CBSE Test Paper 05
CH-06 Linear Inequalities

1. Identify the solution set for –(x – 3) < 5 – 2x
   a. $(-\infty, 2)$
   b. $(-\infty, -1)$
   c. none of these
   d. $(-\infty, -5)$
2. In the first three papers each of 100 marks , Rishi got 95 , 72 , 83 marks . If he wants an average of greater than or equal to 75 marks and less than 80 marks, find the range of marks he should score in the 4th paper .
   a. 73 $<\ \times\ <$100
   b. $50 \leq x < 70$
   c. 25 $<\ \times\ <$75
   d. 75 $<\ \times\ <$80
3. The solution set of 6x $-\ 1\ >\ 5$ is :
   a. none of these
   b. $\{x : x > 1, x \in R\}$
   c. $\{x : x < 1, x \in N\}$
   d. $\{x : x < 1, x \in W\}$
4. Identify the solution set for $\frac{(x-1)}{3} + 4 < \frac{(x-5)}{5} - 2$.
   a. $(-\infty, -50)$
   b. ($-\infty$,-10)

c. $(-\infty, -15)$

d. $(-\infty, -5)$

5. If a , b , c are real numbers such that a $\leq$ b , c $>$ 0, then

a. ac $\leq$ bc

b. ac $<$ bc

c. ac $\geq$ bc

d. ac $>$ bc

6. Fill in the blanks:
The region containing all the solutions of an inequality, is called the ________ region.

7. Fill in the blanks:
A ________ line will divide the xy-plane in two parts, lower half plane and upper half plane.

8. Solve: $\frac{3x-2}{5} \leq \frac{4x-3}{2}$

9. Solve: $\frac{2(x-1)}{5} \leq \frac{3(2+x)}{7}$

10. Solve: 24x < 100, when x is a natural number.

11. Solve the linear inequality in R:
$\frac{5x+8}{4-x}$ < 2

12. Solve the linear inequality $4x + 2 \geq 14$.

13. Check whether the half plane 2x + 3y $\leq$ 24 contains the origin. If so, shade the half plane.

14. The longest side of a triangle is 3 times the shortest side and the third side is 2 cm shorter than the longest side. If the perimeter of the triangle is at least 61 cm. Find the minimum length of the shortest side.

15. Solve the following system of inequations graphically: 2x + y $\geq$ 8, x + 2y $\geq$ 8, x + y $\leq$ 6

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Solution

1. (a) $(-\infty, 2)$

   Explanation:

   $-(x-3) < 5-2x$
   $\Rightarrow -x+3 < 5-2x$
   $\Rightarrow -x+3+x < 5-2x+x$
   $\Rightarrow 3 < 5-x$
   $\Rightarrow 3-5 < 5-x-5$
   $\Rightarrow -2 < -x$
   $\Rightarrow x \in (-\infty, 2)$

2. (b) $50 \leq x < 70$

   Explanation:
   Let the marks scored by Rishi in the fourth paper be x.

   Then$75 \leq \frac{95+72+83+x}{4} < 80$
   $\Rightarrow 75 \leq \frac{250+x}{4} < 80$

   Multipling the inequality throughout by 4 ,we get
   $300 \leq 250+x < 320$
   $\Rightarrow 300-250 \leq 250+x-250 < 320-250$

   $\Rightarrow 50 \leq x < 70$

3. (b) $\{x : x > 1, x \in R\}$

   Explanation:

   $6\text{x} \ - \ 1 \ > \ 5$

   $\Rightarrow 6\text{x} \ - \ 1 \ +1 > \ 5+1$

$\Rightarrow 6x > 6$

$\Rightarrow x > 1$

Hence the solution set is $\{x : x > 1, x \in R\}$

4. (a) $(-\infty, -50)$

   Explanation:

   $\frac{(x-1)}{3} + 4 < \frac{(x-5)}{5} - 2$
   $\Rightarrow \frac{x-1+12}{3} < \frac{x-5-10}{5}$

   $\Rightarrow \frac{x+11}{3} < \frac{x-15}{5}$

   Multiplying both sides byLCM $(3, 5) = 15$,we get
   $\Rightarrow 5(x+11) < 3(x-15)$
   $\Rightarrow 5x + 55 < 3x - 45$
   $\Rightarrow 2x < -100$
   $\Rightarrow x < -50$
   So solution set is$(-\infty, -50)$

5. (a) ac $\leq$ bc

   Explanation:

   The inequality remains same if both sides of an inequality are multiplied by the same positive real number

6. solution

7. non-vertical

8. $\Rightarrow \frac{3x}{5} - \frac{2}{5} \leq \frac{4x}{2} - \frac{3}{2}$
   $\Rightarrow \frac{3x}{5} - \frac{4x}{2} \leq \frac{-3}{2} + \frac{2}{5}$
   $\Rightarrow \frac{6x-20x}{10} \leq \frac{-15+4}{10}$
   $\Rightarrow$ -14x $\leq$ -11
   $\Rightarrow$ 14x $\geq$ 11

$\Rightarrow$ x $\geq \frac{11}{14}$

Therefore, $\left[\frac{11}{14}, \infty\right)$ is the solution set.

9. $\frac{2(x-1)}{5} \leq \frac{3(2+x)}{7}$

$\Rightarrow$ 7(2(x−1)) ≤ 5(3(2+x))

$\Rightarrow$ 14 (x - 1) $\leq$ 15 (2 + x)

$\Rightarrow$ 14x - 14 $\leq$ 30 + 15x

$\Rightarrow$ 14x - 15x $\leq$ 30 + 14

$\Rightarrow$ -x $\leq$ 44

$\Rightarrow$ x $\geq$ -44

$\therefore$ The solution set is $[-44, \infty)$

10. We have 24x < 100

$\Rightarrow \quad \frac{24x}{24} < \frac{100}{24}$ [dividing both sides by 24]

$\Rightarrow \quad x < \frac{25}{6}$

When x is a natural number, then solutions of the inequality are given by $x < \frac{25}{6}$ i.e., all natural numbers x which are less than $\frac{25}{6}$.

Hence, the solution set is {1, 2, 3, 4}

11. $\frac{5x+8}{4-x}$ < 2

$\frac{5x+8}{4-x}$ - 2 < 0

$\frac{5x+8-2(4-x)}{4-x}$ < 0

$\frac{5x+8-8+2x}{4-x}$ < 0

$\frac{7x}{4-x}$ < 0

Case 1: 7x > 0 and 4 - x < 0

$\Rightarrow$ x > 0 and 4 < x

$\Rightarrow$ x > 0 and x > 4

$\Rightarrow$ x > 4

Case 2: 7x < 0 and 4 - x > 0

$\Rightarrow$ x < 0 and 4 > x

$\Rightarrow$ x < 0 and x < 4

$\Rightarrow$ x < 0

Hence, solution set is (-∞, 0) $\cup$ (4, ∞).

12. We have, $4x+2 \geq 14$

$\Rightarrow \quad 4x+2-2 \geq 14-2$ [subtracting 2 from both sides]

$\Rightarrow \quad 4x \geq 12$

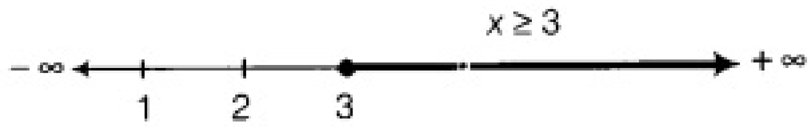
$\Rightarrow \quad \frac{4x}{4} \geq \frac{12}{4}$ [dividing both sides by 4]

$\therefore x \geq 3$

Thus, any value of x greater than or equal to 3 satisfies the inequality.

So, the solution set is $x \in [3, \infty)$.

This solution set can be represented on number line as given below



Hence, the dark portion on the number line represents the solution of given inequality.

13. The given half plane is

2x + 3y $\leq$ 24 ...(i)

On putting x = 0 and y = 0 in Eq. (i) we get

2 (0) + 3 (0) $\leq$ 24 $\Rightarrow$ 0 $\leq$ 24 which is true.

$\therefore$ The given half plane contains the origin.

In equation form, the given inequality can be written as,

2x + 3y = 24 ...(ii)

On putting x = 0 in Eq. (ii) we get

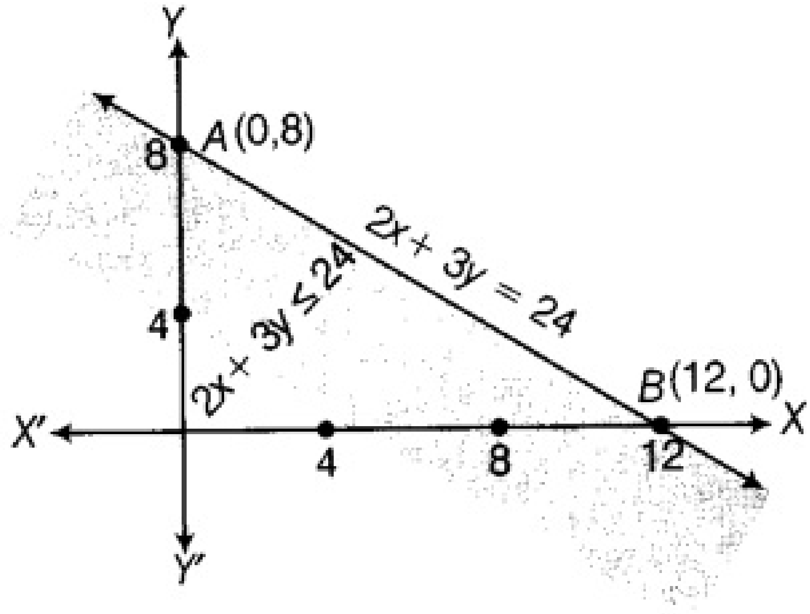
0 + 3y = 24 $\Rightarrow$ y = 8

Thus, line 2x + 3y = 24 meet the Y - axis at point (0, 8).

On putting y = 0 in Eq. (ii), we get

2x + 0 = 24 $\Rightarrow$ x = 12

Thus, line 2x + 3y = 24 meet the X-axis at point (12,0). Now, draw a dark line joining the points (0, 8) and (12, 0) which divide the plane in two half planes. Since, origin contained by the given half plane. So, shade that half plane which contain origin i.e., the region below the line AB (including all points on the line).



14. Let the length of the shortest side be x cm.
    Then length of longest side = 3x cm
    length of third side = (3x - 2)cm
    Perimeter of triangle = x + 3x + 3x - 2
    = (7x - 2)cm
    Now $7x - 2 \geqslant 61$
    $\Rightarrow 7x \geqslant 61 + 2 \Rightarrow 7x \geqslant 63 \Rightarrow x \geqslant 9$
    Thus the minimum length of shortest side = 9 cm

15. We have,
    2x + y $\geq$ 8, x + 2y $\geq$ 8, x + y $\leq$ 6
    Converting the inequations into equations we obtain,
    2x + y = 8, x + 2y = 8, x + y = 6

    Region represented by 2x + y $\geq$ 8:
    Putting x = 0 in 2x + y = 8, we get y = 8,
    Putting y = 0 in 2x + y = 8, we get x = $\frac{8}{2}$ = 4
    $\therefore$ The line 2x + y = 8 meets the coordinates axes at (0,8) and (4,0). Join these points by a thick line.
    Now, putting x = 0 and y = 0 in 2x + y $\geq$ 8, we get 0 $\geq$ 8 This is not possible.
    $\therefore$ We find that (0,0) not satisfies the inequation, 2x + y $\geq$ 8.
    So, the portion not containing the origin is represented by the given inequation.

Region represented by $x + 2y \geq 8$:

Putting x = 0 in x + 2y = 8, we get $y = \frac{8}{2} = 4$

Putting y = 0 in x + 2y = 8, we get x = 8.

$\therefore$ The line x + 2y = 8 meets the coordinate axes at (0,4) and (8,0). Joining these points by a thick line.

Now, putting x = 0 and y = 0 in $x + 2y \geq 8$, we get, $0 \geq 8$, This is not possible.

$\therefore$ We find that (0,0) does not satisfy the inequation, $x + 2y \geq 8$, so the portion not containing the origin is represented by the given inequation.

Region represented by $x + y \leq 6$:

Putting x = 0 in x + y = 6, we get y = 6.

Putting y = 0 in x + y = 6, we get x = 6.

$\therefore$ The line x + y = 6 meets the coordinate axes at (0,6) and (6,0). Joining these points by a thick line. Now, putting x = 0 and y = 0 in $x + y \leq 6$, we get $0 \leq 6$. Therefore, (0, 0) satisfies $x + y \leq 6$, so the portion containing the origin is represented by the given inequation.

The common shaded region of the above three regions represented the solution set of the given inequation as shown below: