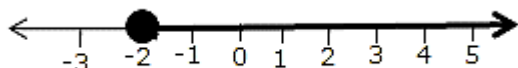


- (ii) $3x + 1 \geq -5$

$$3x \geq -6$$

$$x \geq -2$$

Solution on number line is:



- (iii) $2(2x - 3) \leq 6$

$$2x - 3 \leq 3$$

$$2x \leq 6$$

$$x \leq 3$$

Solution on number line is:



- (iv) $-4 < x < 4$

Solution on number line is:



- (v) $-2 \leq x < 5$

Solution on number line is:



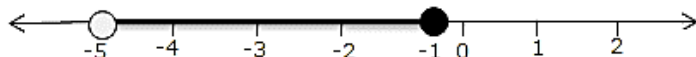
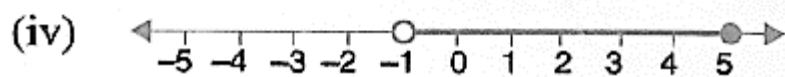
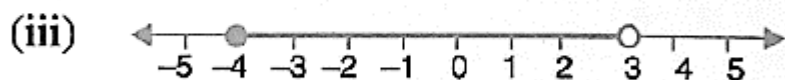
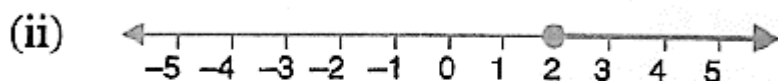
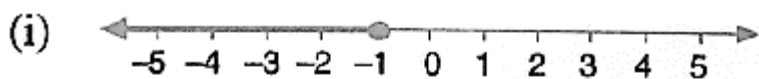
(vi) $8 \geq x > -3$

Solution on number line is:



(vii) $-5 < x \leq -1$

Solution on number line is:

**Question 2:**For each graph given alongside, write an in-equation taking x as the variable**Solution 2:**

(i) $x \leq -1, x \in \mathbb{R}$

(ii) $x \geq 2, x \in \mathbb{R}$

(iii) $-4 \leq x < 3, x \in \mathbb{R}$

(iv) $-1 < x \leq 5, x \in \mathbb{R}$

Question 3:

For the following in-equations, graph the solution set on the real number line:

(i) $-4 \leq 3x - 1 < 8$

(ii) $x - 1 < 3 - x \leq 5$

Solution 3:

(i) $-4 \leq 3x - 1 < 8$

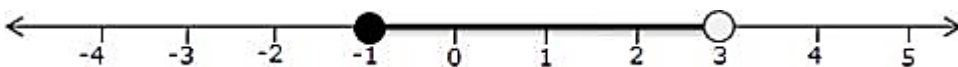
$-4 \leq 3x - 1$

$-1 \leq x$

and $3x - 1 < 8$

and $x < 3$

The solution set on the real number line is:



(ii) $x - 1 < 3 - x \leq 5$

$x - 1 < 3 - x$

$2x < 4$

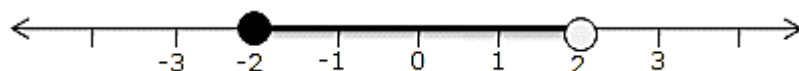
$x < 2$

and $3 - x \leq 5$

and $-x \leq 2$

and $x \geq -2$

The solution set on the real number line is:



Question 4:

Represent the solution of each of the following in-equalities on the real number line:

(i) $4x - 1 > x + 11$

(ii) $7 - x \leq 2 - 6x$

(iii) $x + 3 \leq 2x + 9$

(iv) $2 - 3x > 7 - 5x$

(v) $1 + x \geq 5x - 11$

(vi) $\frac{2x+5}{3} > 3x - 3$

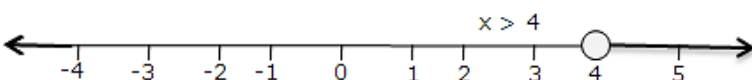
Solution 4:

(i) $4x - 1 > x + 11$

$3x > 12$

$x > 4$

The solution on number line is:

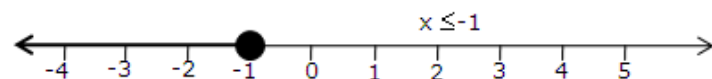


(ii) $7 - x \leq 2 - 6x$

$5x \leq -5$

$x \leq -1$

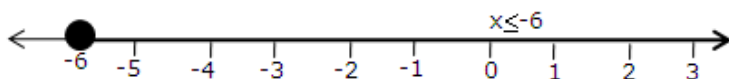
The solution on number line is:



(iii) $x + 3 \leq 2x + 9$

$-6 \leq x$

The solution on number line is:



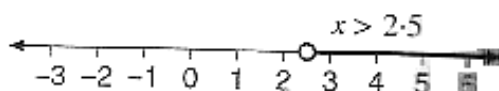
(iv) $2 - 3x > 7 - 5x$

$$2x > 5$$

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

$$x > 2.5$$

The solution on number line is:

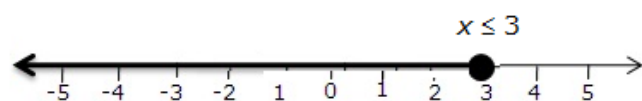


(v) $1 + x \geq 5x - 11$

$$12 \geq 4x$$

$$3 \geq x$$

The solution on number line is:



(vi) $\frac{2x+5}{3} > 3x - 3$

$$2x + 5 > 9x - 9$$

$$-7x > -14$$

$$x < 2$$

The solution on number line is:



Question 5:

$x \in \{\text{real numbers}\}$ and $-1 < 3 - 2x \leq 7$ evaluate x and represent it on a number line.

Solution 5:

– $1 < 3 - 2x \leq 7$

– $1 < 3 - 2x$ and $3 - 2x \leq 7$

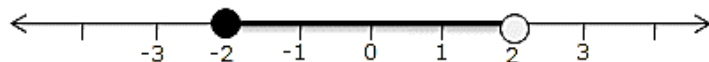
$$2x < 4 \text{ and } -2x \leq 4$$

$$x < 2 \text{ and } x \geq -2$$

$$\text{Solution set} = \{-2 \leq x < 2, x \in \mathbb{R}\}$$

Thus, the solution can be represented on a number line as:

$$-2 \leq x < 2$$



Question 6:

List the elements of the solution set of the in-equation $-3 < x - 2 \leq 9 - 2x$; $x \in \mathbb{N}$.

Solution 6:

- $3 < x - 2 \leq 9 - 2x$
- $3 < x - 2$ and $x - 2 \leq 9 - 2x$
- $1 < x$ and $3x \leq 11$
- $1 < x \leq \frac{11}{3}$

Since, $x \in \mathbb{N}$

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

Question 7:

Find the range of values of x which satisfies

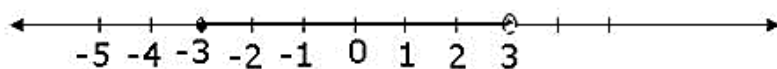
- $2\frac{2}{3} \leq x + \frac{1}{3} < 3\frac{1}{3}$, $x \in \mathbb{R}$.

Graph these values of x on the number line.

Solution 7:

- $2\frac{2}{3} \leq x + \frac{1}{3}$ and $x + \frac{1}{3} < 3\frac{1}{3}$
- $\Rightarrow -\frac{8}{3} \leq x + \frac{1}{3}$ and $x + \frac{1}{3} < \frac{10}{3}$
- $\Rightarrow -\frac{8}{3} - \frac{1}{3} \leq x$ and $x < \frac{10}{3} - \frac{1}{3}$
- $\Rightarrow -\frac{9}{3} \leq x$ and $x < \frac{9}{3}$
- $\Rightarrow -3 \leq x$ and $x < 3$
- $\therefore -3 \leq x$ and $x < 3$

The required graph of the solution set is:

**Question 8:**

Find the values of x , which satisfy the in-equation: $-2 \leq \frac{1}{2} - \frac{2x}{3} < 1\frac{5}{6}$, $x \in \mathbb{N}$.

Graph the solution on the number line.

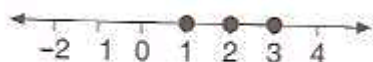
Solution 8:

- $-2 \leq \frac{1}{2} - \frac{2x}{3} < 1\frac{5}{6}$
- $-2 \leq \frac{1}{2} - \frac{2x}{3}$ and $\frac{1}{2} - \frac{2x}{3} < 1\frac{5}{6}$
- $\frac{-5}{2} \leq -\frac{2x}{3}$ and $\frac{-2x}{3} < \frac{8}{6}$
- $\frac{15}{4} \geq x$ and $x > -2$
- $3.75 \geq x$ and $x > -2$

Since, $x \in \mathbb{N}$

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

The required graph of the solution set is:



Question 9:

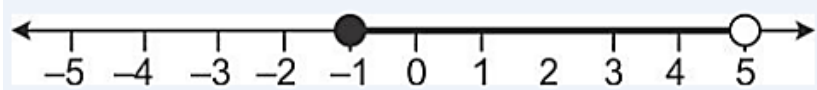
Given $x \in \{\text{real number}\}$, find the range of values of x for which $-5 \leq 2x - 3 < x + 2$ And represent it on a real number line.

Solution 9:

- $5 \leq 2x - 3 < x + 2$
- $5 \leq 2x - 3$ and $2x - 3 < x + 2$
- $2 \leq 2x$ and $x < 5$
- $1 \leq x$ and $x < 5$

$\therefore$ Required range is $-1 \leq x < 5$

The required graph is:



Question 10:

If $5x - 3 \leq 5 + 3x \leq 4x + 2$, express it as $a \leq x \leq b$ and then state the values of a and b .

Solution 10:

- $5x - 3 \leq 5 + 3x \leq 4x + 2$
- $5x - 3 \leq 5 + 3x$ and $5 + 3x \leq 4x + 2$
- $2x \leq 8$ and $-x \leq -3$
- $x \leq 4$ and $x \geq 3$
- Thus, $3 \leq x \leq 4$
- Hence, $a = 3$ and $b = 4$

Question 11:

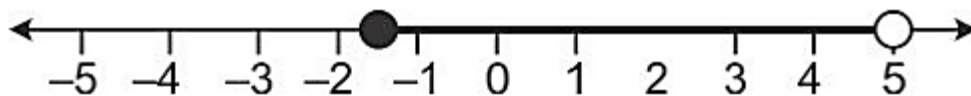
Solve the following in-equation and graph the solution set on the number line:

$$2x - 3 < x + 2 \leq 3x + 5; x \in \mathbb{R}.$$

Solution 11:

- $2x - 3 < x + 2 \leq 3x + 5$
- $2x - 3 < x + 2$ and $x + 2 \leq 3x + 5$
- $x < 5$ and $-3 \leq 2x$
- $x < 5$ and $-1.5 \leq x$
- Solution set = $\{-1.5 \leq x < 5\}$

The solution set can be graphed on the number line as:

**Question 12:**

Solve and graph the solution set of:

- (i) $2x - 9 < 7$ and $3x + 9 \leq 25$; $x \in \mathbb{R}$.
- (ii) $2x - 9 \leq 7$ and $3x + 3x + 9 > 25$; $x \in \mathbb{I}$.
- (iii) $x + 5 \geq 4(x - 1)$ and $3 - 2x < -7$; $x \in \mathbb{R}$.

Solution 12:

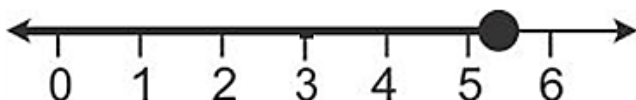
- (i) $2x - 9 < 7$ and $3x + 9 \leq 25$

$$2x < 16 \text{ and } 3x \leq 16$$

$$x < 8 \text{ and } x \leq 5\frac{1}{3}$$

$$\therefore \text{Solution set} = \{x \leq 5\frac{1}{3}, x \in \mathbb{R}\}$$

The required graph on number line is:



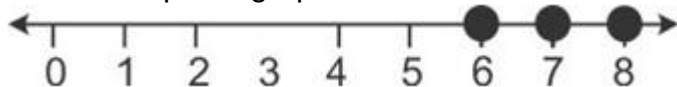
- (ii) $2x - 9 \leq 7$ and $3x + 3x + 9 > 25$

$$2x \leq 16 \text{ and } 3x > 16$$

$$x \leq 8 \text{ and } x > 5\frac{1}{3}$$

$$\therefore \text{Solution set} = \{5\frac{1}{3} < x \leq 8, x \in \mathbb{I}\} = \{6, 7, 8\}$$

The required graph on number line is:



- (iii) $x + 5 \geq 4(x - 1)$ and $3 - 2x < -7$

$$9 \geq 3x \text{ and } -2x < -10$$

$$3 \geq x \text{ and } x > 5$$

$\therefore$ solution set = Empty set

Question 13:

Solve and graph the solution set of:

- (i) $3x - 2 > 19$ or $3 - 2x \geq -7$; $x \in \mathbb{R}$.
- (ii) $5 > p - 1 > 2$ or $7 \leq 2p - 1 \leq 17$; $p \in \mathbb{R}$.

Solution 13:

- (i) $3x - 2 > 19$ or $3 - 2x \geq -7$

$$3x > 21 \text{ or } -2x \geq -10$$

$$x > 7 \text{ or } x \leq 5$$

Graph of solution set of $x > 7$ or $x \leq 5$ = Graph of points which belong to $x > 7$ or $x \leq 5$ or both.

Thus, the graph of the solution set is:



(ii) $5 > p - 1 > 2$ or $7 \leq 2p - 1 \leq 17$

$$6 > p > 3 \text{ or } 8 \leq 2p \leq 18$$

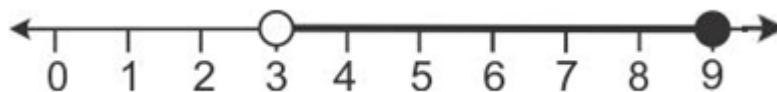
$$6 > p > 3 \text{ or } 4 \leq p \leq 9$$

Graph of solution set of $6 > p > 3$ or $4 \leq p \leq 9$

= Graph of points which belong to $6 > p > 3$ or $4 \leq p \leq 9$ or both

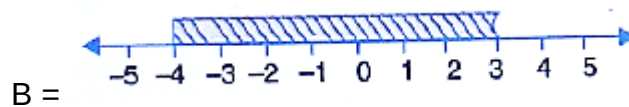
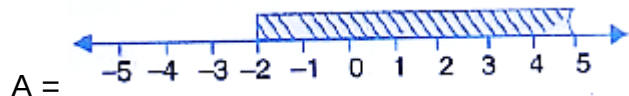
= Graph of points which belong to $3 < p \leq 9$

Thus, the graph of the solution set is:



Question 14:

The diagram represents two in-equations A and B on real number lines:



(i) Write down A and B in set builder notation.

(ii) Represent $A \cap B$ and $A \cap B'$ on two different number lines.

Solution 14:

(i) $A = \{x \in \mathbb{R} : -2 \leq x < 5\}$

$$B = \{x \in \mathbb{R} : -4 \leq x < 3\}$$

(ii) $A \cap B = \{x \in \mathbb{R} : -2 \leq x < 3\}$

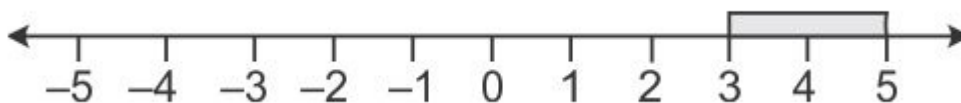
It can be represented on number line as:



$$B' = \{x \in \mathbb{R} : 3 < x < -4\}$$

$$A \cap B' = \{x \in \mathbb{R} : 3 \leq x < 5\}$$

It can be represented on number line as:



Question 15:

Use real number line to find the range of values of x for which:

- (i) $x > 3$ and $0 < x < 6$.
- (ii) $x < 0$ and $-3 \leq x < 1$
- (iii) $-1 < x \leq 6$ and $-2 \leq x \leq 3$

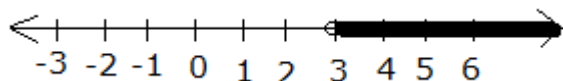
Solution 15:

- (i) $x > 3$ and $0 < x < 6$

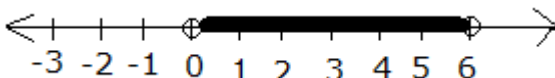
Both the given in equations are true in the range where their graphs on the real number lines overlap.

The graphs of the given in equations can be drawn as:

$$x > 3$$



$$0 < x < 6$$



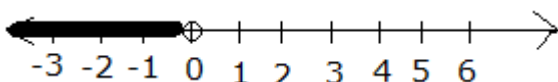
From both graphs, it is clear that their common range is $3 < x < 6$

- (ii) $x < 0$ and $-3 \leq x < 1$

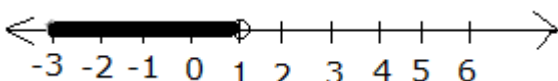
Both the given in equations are true in the range where their graphs on the real number lines overlap.

The graphs of the given in equations can be drawn as:

$$x < 0$$



$$-3 \leq x < 1$$



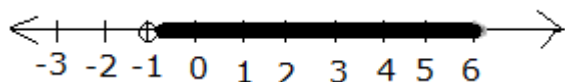
From both graphs, it is clear that their common range is
 $-3 \leq x < 0$

(iii) $-1 < x \leq 6$ and $-2 \leq x \leq 3$

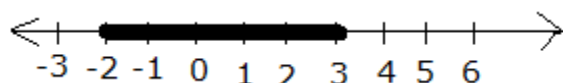
Both the given in equations are true in the range where their graphs on the real number lines overlap.

The graphs of the given in equations can be drawn as:

$$-1 < x \leq 6$$



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



From both graphs, it is clear that their common range is
 $-1 < x \leq 3$

Question 16:

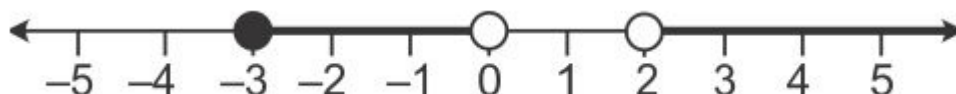
Illustrate the set $\{x: -3 \leq x < 0 \text{ or } x > 2; x \in \mathbb{R}\}$ on a real number line.

Solution 16:

Graph of solution set of $-3 \leq x < 0$ or $x > 2$

= Graph of points which belong to $-3 \leq x < 0$ or $x > 2$ or both

Thus, the required graph is:



Question 17:

Given $A = \{x: -1 < x \leq 5, x \in \mathbb{R}\}$ and $B = \{x: -4 \leq x < 3, x \in \mathbb{R}\}$

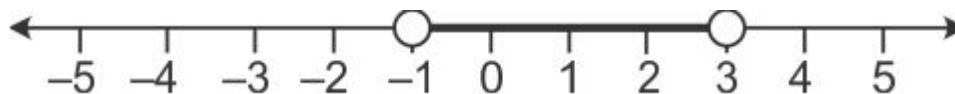
Represent on different number lines:

(i) $A \cap B$ (ii) $A' \cap B$ (iii) $A - B$

Solution 17:

(i) $A \cap B = \{x: -1 < x < 3, x \in \mathbb{R}\}$

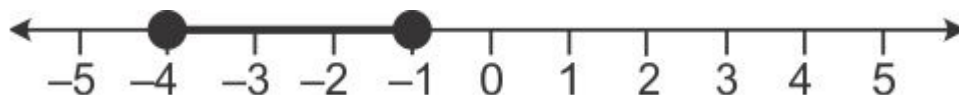
It can be represented on a number line as:



(ii) Numbers which belong to B but do not belong to A = B - A

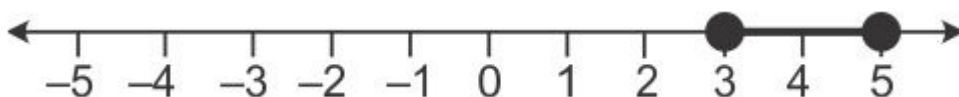
$$A' \cap B = \{x: -4 \leq x \leq -1, x \in \mathbb{R}\}$$

It can be represented on a number line as:



(iii) A - B = {x: 3 ≤ x ≤ 5, x ∈ ℝ}

It can be represented on a number line as:



Question 18:

P is the solution set of $7X - 2 > 4X + 1$ and Q is the solution set of $9x - 45 \geq 5(x - 5)$; where $x \in \mathbb{R}$, Represent:

(i) $P \cap Q$

(ii) $P - Q$

(iii) $P \cap Q'$ on different number lines.

Solution 18:

$$P = \{X : 7X - 2 > 4X + 1, X \in \mathbb{R}\}$$

$$7x - 2 > 4x + 1$$

$$7x - 4x > 1 + 2$$

$$3x > 3$$

$$x > 1$$

and

$$Q = \{x: 9x - 45 \geq 5(x - 5), x \in \mathbb{R}\}$$

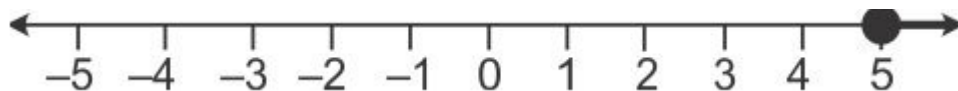
$$9x - 45 \geq 5x - 25$$

$$9x - 5x \geq -25 + 45$$

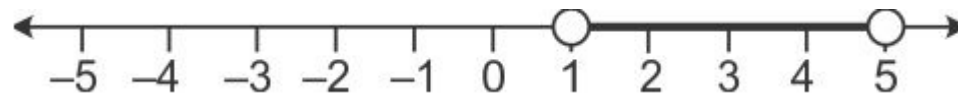
$$4x \geq 20$$

$$x \geq 5$$

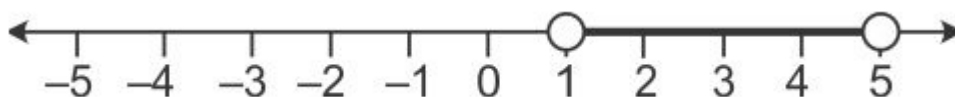
(i) $P \cap Q = \{x : x \geq 5, x \in \mathbb{R}\}$



(ii) $P - Q = \{X : 1 < X < 5, X \in \mathbb{R}\}$



(iii) $P \cap Q' = \{x : 1 < x < 5, x \in \mathbb{R}\}$



Question 19:

If $P = \{X : 7X - 4 > 5X + 2, X \in \mathbb{R}\}$ and $Q = \{X : X - 19 \geq 1 - 3X, X \in \mathbb{R}\}$; find the range of set $P \cap Q$ and represent it on a number line.

Solution 19:

$P = \{X : 7X - 4 > 5X + 2, X \in \mathbb{R}\}$

$$7X - 4 > 5X + 2$$

$$7X - 5X > 2 + 4$$

$$2X > 6$$

$$X > 3$$

$Q = \{X : X - 19 \geq 1 - 3X, X \in \mathbb{R}\}$

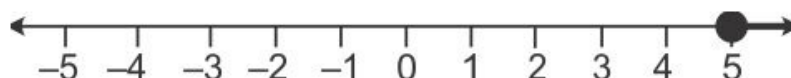
$$X - 19 \geq 1 - 3X$$

$$X + 3X \geq 1 + 19$$

$$4X \geq 20$$

$$X \geq 5$$

$P \cap Q = \{X : X \geq 5, X \in \mathbb{R}\}$



Question 20:

Find the range of values of x , which satisfy:

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

Graph, in each of the following cases, the values of x on the different real number lines:

(i) $x \in \mathbb{W}$ (ii) $x \in \mathbb{Z}$ (iii) $x \in \mathbb{R}$.

Solution 20:

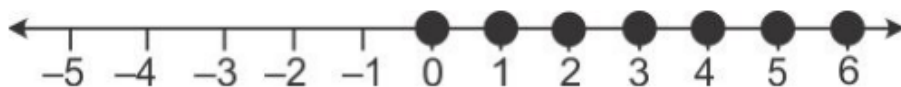
$$-\frac{1}{3} \leq \frac{x}{2} + 1 \frac{2}{3} < 5 \frac{1}{6}$$

$$-\frac{1}{3} - \frac{5}{3} \leq \frac{x}{2} < \frac{31}{6} - \frac{5}{3}$$

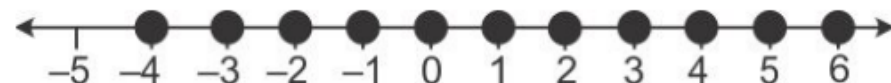
$$-\frac{6}{3} \leq \frac{x}{2} < \frac{21}{6}$$

$$-4 \leq x < 7$$

(i) If $x \in \mathbb{W}$, range of value of x is $\{0, 1, 2, 3, 4, 5, 6\}$



(ii) If $x \in \mathbb{Z}$, range of values of x is $\{-4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$.



(iii) If $x \in \mathbb{R}$, range of values of x is $-4 \leq x < 7$.



Question 21:

Given: $A = \{x : -8 < 5x + 2 \leq 17, x \in \mathbb{I}\}$

$B = \{x : -2 \leq 7 + 3x < 17, x \in \mathbb{R}\}$

Where $\mathbb{R} = \{\text{Real numbers}\}$ and $\mathbb{I} = \{\text{integers}\}$. Represent A and B on two different number lines. Write down the elements of $A \cap B$.

Solution 21:

$A = \{x : -8 < 5x + 2 \leq 17, x \in \mathbb{I}\}$

$= \{x : -10 < 5x \leq 15, x \in \mathbb{I}\}$

$= \{x : -2 < x \leq 3, x \in \mathbb{I}\}$

It can be represented on number line as:

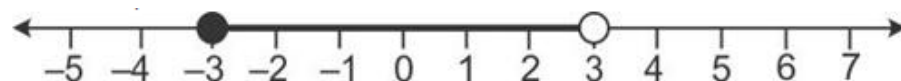


$B = \{x : -2 \leq 7 + 3x < 17, x \in \mathbb{R}\}$

$= \{x : -9 \leq 3x < 10, x \in \mathbb{R}\}$

$= \{x : -3 \leq x < 3.33, x \in \mathbb{R}\}$

It can be represented on number line as:



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

Question 22:

Solve the following in-equation and represent the solution set on the number line.

$2x - 5 \leq 5x + 4 < 11$, where $x \in \mathbb{I}$.

Solution 22:

$$2x - 5 \leq 5x + 4 \text{ and } 5x + 4 < 11$$

$$2x - 5x \leq 4 - 5 \text{ and } 5x < 11 - 4$$

$$3x \leq -1 \text{ and } 5x < 7$$

$$x \geq -1 \text{ and } x < \frac{7}{5}$$

$$x \geq -1 \text{ and } x < 1.4$$

Since $x \in I$, the solution set is $\{-3, -2, -1, 0, 1\}$

And the number line representation is



Question 23:

Given that $x \in I$, solve the in-equation and graph the solution on the number line:

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

Solution 23:

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

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

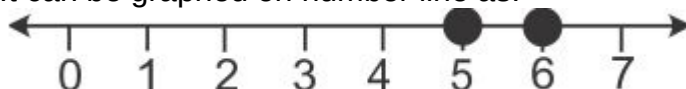
$$18 \geq 5x - 12 \geq 12$$

$$30 \geq 5x \geq 24$$

$$6 \geq x \geq 4.8$$

Solution set = $\{5, 6\}$

It can be graphed on number line as:



Question 24:

Given:

$$A = \{x: 11x - 5 > 7x + 3, x \in R\} \text{ and}$$

$$B = \{x: 18x - 9 \geq 15 + 12x, x \in R\}$$

Find the range of set $A \cap B$ and represent it on a number line.

Solution 24:

$$A = \{x: 11x - 5 > 7x + 3, x \in R\}$$

$$= \{x: 4x > 8, x \in R\}$$

$$= \{x: x > 2, x \in R\}$$

$$B = \{x: 18x - 9 \geq 15 + 12x, x \in R\}$$

$$= \{x: 6x \geq 24, x \in R\}$$

$$= \{x: x \geq 4, x \in R\}$$

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

It can be represented on number line as:

**Question 25:**

Find the set of value of x, Satisfying:

$$7X + 3 \geq 3X - 5 \text{ and } \frac{x}{4} - 5 \leq \frac{5}{4} - x,$$

Where $x \in \mathbb{N}$.

Solution 25:

$$7X + 3 \geq 3X - 5$$

$$4X \geq -8$$

$$X \geq -2$$

$$\frac{X}{4} - 5 \leq \frac{5}{4} - X$$

$$\frac{X}{4} - X \leq \frac{5}{4} + 5$$

$$\frac{5X}{4} \leq \frac{25}{4}$$

$$X \leq 5$$

Since, $x \in \mathbb{N}$

$\therefore$ Solution set = $\{1, 2, 3, 4, 5\}$

Question 26:

Solve:

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

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

Solution 26:

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

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

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

$$x \leq 6$$

Since, x is a positive odd integer

$\therefore$ Solution set = $\{1, 3, 5\}$

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

$$8x + 12 \geq 9x - 3$$

$$-X \geq -15$$

$$X \leq 15$$

Since, x is a positive even integer

∴ Solution set = {2, 4, 6, 8, 10, 12, 14}

Question 27:

Solve the in-equation:

$$-2\frac{1}{2} + 2x \leq \frac{4x}{5} \leq \frac{4}{3} + 2x, x \in W.$$

Graph the solution set on the number line.

Solution 27:

$$-2\frac{1}{2} + 2x \leq \frac{4x}{5} \leq \frac{4}{3} + 2x$$

$$-2\frac{1}{2} \leq \frac{4x}{5} - 2x \leq \frac{4}{3}$$

$$-\frac{5}{2} \leq -\frac{6x}{5} \leq \frac{4}{3}$$

$$\frac{25}{12} \geq x \geq -\frac{10}{9}$$

$$2.083 \geq x \geq -1.111$$

Since, $x \in W$

∴ Solution set = {0, 1, 2}

The solution set can be represented on number line as:



Question 28:

Find three consecutive largest positive integers such that the sum of one-third of first, one-fourth of second and one-fifth of third is atmost 20.

Solution 28:

Let the required integers be x, x + 1 and x + 2.

According to the given statement,

$$\frac{1}{3}x + \frac{1}{4}(x + 1) + \frac{1}{5}(x + 2) \leq 20$$

$$\frac{20x + 15x + 15 + 12x + 24}{60} \leq 20$$

$$47x + 39 \leq 1200$$

$$47x \leq 1161$$

$$X \leq 24.702$$

Thus, the largest value of the positive integer x is 24.

Hence, the required integers are 24, 25 and 26.

Question 29:

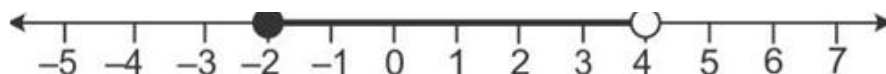
Solve the given in-equation and graph the solution on the number line.

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

Solution 29:

$$\begin{aligned}
 2y - 3 < y + 1 \leq 4y + 7, y \in \mathbb{R} \\
 \Rightarrow 2y - 3 - y < y + 1 - y \leq 4y + 7 - y \\
 \Rightarrow y - 3 < 1 \leq 3y + 7 \\
 \Rightarrow y - 3 < 1 \text{ and } 1 \leq 3y + 7 \\
 \Rightarrow y < 4 \text{ and } 3y \geq -6 \Rightarrow y \geq -2 \\
 \Rightarrow -2 \leq y < 4
 \end{aligned}$$

The graph of the given equation can be represented on a number line as:

**Question 30:**

Solve the inequation:

$$3z - 5 \leq z + 3 < 5z - 9; z \in \mathbb{R}.$$

Graph the solution set on the number line.

Solution 30:

$$\begin{aligned}
 3z - 5 \leq z + 3 < 5z - 9 \\
 3z - 5 \leq z + 3 \text{ and } z + 3 < 5z - 9 \\
 2z \leq 8 \text{ and } 12 < 4z \\
 z \leq 4 \text{ and } 3 < z
 \end{aligned}$$

Since, $z \in \mathbb{R}$

$$\therefore \text{Solution set} = \{3 < z \leq 4, z \in \mathbb{R}\}$$

It can be represented on a number line as:

**Question 31:**

Solve the following in equation and represent the solution set on the number line.

$$-3 < -\frac{1}{2} - \frac{2x}{3} \leq \frac{5}{6}, x \in \mathbb{R}$$

Solution 31:

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

Multiply by 6, we get

$$\Rightarrow -18 < -3 - 4x \leq 5$$

$$\Rightarrow -15 < -4x \leq 8$$

Dividing by -4 , We get

$$\Rightarrow \frac{-15}{-4} > x \geq \frac{8}{-4}$$

$$\Rightarrow -2 \leq x < \frac{15}{4}$$

$$\Rightarrow x \in \left(-2, \frac{15}{4}\right)$$

The solution set can be represented on a number line as:



Question 32:

Solve the following in equation and represent the solution set on the number line:

$$4x - 19 < \frac{3x}{5} - 2 \leq \frac{-2}{5} + x, x \in R$$

Solution 32:

$$4x - 19 < \frac{3x}{5} - 2 \leq \frac{-2}{5} + x, x \in R$$

$$\Rightarrow 4X - 19 + 2 < \frac{3X}{5} - 2 + 2 \leq \frac{-2}{5} + X + 2, X \in R$$

$$\Rightarrow 4X - 17 < \frac{3X}{5} \leq X + \frac{8}{5}, X \in R$$

$$\Rightarrow 4X - \frac{3X}{5} < 17 \text{ and } \frac{-8}{5} \leq x - \frac{3x}{5}, x \in R$$

$$\Rightarrow \frac{20X - 3X}{5} < 17 \text{ and } \frac{-8}{5} \leq \frac{5X - 3X}{5}, X \in R$$

$$\Rightarrow \frac{17x}{5} < 17 \text{ and } \frac{-8}{5} \leq \frac{2x}{5}, x \in R$$

$$\Rightarrow \frac{x}{5} < 1 \text{ and } -4 \leq x, x \in R$$

$$\Rightarrow x < 5 \text{ and } -4 \leq x, x \in R$$

The solution set can be represented on a number line as:

