8. LINEAR INEQUATIONS

EXERCISE 8.1

1) Write the inequations that represent the interval and state whether the interval is bounded or unbounded.

(I) $(-4, 7/3)$

Sol: The inequation is $-4 \leq x \leq \frac{7}{3}$

Here, $x \in \mathrm{R}$ can take all values between -4 and $\frac{7}{3}$ (both inclusive).

∴ The interval is bounded (closed).

(II) $(0, 0.9)$

Sol: The inequation is $-4 < x \leq 0.9$

Here, $x \in \mathrm{R}$ can take all values between 0 and 0.9 (excluding 0, but including 9)

∴ The interval is bounded (semi-right closed).

(III) $(-\infty, \infty)$

Sol: The inequation is $-\infty < x < \infty$

Here, $x \in \mathrm{R}$ can take all values between $-\infty$ And ∞ (both exclusive)

∴ The interval is unbounded.

(IV) $[5, \infty]$

Sol: The inequation is $5 \leq x < \infty$

Here, $x \in \mathrm{R}$ can take all values between 5 and ∞ (including 5, but excluding ∞)

∴ The interval is unbounded (semi left closed).

(V) $(-11, -2)$

Sol: The inequation is $-11 < x < -2$
Here, $x \in \mathrm{R}$ can take all values between -11 and -2 (both exclusive).

∴ The interval is bounded (open).

(VI) $(-\infty, 3)$

Sol: The inequation is $-\infty < x < 3$
Here, $x \in \mathrm{R}$ can take all values between $-\infty$ and 3 (both exclusive).

∴ The interval is unbounded.

2. Solve the following inequations:

(I) $3x - 36 > 0$

Sol: $3x - 36 > 0 \Rightarrow 3x > 36 \Rightarrow x > 12$
Solution set: $(12, \infty)$

(II) $7x - 25 \leq -4$

Sol: $7x - 25 \leq -4 \Rightarrow 7x \leq 25 - 4 \Rightarrow 7x \leq 21 \Rightarrow x \leq 3$
Solution set: $(-\infty, 3)$

(III) $0 < \frac{x-5}{4} < 3$

Sol: $0 < \frac{x-5}{4} < 3$

Multiply by 4, we get
$0 < x - 5 < 12$
i.e. $0 < x - 5$ and $x - 5 < 12$

i.e. $5 < x$ and $x < 17$

i.e. $x > 5$ and $x < 17$

i.e. $5 < x < 17$
Solution set: $(5,17)$

(IV) $|7x - 4| < 10$

Sol: If $|x| < k$, then $-k < x < k$

$\therefore -10 < 7x - 4 < 10$

Add 4 to each part of inequation.

$-10 + 4 < 7x - 4 + 4 < 10 + 4$

$\therefore -6 < 7x < 14$

Divide by 7

$-\frac{6}{7} < x < 2$

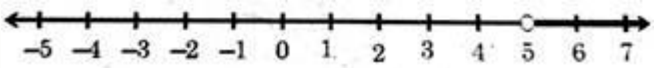
Solution set: $(-6/7, 2)$

3. Sketch the graph which represents the solution set for the following inequations.

(I) $x > 5$

Sol: The solution set of the given inequation is $(5, \infty)$

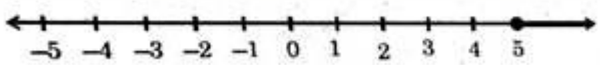
$\therefore$ The graph is:



(II) $x \geq 5$

Sol: The solution set of the given inequation is $(5, \infty)$

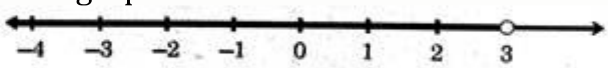
$\therefore$ The graph is:



(III) $x < 3$

Sol: The solution set of the given inequation is $(-\infty, 3)$

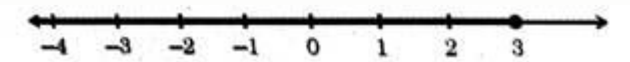
$\therefore$ The graph is:



(IV) $x \leq 3$

Sol: The solution set of the given inequation is $(-\infty, 3)$

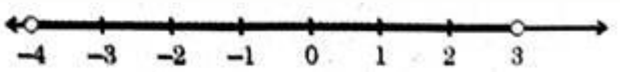
$\therefore$ The graph is:



(V) $-4 < x < 3$

Sol: The solution set of the given inequation is $(-4,3)$

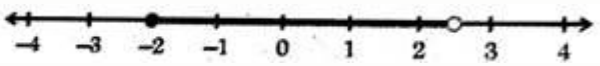
$\therefore$ The graph is:



(VI) $-2 \leq x < 2.5$

Sol: The solution set of the given inequation is $(-2,2.5)$

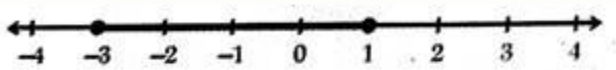
$\therefore$ The graph is:



(VII) $-3 \leq x \leq 1$

Sol: The solution set of the given inequation is $(-3,1)$

$\therefore$ The graph is:



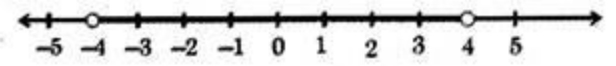
(VIII) $|x| < 4$

Sol: $\because$ $|x| < 4$

$\therefore$ $-4 < x < 4$

The solution set of the given inequation is $(-4,4)$

∴ The graph is:



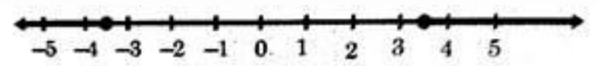
(IX) $|x| \geq 3.5$

Sol: ∵ $|x| \geq 3.5$

∴ $X \geq 3.5$ or $X \leq 3.5$

The solution set of the given inequation is $(-\infty, 3.5] \cup [3.5, \infty)$

∴ The graph is:



4. Solve the inequations.

(I) $5x + 7 > 4 - 2x$

Sol: ∴ $5x + 7 > 4 - 2x$

∴ $5x + 2x > 4 - 7$

∴ $7x > -3$

∴ $x > -3/7$

Solution Interval: The solution set is unbounded open interval $(-3/7, \infty)$

(II) $3x + 1 \geq 6x - 4$

Sol: $3x + 1 \geq 6x - 4$

∴ $3x + 1 + 4 \geq 6x$

∴ $3x + 5 \geq 6x$

∴ $5 \geq 3x$

∴ $\frac{5}{3} \geq x$

$\therefore x \le 5/3$

Solution Interval: The solution set is unbounded open interval $(-\infty, 5/3)$

(III) $\mathbf{4 - 2x < 3(3 - x)}$

Sol: $4 - 2x < 3(3 - x)$

$\therefore 4 - 2 < 9 - 3x$
$\therefore 4 - 2x + 3x < 9$

$\therefore x < 9 - 4$

$\therefore x < 5$

Solution Interval: The solution set is unbounded open interval $(-\infty, 5)$

(IV) $\mathbf{(3/4)x - 6 \le x \le -7}$

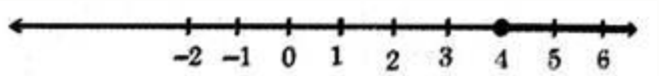
Sol: $\frac{3}{4}x - 6 \le -7 \quad \Rightarrow 3x - 24 \le 4 - 28$

$\Rightarrow -24 \le 4x - 28 - 3x \Rightarrow -24 + 28 \le x$

$\Rightarrow 4 \le x \quad \Rightarrow x \ge 4$

Solution set: The solution Set of the inequation is the set of all real values of x which are greater than 4. **Solution Interval:** The solution set is unbounded set semi closed left interval $[4, \infty)$

Solution Graph on number line:



(V) $\mathbf{-8 \le -(3x - 4) < 13}$

Sol: $-8 \le -(3x - 4) < 13$
Multiply the inequation by -1, the sign of inequality changes.

$8 \ge 3x - 5 > -13$

Add 5: $8+5 \geq 3x-5+5 > -13+5$

$13 \geq 3x > -8$

$\frac{13}{3} \geq x > \frac{-8}{3}$ or $\frac{-8}{3} < x \leq \frac{13}{3}$

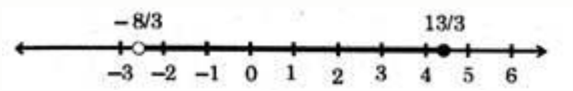
Solution set: The solution set of the inequation is the set of all values of x

between $\frac{-8}{3}$ and $\frac{13}{3}$ excluding left boundary

point and including right boundary point.

Solution Interval: The solution set is semi right closed interval $\left(\frac{-8}{3}, \frac{13}{3}\right)$

Solution Graph on number line:



(VI) $\mathbf{-1 < 3 - \left(\frac{x}{5}\right) \leq 1}$

Sol: $-1 < 3 - \left(\frac{x}{5}\right) \leq 1$

Multiplying the inequation by 5, the sign of inequality changes

$5 > -15 + x > -5$

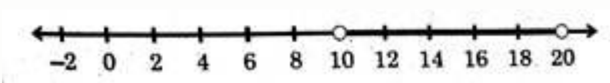
Adding 15 on both the sides, we get

$20 > x > 10 \qquad \Longrightarrow 10 < x < 20$

Solution Set: The solution contains all the real values of x lying between 10 and 20, excluding the boundary value.

Solution Interval: The solution set can be written in the form of open interval $(10, 20)$.

Solution Graph on number line:



(VII) $2|4-5x| \geq 9$

Sol: Dividing the inequality by $2,$ we get

$|4-5x| \geq \frac{9}{2}$

We know that $|x^2| \geq k$ implies $x < -k$

or $x > k$

$\therefore 4-5x \geq -\frac{9}{2}$ or $4-5x \geq +\frac{9}{2}$

Multiplying the inequations by -1, sign of inequation changes.

$-4+5x \geq \frac{9}{2}$ or $-4+5x \leq -\frac{9}{2}$

$\therefore 5x \geq 4+\frac{9}{2}$ or $5x \leq 4-\frac{9}{2}$

$\therefore x \geq \frac{17}{10}$ or $x \leq -\frac{1}{10}$

$\therefore x \geq 1.7$ or $x \leq -0.1$

$\therefore x \leq -0.1$ or $x \geq 1.7$

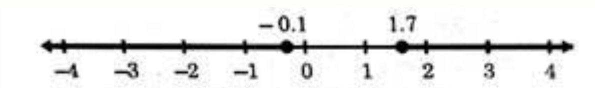
Solution Set: The solution set contains all real values of x which are either less than equal to -0.1 or greater than or equal to 1.7

Solution Interval: $x \leq -0.1$ means all the real values less than equal to -0.1i.e. interval ($-\infty, -0.1$] and $x \geq 1.7$ implies the interval [$1.7, \infty$)

$\therefore x \leq -0.1$ or $x \geq 1.7$ can be written as interval

$(-\infty, -0.1] \cup [1.7, \infty)$

Solution Graph:



(VIII) $|2x+7| \leq 25$

Sol: We know that $|x| \leq k$ implies $-k \leq x \leq k$

$|2x+7| \leq 25$ implies $-25 \leq 2x+7 \leq 25$

Thus, we have

$-25 \le 2x + 7 \le 25$

Subtract 7 from each part,

$25 - 7 \le 2x + 7 - 7 \le 25 - 7$

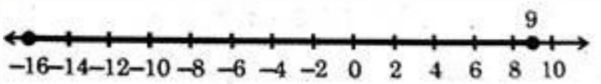
$-32 \le 2x \le 18$

Divide by $2,$

Solution Set: The inequation $|2x + 7| \le 25$ has its solution as all real values of x lying between and including -16 and 9

Solution Interval: The interval of solution set is a closed interval $[-16, 9]$

Solution Graph on number line:



(IX) $\mathbf{2|x + 3| > 1}$

Sol: $2|x + 3| > 1$

Dividing the inequality by 2

$\therefore |x + 3| > 1$

Now, $|x| > k$ implies $x < -k$ or $x > k$

$\therefore (x + 3) < \frac{-1}{2}$ or $(x + 3) > \frac{1}{2}$

$\therefore x < \frac{-1}{2} - 3$ or $x > \frac{1}{2} - 3$

$\therefore x < \frac{-1-6}{2}$ or $x > \frac{1-6}{2}$

$\therefore x < \frac{-7}{2}$ or $x >$

$\frac{-5}{2}$ **Solution set:** The solution set contains all real values of x which are either less

than

$\frac{-7}{2}$ or greater than $\frac{-5}{2}$

Solution Interval: $x < \frac{-7}{2}$ means all the real values less than $\frac{-7}{2}$, i.e. interval

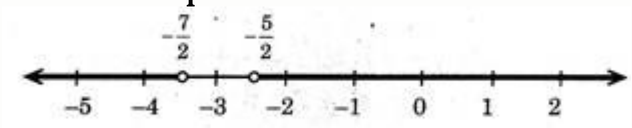
$\left(-\infty \frac{-7}{2}\right)$ and $x > \frac{-5}{2}$ implies the interval

$\left(\frac{-5}{2} \infty\right)$

$\therefore x < \frac{-7}{2}$ or $x > \frac{-5}{2}$ can be written as interval

$\left(-\infty \frac{-7}{2}\right) \cup \left(\frac{-5}{2} \infty\right)$

Solution Graph:



(X) $\frac{x+5}{x-3} < 0$

Sol: We know that if $\frac{a}{b} < 0$

Then either $a > 0$ or $b < 0$

or $a < 0$ or $b > 0$

$\therefore \frac{x+5}{x-3} < 0 \Rightarrow$ either $x + 5 < 0$ and $x - 3 > 0$

Case I: $x + 5 < 0$ and $x - 3 > 0$

or $x < -5$ and $x > 3$

Which is not possible as x can not be simultaneously less than -5 and greater than 3

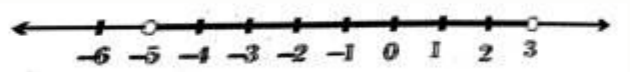
Case II: $x + 5 > 0$ and $x - 3 < 0$

or $x > -5$ and $x < 3$

or $-5 < x < 3$

Which is an open interval $(-5,3)$ where x can take any value between -5 to 3.

Solution graph:



(XI) $\frac{x-2}{x+5} > 0$

Sol: If $\frac{a}{b} > 0,$ then either $a > 0$ and $b > 0$

or $a < 0$ and $b < 0$

Case I:

$\frac{x-2}{x+5} > 0 \Rightarrow x - 2 > 0$ and $x + 5 > 0$

$x > 2$ and $x > -5$

If $x > 2$ then already $x > -5$, therefore we can consider $x > 2$.

The solution set is $(2, \infty)$.

Case II:

$\frac{x-2}{x+5} > 0 \Rightarrow x - 2 < 0$ and $x + 5 < 0$

$x < 2$ and $x < -5$

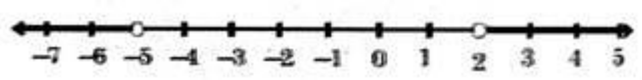
If , $x < -5,$ then also $x < 2$.

The solution set is $(-\infty, -5)$

Combining both the cases, we can take solution set as $(-\infty, -5) \cup (2, \infty)$ or

$\{x; x < -5 \text{ or } x < 2\}$

Solution graph:



5) Rajiv obtained 70 and 75 marks in first two unit tests. Find the minimum marks he should get in the third test to have an average of at least 60 marks.

Sol: Let Rajiv obtain 'x' marks in the third test. Rajiv obtained 70 and 75 marks in the
first two unit tests. $\therefore$ Average of his marks in the three tests

$$= \frac{x+70+75}{3}$$

$$= \frac{x+145}{3}$$

$\therefore$ The average of marks should be at least 60

$$\therefore \frac{x+145}{3} \geq 60$$

$$\therefore x + 145 \geq 180$$

$$\therefore x \geq 180 - 145$$

$$\therefore x \geq 35$$

Rajiv should get minimum 35 marks in the third test.

6) To receive Grade 'A' in a course, one must obtain an average of 90 marks or more in five examinations (each of 100 marks). If Sunita's marks in first four examinations are 87, 92, 94 and 95, find minimlim marksthat Sunita must obtain in fifth examination to get grade 'A' in the course.

Sol: Let Sunita obtain 'x' marks in the fifth examination. Sunita's marks in the first four examination are 87, 92, 94 and 95.
Average of her marks in the five examinations

$$= \frac{x+87+92+94+95}{5}$$

$$= \frac{x+368}{5}$$

To receive grade A, Sunita's average should be 90 or more.

$$\therefore \frac{x+368}{5} \geq 90$$

$$\therefore x + 368 \geq 450$$

$$\therefore x \geq 450 - 368$$

$\therefore x \geq 82$

∴ Sunita must get minimum 82 marks in the fifth examination.

7) Find all pairs of consecutive odd positive integers both of which are smaller than 10 such that their sum is more than 11.

Sol: Let the Consecutive odd positive integers be $'x'$ and $'x+2'$.
Sum of the numbers is more than 11

$\therefore x + (x+2) > 11$

$\therefore 2x + 2 > 11$

$\therefore 2x > 11 - 2$

$\therefore 2x > 9$

$\therefore x > \frac{9}{2}$

$\therefore x > 4.5$

It is also stated that the numbers are less than 10. The immediate odd positive integer greater than 4.5 and less than 10 is 5.

When $x = 5$; $x + 2 = 5 + 2 = 7$

When $x = 7$; $x + 2 = 7 + 2 = 9$

When $x = 9$; $x + 2 = 9 + 2 = 11$

But, the numbers should be less than 10

$\therefore x + 2 = 11$ is discarded.
The pairs are $(5,7)$ and $(7,9)$
8) Find all pairs of consecutive even positive integers, both of which are larger than 5 such that their sum is less than 23.

Sol: Let the consecutive even positive integers be 'x' and '$x+2$'.

Sum of the members is less than 23

$\therefore x + (x + 20 < 23$

$\therefore 2x + 2 < 23$

$\therefore 2x < 23 - 2$

$\therefore 2x < 21$

$\therefore x < \frac{21}{2}$

$\therefore x < 10.5$

It is also stated that the numbers are larger than 5.
The immediate even positive integer greater than 5 and less than 10.5 is 6.

When $x = 6$; $x + 2 = 6 + 2 = 8$

When $x = 8$; $x + 2 = 8 + 2 = 10$

When $x = 10$; $x + 2 = 10 + 2 = 12$

$\therefore$ The pairs are $(6, 8)$, $(8, 10)$ and $(10, 12)$

9) The longest side of a triangle is twice the shortest side and the third side is 2cm longer than the shortest side. If the perimeter of the' triangle is more than 166 cm then find the minimum length of the shortest side.

Sol: Let the sides of the triangle be a, b, c such that $a > b > c$.
The longest side is twice the shortest side

$\therefore a = 2c$

The third side is 2 cm longer than the shortest side.

$\therefore b = c + 2$

$\therefore$ Perimeter of the triangle $= a + b + c$
$= 2c + (c + 2) + c$
$= 4c + 2$

But, perimeter of the triangle is more than 166 cm.

$\therefore 4c + 2 > 166$

$\therefore 4c > 166 - 2$

$\therefore 4c > 164$

$\therefore c > \frac{164}{4}$

$\therefore > 41.$

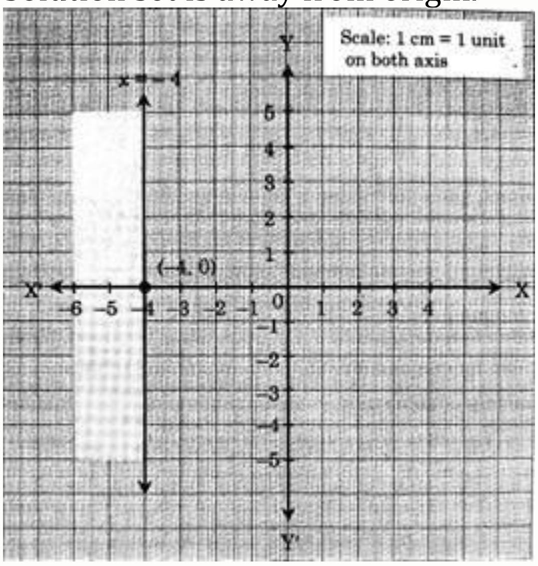
The minimum length of the shortest side is 41 cm.

EXERCISE 8.2

1) Solve the following inequations graphically in two-dimensional plane

(I) $x \leq -4$

Sol: Consider the equation $x = -4$.
It is the equation of the line passing through $(-4, 0)$ and parallel to Y-axis. If we put $x = 0$, then $0 \leq -4$ does not satisfy the inequation.
Solution set is away from origin.

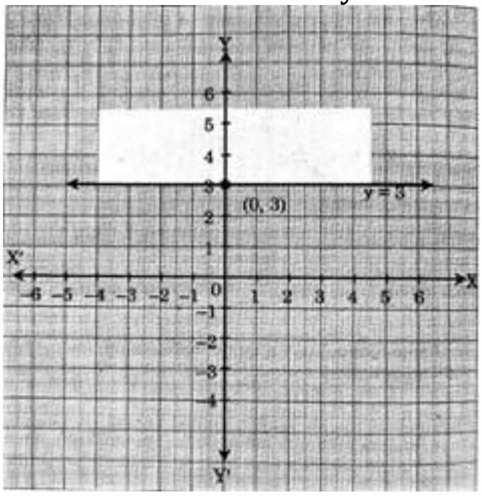


(II) $y \geq 3$

Sol: Consider the equation $y = 3$.
It is the equation of a line parallel to Y-axis passing through the point $(0, 3)$ on the Y-axis.

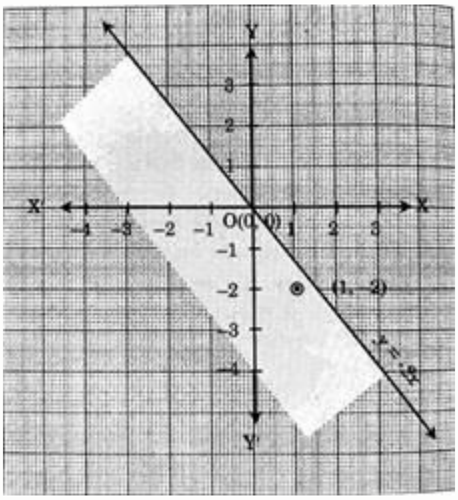
Choose the point $O(0, 0)$.
$0 \geq 3$ does not satisfy the inequation.

The solution set is away from the origin.



(III) $\boldsymbol{y \leq -2x}$

Sol: Consider the equation $y = 2x$.
This is the equation of a line passing through origin in third and fourth quadrant inclined.
more towards Y-axis.



Consider a point $(2, 1)$.

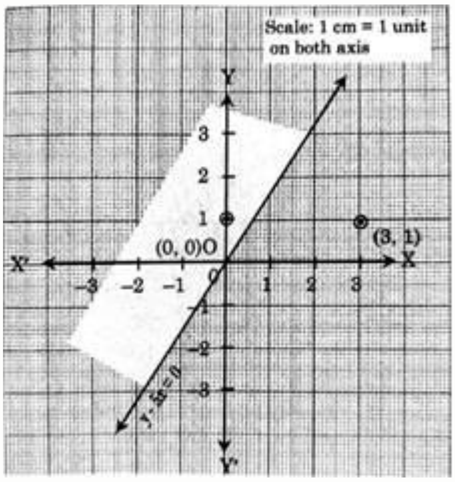
Substitute in equation
$y \leq -2x \Rightarrow 1 \leq 2(2) \Rightarrow 1 \leq -4$

shows that point $(2, 1)$ does not satisfy the inequation.
The solution is in the other plane away from that point.

(IV) $\boldsymbol{y - 5x \geq 0}$

Sol: The equation $\boldsymbol{y - 5x \geq 0}$ of the form $y = 5x$, which shows that the line passes through the origin in first and third quadrant more inclined towards Y-axis. Since the line passes through the origin, it can not be taken as a landmark for the solution set.

Consider another point, say $(3, 1)$ on the graph.



The inequation is

$y - 5x \leq 0$

Put $x = 3, y = 1$ in the inequation

$y - 5x \geq 0$

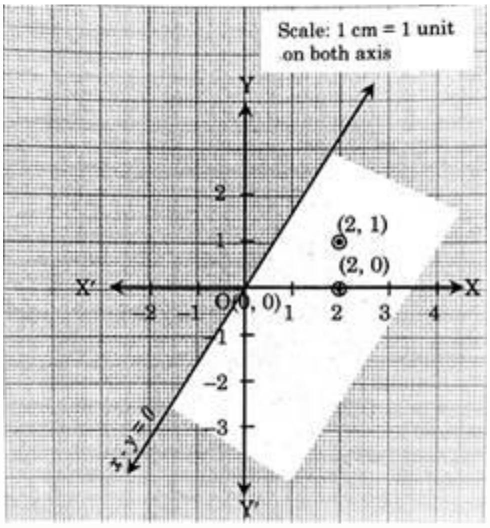
$1 - 5(3) = -14 \geq 0$

Which shows that the solution set is not containing the point $(3, 1)$.
The solution set does not contain the point $(3, 1)$.

(V) $x - y \leq 0$

Sol: Consider the equation $x - y = 0$ which shows that $y = x$ is the equation of the line passing through the origin and divides quadrants in to equal parts. So, the origin can not be considered as a landmark for the solution set. We have to consider another point say $(2, 1)$ to judge the plane of the solution set

.



The inequation is $x - y \geq 0$

$$2 - 1 \geq 0$$

$$1 \geq 0$$

(VI) $\boldsymbol{x - y \leq -2}$

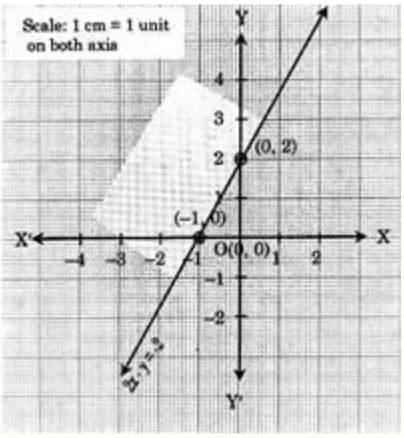
Sol: Consider the equation $2x - y = -2$
Two points on the axes are given as

x	-1	0
y	0	2

i.e. $(-1, 0)$ on the X-axis and $(0,2)$ on Y-axis.
If we put $x = 0, y = 0$ then.
$2(0) - 0 \leq -2$

$0 \leq -2$

Which shows that the origin is hot satisfying the inequation.
Solution set is lying on the line as Well as in the plane away from the origin.



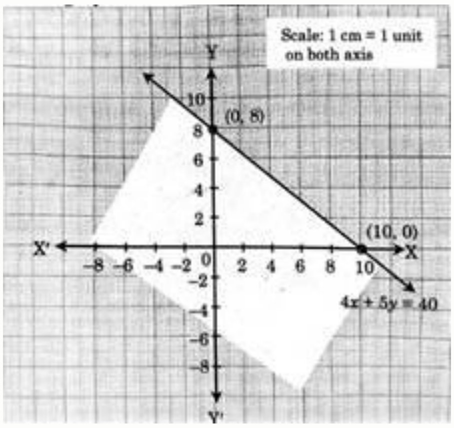
(VII) $4x + 5y \le 40$

Sol: Consider the equation $4x + 5y \le 40$
Two points required to draw the line are given by the table

x	10	0
y	0	8

The two points on the coordinate axes are $(10, 0)$ and $(0, 8)$ respectively.
Since the inequality is $4x + 5y \le 40$, the origin $O(0, 0)$ will satisfy the inequation as
$4x + 5y \le 40$
i.e. $0 \le 40$. T

The solution set is in the part of plane towards the origin.

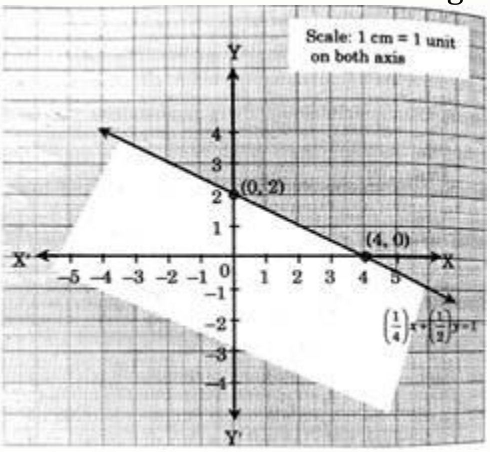


(VIII) $(1/4)x + (1/2)y \le 1$
Sol: $x + 2y \le 4$
Consider the equation $x + 2y - 4$
The two points required to plotting the line on the graph are

x	4	0
y	0	2

$(4, 0)$ and $(0, 2)$ on the X and Y axe respectively.
Substitute $x = 0, y = 0$ in the inequation.
$0 + 2(0) \leq 4$
i.e. $0 \leq 4$.

Origin satisfies the inequation on showing that the solution set contains origin.
The solution set is towards origin.



2. Mr. Rajesh. Has Rs. $1,800$/- to spend on fruits for a meeting. Grapes cost Rs. 150 /- per kg and peaches cost Rs. 200/- per kg. Formulate and solve it graphically.

Sol: The cost of grapes = Rs.150/- per kg.
Let x kg of grapes be bought.
Then total cost of grapes = 150 x
The cost of peaches = Rs.200/- per kg.
Let y kg of peaches be bought.
Then total cost of peaches = 200 y
Since Mr. Rajesh has total amount Rs. $1{,}800$ to spend on fruits.
His total expenses $150x + 200\,y$ should be less than or equal to 1800.
Inequation is $150x + 200y \leq 1800$

$\Rightarrow 3x + 4y \leq 36$

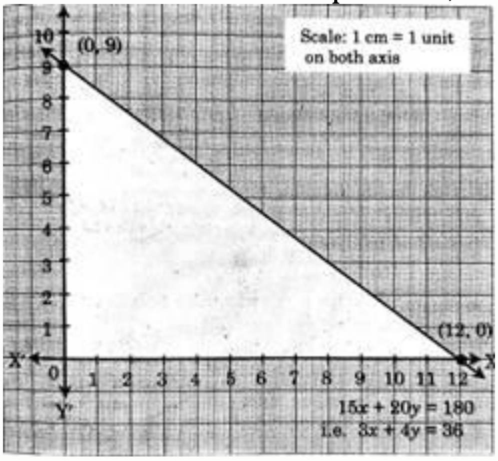
$x, y \geq 0$ as the quantities of grapes and peaches can't be negative.

Points on axes are

x	12	0

y	0	9

$(12, 0)$ on X-axis and $(0, 9)$ on Y axis.
Since origin satisfies the inequation, solution set is towards origin.
Since x and y are both positive, solution lies in first quadrant only.



3) Diet of a sick person must contain at least 4000 units of vitamins. Each unit of food F1 contains 200 units of vitamins, where as each unit of food F2 contains 100 units of vitamins. Write an inequation to fulfil sick person's requirements. Represent the solution set graphically.

Sol: Let x units of vitamins be consumed in food
F1 and y units of vitamins be consumed in food F2 by sick person.
One unit of food F1 contains

$= 200$ units of vitamins
One unit of food F2 contains

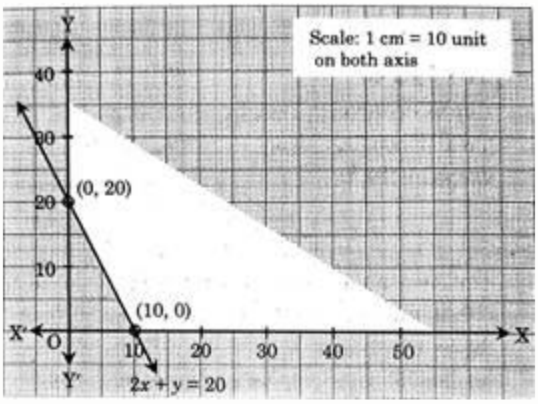
$=$ 100 units of vitamins
Total vitamin consumption $= 200x + 100y$
As minimum requirement $= 4000$ units consumption will either greater than or equal to 4000.
The inequation is $200x + 100y \geq 4000$
or $2x + y \geq 20, x \geq 0, y \geq 0$
For drawing the graph, consider $2x + 4y = 20$.
The two points required for the plotting the line are

x	10	0
y	0	20

$(10, 0)$ on X axis and $(0,20)$ on Y axis. $x = 0$
Substitute the coordinate of origin ,
$y = 0$
in the inequation
$2(0) + 0 \geq 20 \Rightarrow 0 \geq 20$

which shows that the origin is not satisfying the inequation.

∴ Plane containing solution 1s away from the origin.
Solution set is in first quadrant only.



__EXERCISE 8.3__

1) Find the graphical solution of the following system of linear inequations:

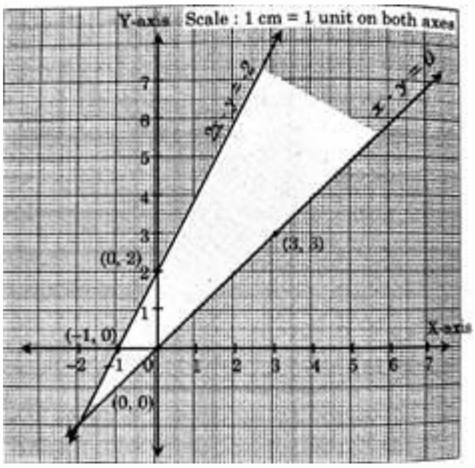
(I) $\boldsymbol{x - y \leq 0, 2x - y \geq -2}$

Sol: Writing the above inequalities as equations
$x - y = 0$

x	0	3
y	0	3
(x, y)	(0,0)	(3,3)

$2x - y = -2$

x	0	−1
y	2	0
(x, y)	(0,2)	(−1,0)



The inequality $x - y \leq 0$ represents the region above the line,
in dividing the points on the line $x - y = 0$.
The inequality $2x - y \geq 2$ represents the region below the line,
including the points on the line $2x - y = -2$.

∴ The shaded region between the lines represents the solution of the given inequations.

(II) $\mathbf{2x + 3y \geq 12; -x + y \leq 3, x \leq 4;\ y \leq 3.}$

Sol: The given equations in system are

$2x + 3y \geq 12; -x + y \leq 3, x \leq 4;\ y \leq 3$

Consider the equations:

$2x + 3y = 12$

x	6	0
y	0	4

The two points on the coordinate axes are
$(6, 0)$ and $(0, 4)$.

Origin $(0, 0)$ does not satisfy the inequation as
$2(0) + 3(0) \geq 12$

i.e. $0 \geq 12$ which is not true.

∴ Solution set is always from the origin·

$-x+y=3$

x	-3	3
y	0	3

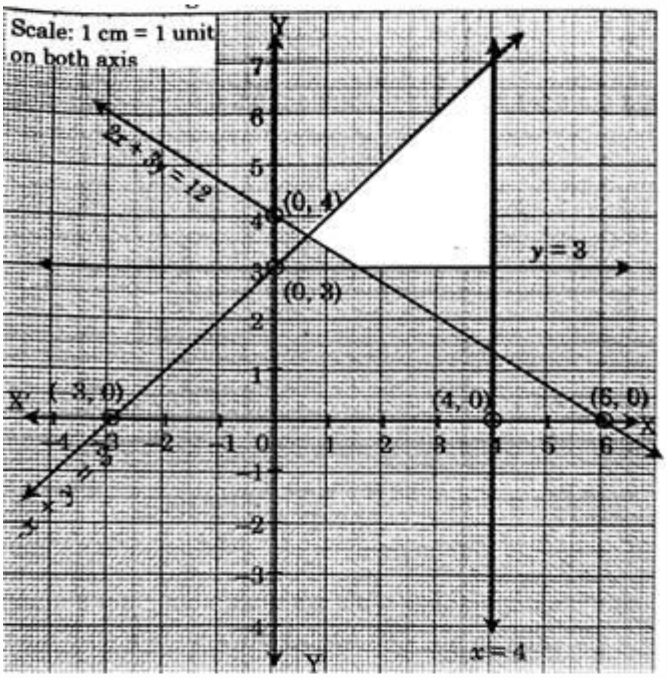
The points on the coordinate axes are
$(3, 0)$ and $(0, 3)$.
Origin $(0, 0)$ satisfies the inequation as
$-0 + 0 \leq 3$ i.e. $0 \leq 3$ which is true.
Solution set is towards origin.

For $x \leq 4$, consider $x = 4$. Equation of line which passes through the point $(4, 0)$ and

since $0 \leq 4$ implies solution is towards origin.

For $y \geq 3$, consider $y = 3$ which is the equation of a line passing through (0, 3) and parallel to X-axis.

As $0 \geq 3$ is not possible, solution set is away from origin,



(III) $3x + 2y \leq 1800;\ 2x + 7y \leq 1400, 0 \leq x \leq 350; 0 \leq y \leq 150.$

Sol: Inequations System of inequalities contains the
$3x + 2y \leq 1800;\ 2x + 7y \leq 1400, 0 \leq x \leq 350; 0 \leq y \leq 150.$

Consider the equations:
$3x + 2y = 1800$

x	600	0
y	0	900

The two points required for plotting graph on the axes are
$(600, 0)$ and $(0, 900)$ respectively.

$\because 3(0) + 2(0) \leq 1800.$.

i.e. $0 \leq 1800$
Origin satisfies the inequation« showing that the solution set is towards origin.
$2x + 7y = 1400$

x	700	0
y	0	200

The two points on the axes are $(700, 0)$ and $(0, 200)$ respectively.
$\because 2(0) + 7(0) \leq 1400$

$\Rightarrow\ 0 \leq 1400$

Showing that the inequation satisfies the inequations solution set is towards origin.
The two double inequations are

$0 \leq x \leq 350$ and $0 \leq y \leq 150$

Which can be written as:

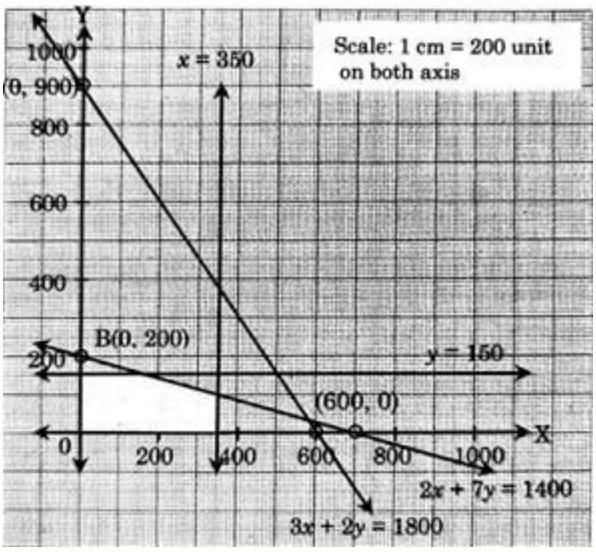
$0 \leq x$ and $x \leq 350$ $\quad 0 \leq y$ and $y \leq 150$
For $x \leq 350$, consider $x = 350$.

It is the equation of a line passing through $(350,0)$ and parallel to Y axis.
For $y \leq 150$, consider $y = 150$.

The line passes through $(0, 150)$ and parallel to X axis.

$\because$ Both the inequations $x \leq 350$ and $y \leq 150$ satisfy the origin.

$\therefore$ Solutions sets are towards the origin.
The conditions $x, y \leq 0$ show that the common solution set of system lies in first quadrant.



The line $3x + 2y \leq 1800$ has not contributed to solution set.

$\therefore$ It is known as redundant.

(IV) $\frac{x}{60} + \frac{y}{90} \leq 1, \frac{x}{120} + \frac{y}{75} \leq 1$

Sol: Consider the equations:
$\frac{x}{60} + \frac{y}{90} \leq 1,$

x	60	0
y	0	90

The two points on the axes are $(60, 0)$ and $(0, 90)$ as in the equation 60 and 90 are x and y intercepts,
(x and y are equivalent to X and Y axes.)

$\because$ The inequation

$\frac{x}{60} + \frac{y}{90} \leq 1$ satisfies the origin.
Solution set is towards origin.

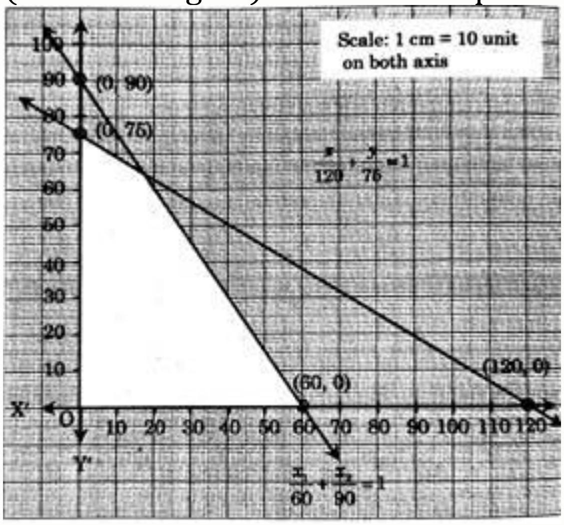
$\frac{x}{120} + \frac{y}{75} \leq 1$

x	120	0
y	0	75

The two points on the axes are $(120, 0)$ and $(0, 75)$ respectively. The inequation

$\frac{x}{120} + \frac{y}{75} \leq 1$ satisfies the origin.

Solution set of the inequation is towards origin
$x \geq 0, y \geq 0$ are the inequations showing thw conditions that the solutions set (common region) is in the first quadrant



(V) $\mathbf{3x + 2y \leq 24; 3x + y \geq 15; x \geq 4.}$

Sol: Writing the above inequalities as equations
$3x + 2y \leq 24$

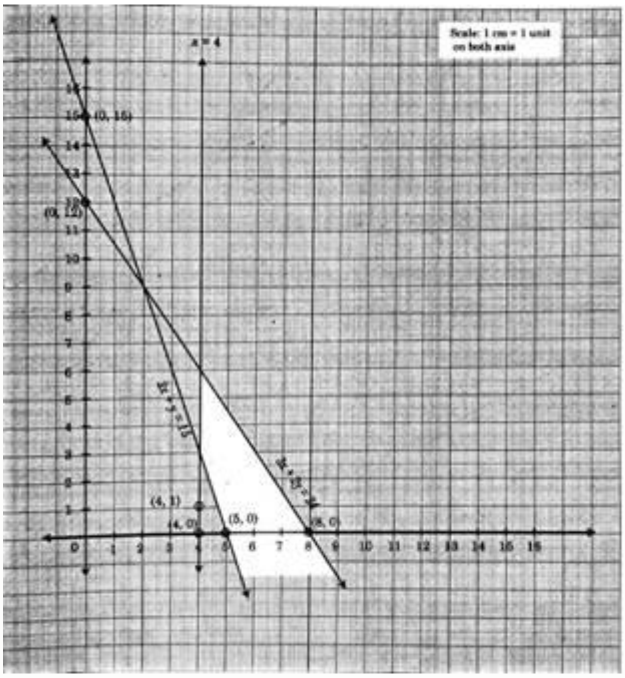
x	0	8
y	12	0
(x, y)	(0,12)	(8,0)

$3x + y \geq 15$

x	0	5
y	15	0
(x, y)	(0,15)	(5,0)

$x \geq 4$

x	4	4
y	0	1
(x, y)	(4,0)	(4,1)



The inequality $3x + 2y \leq 24$ represents the region below the line including the points on the line

$3x + 2y = 24.$

The inequality $3x + y \geq 15$ represents the region above the line, including the points on the line

$3x + y = 15.$

The inequality $x \geq 4$ repyesents the region to the right of the line, including the points on the line

$x = 4.$

∴ The shaded region between the lines represents the solution of the given inequality.

(VI) $2x + y \geq 8; x + 2y \geq 10; x \geq 0; y \geq 0$

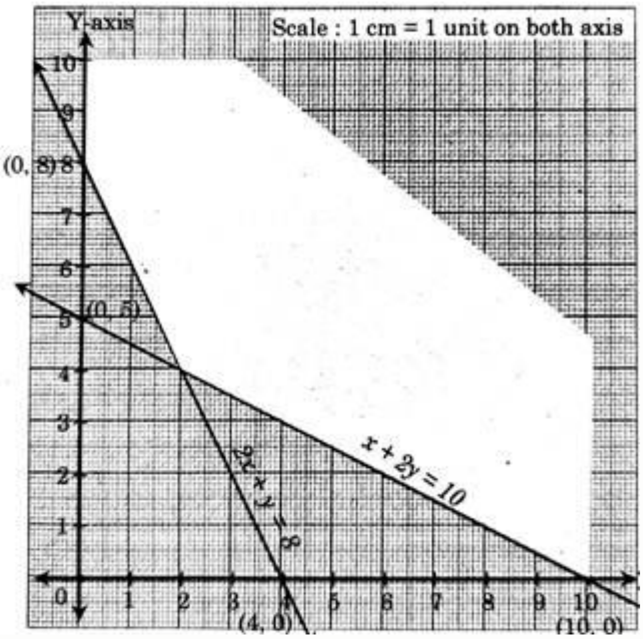
Sol: Writing the above inequalities as equations

$2x + y = 8$

x	0	4
y	8	0
(x, y)	(0,8)	(4,0)

$x + 2y = 10$

x	0	10
y	5	0
(x, y)	(0,5)	(10,0)



The inequality $2x + y = 8$ represents the region above the line, including the points on
the line $2x + y = 8$
The inequality $x + 2y \geq 10$ represents the region above the line,
including the points on the line $x + 2y = 10$
Since $x \geq 0$; $y \geq 0$, all points in the shaded region represents solution of the given system of inequalities.