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Digvijay
Arjun

Maharashtra State Board 11th Commerce Maths Solutions Chapter 8 Linear Inequations Ex 8.1

Question 1.
Write the inequations that represent the interval and state whether the interval is bounded or unbounded:
(i) [-4, 73]
Solution:
[-4, 73]
Here, x takes values between -4 and 73 including -4 and 73
∴ the required inequation is $-4 \leq x \leq 73$
∴ it is a bounded (closed) interval.

(ii) (0, 0.9]
Solution:
(0, 0.9]
Here, x takes values between 0 and 0.9, including 0.9 and excluding 0.
∴ the required inequation is $0 < x \leq 0.9$
∴ it is a bounded (semi-right closed) interval.

(iii) $(-\infty, \infty)$
Solution:
$(-\infty, \infty)$
Here, x takes values between $-\infty$ and ∞
∴ the required inequation is $-\infty < x < \infty$
∴ it is an unbounded (open) interval.

(iv) $[5, \infty)$
Solution:
$[5, \infty)$
Here, x takes values between 5 and ∞ including 5.
∴ the required inequation is $5 \leq x < \infty$
∴ it is an unbounded (semi-left closed) interval.

(v) (-11, -2)
Solution:

(-11, -2)
Here, x takes values between -11 and -2
∴ the required inequation is -11 < x < -2
∴ it is a bounded (open) interval.

(vi) (-∞, 3)
Solution:
(-∞, 3)
Here, x takes values between -∞ and 3
∴ the required inequation is -∞ < x < 3
∴ it is an unbounded (open) interval.

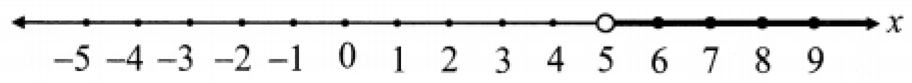
Question 2.
Solve the following inequations
(i) 3x – 36 > 0
Solution:
3x – 36 > 0
Adding 36 both sides, we get
3x – 36 + 36 > 0 + 36
∴ 3x > 36
Dividing both sides by 3, we get
3x3>363
∴ x > 12
∴ x takes all real values more than 12
∴ Solution set = (12, ∞)

(ii) 7x – 25 ≤ -4
Solution:
7x – 25 ≤ -4
Adding 25 on both sides, we get
7x – 25 + 25 ≤ -4 + 25
∴ 7x ≤ 21
Dividing both sides by 7, we get
x ≤ 3
∴ x takes all real values less or equal to 3.
∴ Solution Set = (-∞, 3]

(iii) 0 < $x-54$ < 3
Solution:
0 < $x-54$ < 3
0 < x – 5 < 12
Adding 5 on both sides, we get
5 < x < 17
x takes all real values between 5 and 17.
∴ Solution set = (5, 17)

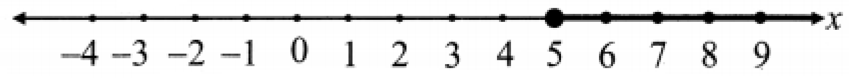
(iv) |7x – 4| < 10
Solution:
|7x – 4| < 10
-10 < 7x – 4 < 10 …….[|x| < k is same as -k < x < k]
Adding 4 on both sides, we get
-6 < 7x < 14
Dividing both sides by 7, we get
$-67<x<147$
∴ -67 < x < 2
∴ x takes all real values between -67 and 2.
∴ Solution set = (-67, 2)

Question 3.
Sketch the graph which represents the solution set for the following inequations:
(i) x > 5
Solution:
x > 5
Here, x takes all real values that are greater than 5.
∴ Solution set represents the unbounded (open) interval (5, ∞)
∴ the required graph of the solution set is as follows:

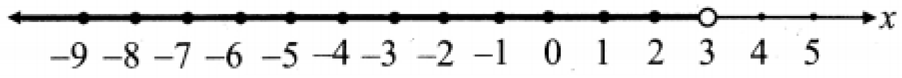


(ii) x ≥ 5
Solution:
x ≥ 5

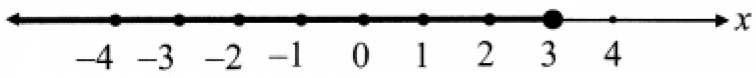
Here, x takes all real values that are greater than or equal to 5
∴ Solution set represents the unbounded (semi-left closed) interval [5, ∞)
∴ the required graph of the solution set is as follows:



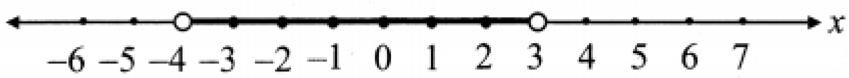
(iii) x < 3
Solution:
x < 3
Here, x takes all real values that are less than 3.
∴ Solution set represents the unbounded (open) interval (-∞, 3)
∴ the required graph of the solution set is as follows:



(iv) x ≤ 3
Solution:
x ≤ 3
Here, x takes all real values less than and including 3
∴ Solution set represents the unbounded (semi-right closed) interval (-∞, 3]
∴ the required graph of the solution set is as follows:

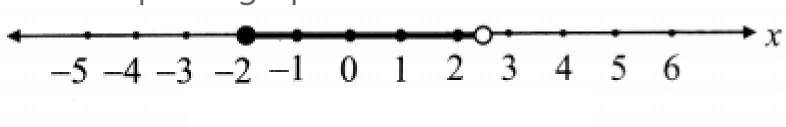


(v) -4 < x < 3
Solution:
-4 < x < 3
Here, x takes all real values between -4 and 3.
∴ Solution set represents the bounded (open) interval (-4, 3)
∴ the required graph of the solution set is as follows:

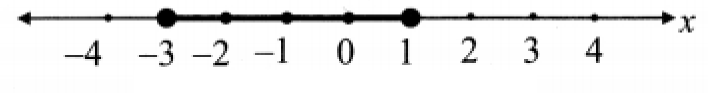


(vi) -2 ≤ x < 2.5
Solution:
-2 ≤ x < 2.5

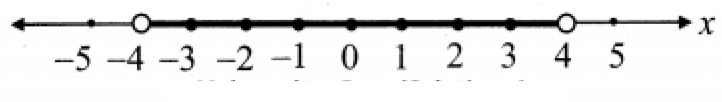
Here, x takes all values between -2 and 2.5 including -2.
∴ Solution set represents the bounded (semi-left closed) interval [-2, 2.5)
∴ the required graph of the solution set is as follows.



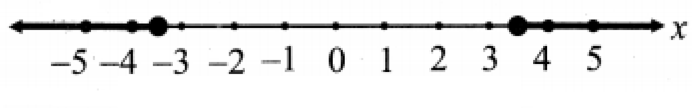
(vii) $-3 \leq x \leq 1$
Solution:
$-3 \leq x \leq 1$
Here, x takes all real values between -3 and 1 including -3 and 1
∴ Solution set represents the bounded (closed) interval [-3, 1]
∴ the required graph of the solution set is as follows:



(viii) $|x| < 4$
Solution:
$|x| < 4 \Rightarrow -4 < x < 4$
Here, x takes all real values between -4 and 4.
∴ Solution set represents bounded (open) interval (-4, 4)
∴ the required graph of the solution set is as follows:



(ix) $|x| \geq 3.5$
Solution:
$|x| \geq 3.5 \Rightarrow x \geq 3.5$ or $x \leq -3.5$
Here, x takes values greater than or equal to 3.5 or it takes values less than or equal to -3.5
∴ Solution set represents the unbounded (semi-left closed) interval [3.5, ∞) or the unbounded (semi-right closed) interval (-∞, -3.5]
∴ $x \in (-\infty, -3.5] \cup [3.5, \infty)$
∴ the required graph of the solution set is as follows:



Question 4.
Solve the inequations:
(i) $5x + 7 > 4 - 2x$
Solution:
$5x + 7 > 4 - 2x$
Adding 2x on both sides, we get
$7x + 7 > 4$
Subtracting 7 from both sides, we get
$7x > -3$
Dividing by 7 on both sides, we get
∴ $x > -37$
i.e., x takes all real values greater than -37
∴ the solution set is $(-37, \infty)$

(ii) $3x + 1 \geq 6x - 4$
Solution:
$3x + 1 \geq 6x - 4$
Subtracting 3x from both sides, we get
$1 \geq 3x - 4$
Adding 4 on both sides, we get
$5 \geq 3x$
Dividing by 3 on both sides, we get
$53 \geq x$
i.e., $x \leq 53$
i.e., x takes all real values less than or equal to 53.
∴ the solution set is $(-\infty, 53]$

(iii) $4 - 2x < 3(3 - x)$
Solution:
$4 - 2x < 3(3 - x)$
∴ $4 - 2x < 9 - 3x$
Adding 3x on both sides, we get
$4 + x < 9$
Subtracting 4 from both sides, we get
$x < 5$

i.e., x takes all real values less than 5
∴ the solution set is (-∞, 5)

(iv) 34x – 6 ≤ x – 7
Solution:
34x – 6 ≤ x – 7
Multiplying by 4 on both sides, we get
3x – 24 ≤ 4x – 28
Subtracting 3x from both sides, we get
-24 ≤ x – 28
Adding 28 on both the sides, we get
∴ 4 ≤ x i.e., x ≥ 4
i.e., x takes all real values greater or equal to 4.
∴ the solution set is [4, ∞)

(v) -8 ≤ -(3x – 5) < 13
Solution:
-8 < -(3x – 5) < 13 Multiplying by -1 throughout (so inequality sign changes) 8 ≥ 3x – 5 > -13
i.e., -13 < 3x – 5 ≤ 8
Adding 5 on both the sides, we get
-8 < 3x ≤ 13
Dividing, by 3 on both sides, we get
∴ −83 < x ≤ 133
i.e., x takes all real values between −83 and 133 including 133.
∴ the solution set is (−83,133]

(vi) -1 < 3 – x5 ≤ 1
Solution:
-1 < 3 – x5 ≤ 1
Subtracting 3 from both sides, we get
-4 < –x5 < -2 Multiplying by -1 throughout (so inequality sign changes) ∴ 4 > x5 > 2
i.e., 2 < x5 < 4
Multiplying by 5 on both sides, we get
10 < x < 20
i.e., x takes all real values between 10 and 20.
∴ the solution set is (10, 20)

(vii) 2|4 – 5x| ≥ 9
Solution:
2|4 – 5x | ≥ 9
∴ |4 – 5x| ≥ 92
∴ 4 – 5x ≥ 92 or 4 – 5x ≤ –92 ……[|x| ≥ a implies x ≤ -a or x ≥ a]
Subtracting 4 from both sides, we get
-5x ≥ 12 or -5x ≤ –172
Divide by -5 (so inequality sign changes)
∴ x ≤ −110 or x ≥ 1710
∴ x takes all real values less than or equal to −110
or it takes all real values greater or equal to 1710.
∴ the solution set is (-∞, −110] or [1710, ∞)

(viii) |2x + 7| ≤ 25
Solution:
|2x + 7| < 25
∴ -25 ≤ 2x + 7 ≤ 25 …..[|x| ≤ a implies -a ≤ x ≤ a]
Subtracting 7 from both sides, we get
-32 ≤ 2x ≤ 18
Dividing by 2 on both sides, we get
-16 ≤ x ≤ 9
∴ x can take all real values between -16 and 9 including -16 and 9.
∴ the solution set is [-16, 9]

(ix) 2|x + 3| > 1
Solution:
2|x + 3| > 1
Dividing by 2 on both sides, we get
|x + 3| > 12
∴ x + 3 < –12 or x + 3 > 12 …..[|x| > a implies x < -a or x > a]
Subtracting 3 from both sides, we get
x < – 3 – 12 or x > -3 + 12
∴ x < –72 or x > –52
∴ x can take all real values less –72 or it can take values greater than –52.
∴ Solution set is (-∞, –72) ∪ (–72, ∞)

(x) $x+5x-3 < 0$

Solution:

$x+5x-3 < 0$

Since $ab < 0$, when $a > 0$ and $b < 0$ or $a < 0$ and $b > 0$

∴ either $x + 5 > 0$ and $x - 3 < 0$

or $x + 5 < 0$ and $x - 3 > 0$

Case I:

$x + 5 > 0$ and $x - 3 < 0$ ∴ $x > -5$ and $x < 3$

∴ $-5 < x < 3$

∴ solution set = (-5, 3)

Case II:

$x + 5 < 0$ and $x - 3 > 0$

∴ $x < -5$ and $x > 3$

which is not possible

∴ solution set = Φ

∴ solution set of the given inequation is (-5, 3)

(xi) $x-2x+5 > 0$

Solution:

$x-2x+5 > 0$

Since $ab > 0$,

when $a > 0$ and $b > 0$ or $a < 0$ and $b < 0$ b

∴ either $x - 2 > 0$ and $x + 5 > 0$

or $x - 2 < 0$ and $x + 5 < 0$ Case I: $x - 2 > 0$ and $x + 5 > 0$

∴ $x > 2$ and $x > -5$

∴ $x > 2$

∴ solution set = (2, ∞)

Case II:

$x - 2 < 0$ and $x + 5 < 0$

∴ $x < 2$ and $x < -5$

∴ $x < -5$

∴ solution set = (-∞, -5)

∴ the solution set of the given inequation is (-∞, -5) ∪ (2, ∞)

Question 5.

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

Solution:
Let x_1, x_2, x_3 denote the marks in 1st, 2nd and 3rd unit test respectively. Then
x1+x2+x33 ≥ 60
∴ 70+75+x33 ≥ 60
∴ 145 + x_3 ≥ 3(60)
Subtracting 145 from both sides, we get
x_3 ≥ 180 – 145
∴ x_3 ≥ 35
Rajiv must obtain a minimum of 35 marks to maintain an average of at least 60 marks.

Question 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 the first four examinations are 87, 92, 94, and 95, find the minimum marks that Sunita must obtain in the fifth examination to get a grade 'A' in the course.
Solution:
Let x_1, x_2, x_3, x_4, x_5 denote the marks in five examinations. Then
x1+x2+x3+x4+x55 ≥ 90
∴ 87+92+94+95+x55 ≥ 90
∴ 368 + x_5 ≥ 450
Subtracting 368 from both sides, we get
∴ x_5 ≥ 82
Sunita must obtain a minimum of 82 marks in the 5th examination to get a grade of A.

Question 7.
Find all pairs of consecutive odd positive integers, both of which are smaller than 10 such that their sum is more than 11.
Solution:
Let two consecutive positive integers be 2n – 1, 2n + 1 where n ≥ 1 ∈ Z,
Given that 2n – 1 < 10 and 2n + 1 < 10
∴ 2n < 11 and 2n < 9
∴ 2n < 9
∴ n < 92 …..(i) Also, (2n – 1) + (2n + 1) > 11
∴ 4n > 11

∴ n > 114 …….(ii)
From (i) and (ii)
114<n<92 Since, n is an integer,
∴ n = 3, 4
n = 3 gives 2n – 1 = 5, 2n + 1 = 7
and n = 4 gives 2n – 1 = 7, 2n + 1 = 9
∴ The pairs of positive consecutive integers are (5, 7) and (7, 9).

Question 8.
Find all pairs of consecutive even positive integers, both of which are larger than 5 such that their sum is less than 23.
Solution:
Let 2n, 2n + 2 be two positive consecutive integers where n ≥ 1 ∈ Z.
Given that 2n > 5 and 2n + 2 > 5
∴ n > 52 and 2n > 3
∴ n > 52 and n > 32
∴ n > 52 ……(i)
Also (2n) + (2n + 2) < 23
∴ 4n + 2 < 23
∴ 4n < 21
∴ n < 214 ……(ii)
From (i) and (ii)
52<n<214 and n is an integer.
∴ n = 3, 4, 5
n = 3 gives 2n = 6, 2n + 2 = 8
n = 4 gives 2n = 8, 2n + 2 = 10
n = 5 gives 2n = 10, 2n + 2 = 12
∴ The pairs of positive even consecutive integers are (6, 8) (8, 10), (10, 12)

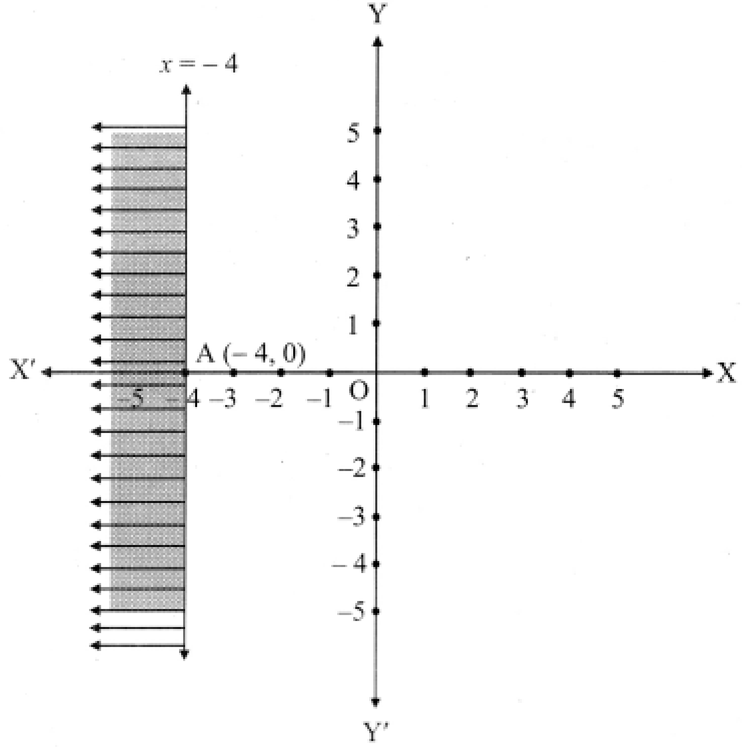
Question 9.
The longest side of a triangle is twice the shortest side and the third side is 2 cm longer than the shortest side. If the perimeter of the triangle is more than 166 cm then find the minimum integer length of the shortest side.
Solution:
Let the shortest side be x.
Then longest side length = 2x

and third side length = x + 2
Perimeter = x + 2x + x + 2 = 4x +2
Given, perimeter > 166
∴ 4x + 2 > 166
∴ 4x > 164
∴ x > 41
∴ Minimum integer length of shortest side is 42 cm.

Maharashtra State Board 11th Commerce Maths Solutions Chapter 8 Linear Inequations Ex 8.2

Question 1.
Solve the following inequations graphically in a two-dimensional plane
(i) x ≤ -4
Solution:
Given, inequation is x ≤ -4
∴ corresponding equation is x = -4
It is a line parallel to Y-axis passing through the point A(-4, 0)
Origin test:
Substituting x = 0 in inequation, we get
0 ≤ -4 which is false.
∴ Points on the origin side of the line do not satisfy the inequation.
So the points on the non-origin side of the line and points on the line satisfy the inequation
∴ all the points on the line and left of it satisfy the given inequation.

The shaded portion represents the solution set.



(ii) y ≥ 3

Solution:

Given, inequation is y ≥ 3

∴ corresponding equation is y = 3

It is a line parallel to X-axis passing through point A(0, 3)

Origin test:

Substituting y = 0 in inequation, we get

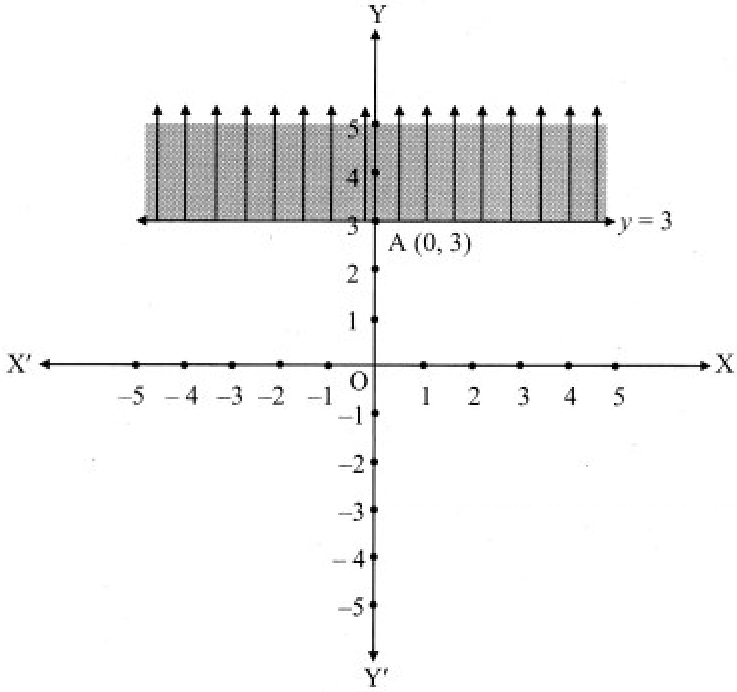
0 ≥ 3 which is false.

∴ Points on the origin side of the line do not satisfy the inequation

∴ Points on the non-origin side of the line satisfy the inequation.

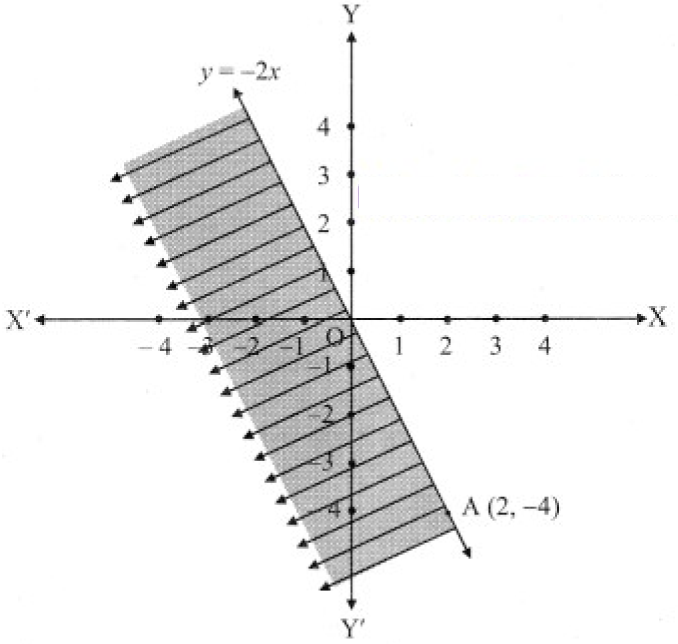
∴ all the points on the line and above it satisfy the given inequation.

The shaded portion represents the solution set.



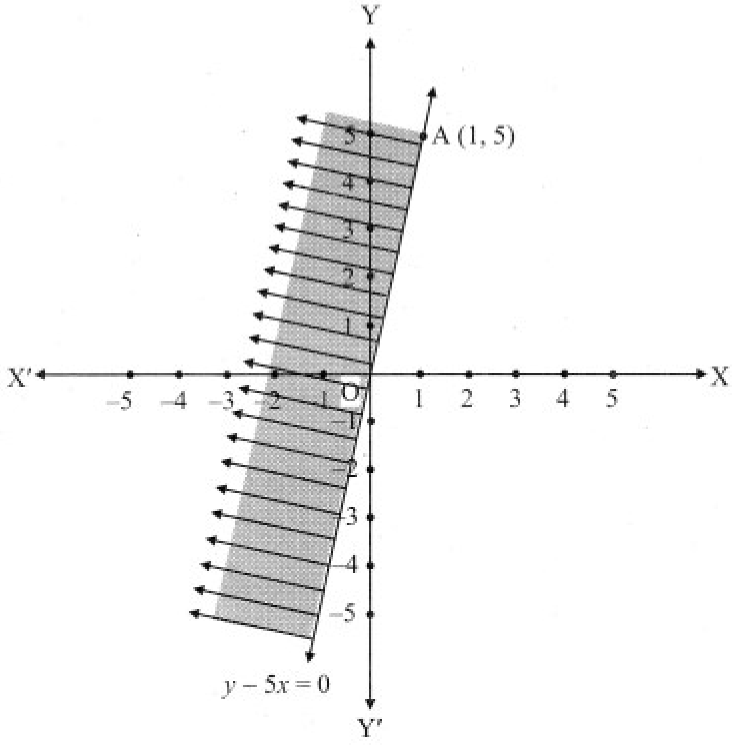
(iii) y ≤ -2x
Solution:
Given, inequation is y ≤ -2x
∴ corresponding equation is y = -2x
It is a line passing through origin O(0, 0).
To draw the line, we need one more point.
To find another point on the line, we can take any value of x,
say, x = 2.
∴ substituting x = 2 in y = -2x, we get
y = -2(2)
∴ y = -4
∴ another point on the line is A(2, -4)
Now, the origin test is not possible as the origin lies on the line y = -2x
So, choose a point which does not lie on the line say, (2, 1)
∴ substituting x = 2, y = 1 in inequation, we get
1 ≤ -2(2)
∴ 1 ≤ -4 which is false.
∴ the points on the side of the line y = -2x, where (2, 1) lies do not satisfy the inequation.
∴ all the points on the line y = -2x and on the opposite side of the line where (2, 1) lies, satisfy the inequation

The shaded portion represents the solution set.



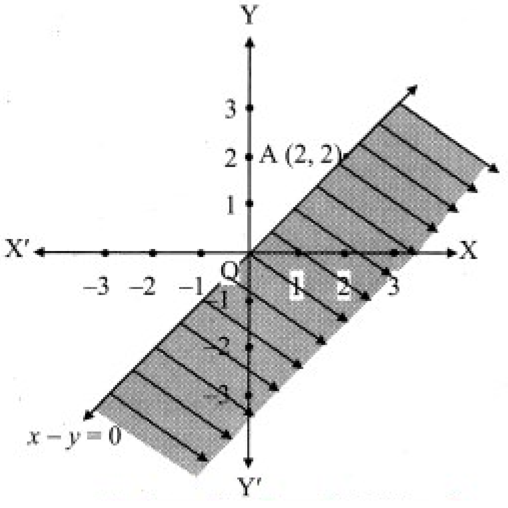
(iv) y – 5x ≥ 0
Solution:
Given, inequation is y – 5x ≥ 0
∴ corresponding equation is y – 5x = 0
It is a line passing through the point O(0, 0)
To draw the line, we need one more point.
To find another point on the line,
we can take any value of x, say, x = 1.
Substituting x = 1 in y – 5x = 0, we get
y – 5(1) = 0
∴ y = 5
∴ Another point on the line is A(1, 5)
Now origin test is not possible as the origin lies on the line y = 5x
∴ choose a point that does not lie on the line, say (3, 2).
∴ substituting x = 3, y = 2 in inequation, we get
2 – 5(3) ≥ 0
∴ 2 – 10 ≥ 0
∴ -8 ≥ 0 which is false.
∴ the points on the side of line y = 5x where (3, 1) lies do not satisfy the inequation.
∴ the points on the line y = 5x and on the opposite of the line where (3, 2) lies, satisfy the inequation.

The shaded portion represents the solution set.



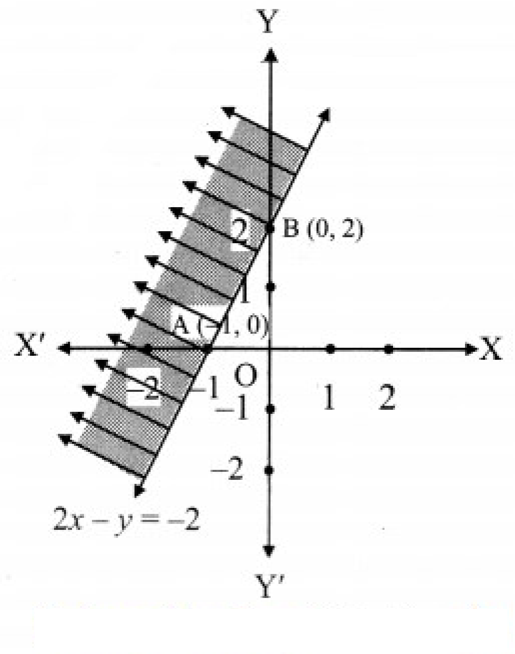
(v) $x - y \geq 0$
Solution:
Given, inequation is $x - y \geq 0$
$\therefore$ Corresponding equation is $x - y = 0$
It is a line passing through origin O(0, 0)
To draw the line we need one more point.
To find another point on the line, we can take any value of x,
Say, $x = 2$.
$\therefore$ substituting $x = 2$ in $x - y = 0$, we get
$2 - y = 0$
$\therefore y = 2$
$\therefore$ another point on the line is A(2, 2)
Now origin test is not possible as the origin lies on the line $y = x$
$\therefore$ choose a point which not lie on the line say (3, 1)
$\therefore$ substituting $x = 3$, $y = 1$ in inequation, we get
$3 - 1 \geq 0$
$\therefore 2 \geq 0$ which is true.
$\therefore$ all the points on line $x - y = 0$ and the points on the side where (3, 1) lies

satisfy the inequation
The shaded portion represents the solution set.



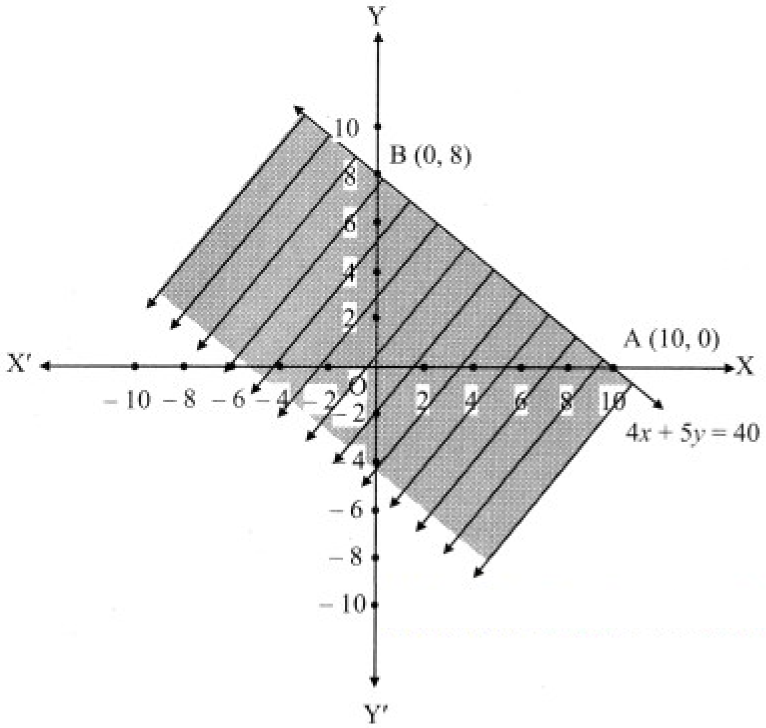
(vi) 2x – y ≤ -2
Solution:
Given, inequation is 2x – y ≤ -2
∴ corresponding equation is 2x – y = -2
∴ 2x−2−y−2=−2−2
∴ x−1+y2=1
∴ intersection of line with X-axis is A(-1, 0),
intersection of line with Y-axis is B(0, 2)
Origin test:
Substituting x = 0, y = 0 in the given inequation, we get
2(0) – (0) ≤ -2
∴ 0 ≤ -2
which is false.
∴ Points on the origin side of the line do not satisfy the inequation.
∴ Points on the non-origin side of the line satisfy the inequation
∴ all the points on the line and above it satisfy the given inequation.

The shaded portion represents the solution set.



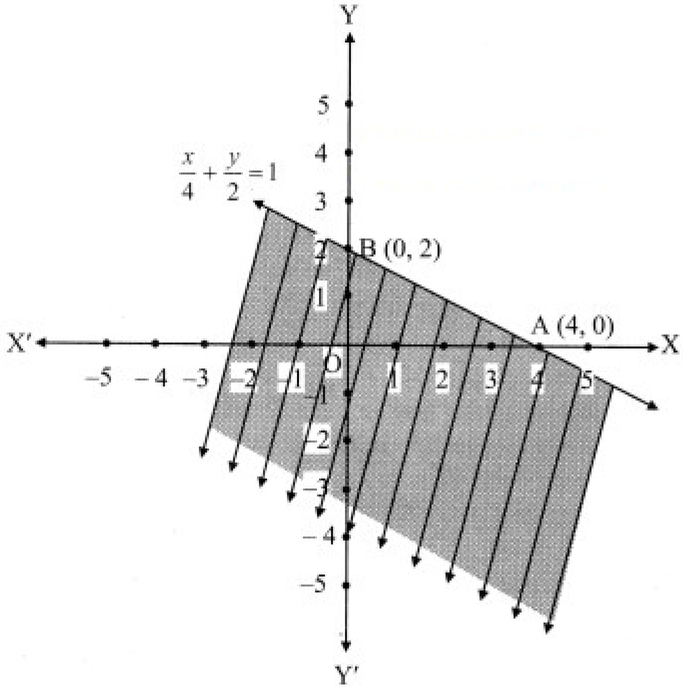
(vii) 4x + 5y ≤ 40
Solution:
Given, inequation is 4x + 5y ≤ 40
∴ Corresponding equation is 4x + 5y = 40
∴ 4x40+5y40=4040
∴ x10+y8=1
∴ Intersection of line with X-axis is A(10, 0)
Intersection of line with Y-axis is B(0, 8)
Origin test:
Substituting x = 0, y = 0 in the inequation, we get
4(0) + 5(0) ≤ 40
∴ 0 ≤ 40 which is true.
∴ all the points on the origin side of the line and points on the line satisfy the given inequation.

The shaded portion represents the solution set.



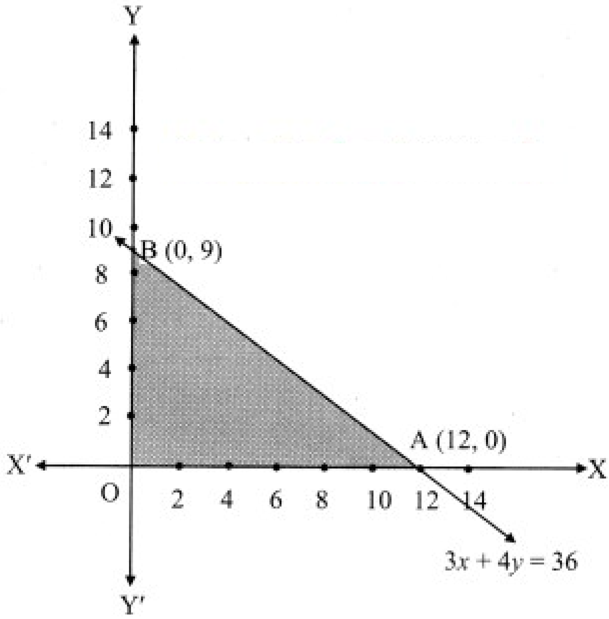
(viii) $(14)x+(12)y \le 1$
Solution:
Given, inequation is $(14)x+(12)y \le 1$
∴ corresponding equation is $x4+y2 = 1$
∴ intersection of line with X-axis is A(4, 0),
intersection of line with Y-axis is B(0, 2)
Origin test:
Substituting x = 0, y = 0 in the given inequation, we get
$14(0)+12(0) \le 1$
∴ $0 \le 1$ which is true.
∴ all the points on the origin side of the line and points on the line satisfy the given inequation.

The shaded portion represents the solution set.



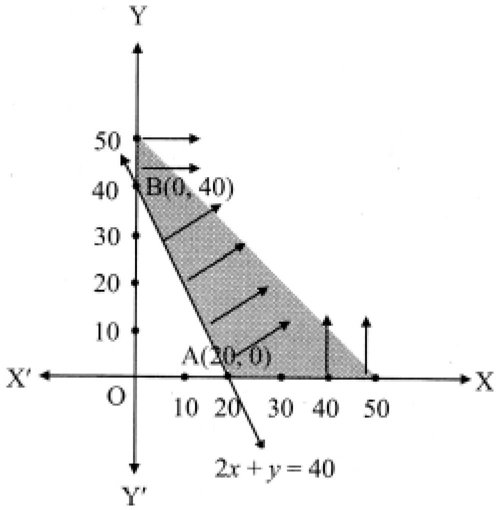
Question 2.
Mr. Rajesh has ₹ 1,800 to spend on fruits for the meeting. Grapes cost ₹ 150 per kg. and peaches cost ₹ 200 per kg. Formulate and solve it graphically.
Solution:
Let x and y be the number of kgs. of grapes and peaches bought.
The cost of grapes is ₹ 150/- per kg, cost of peaches is ₹ 200/- per kg.
∴ cost of v kg of grapes is ₹ 150x
and the cost of y kg of peaches is ₹ 200y.
Mr. Rajesh has ₹ 1800 to spend on fruits.
∴ the total cost of grapes and peaches must be less than or equal to ₹ 1800.
∴ required inequation is $150x + 200y \le 1800$
i.e., $3x + 4y \le 36$ ……(i)
Since the number of kg of grapes and peaches can not be negative
∴ $x \ge 0$, $y \ge 0$
Now, corresponding equation is $3x + 4y = 36$
∴ $\frac{3x}{36}+\frac{4y}{36}=\frac{36}{36}$
∴ $\frac{x}{12}+\frac{y}{9}=1$
∴ the intersection of the line with the X-axis is A(12, 0)

the intersection of the line with the Y-axis is B(0, 9)
Origin test:
Substituting x = 0, y = 0 in inequation, we get
$3(0) + 4(0) \leq 36$
$\therefore 0 \leq 36$ which is true.
$\therefore$ all the points on the origin side of the line and points on the line satisfy the inequation.
Also, $x \geq 0, y \geq 0$
$\therefore$ the solution set is the points on the sides of the triangle OAB and in the interior of ΔOAB.
$\therefore$ the shaded portion represents the solution set.



Question 3.
The Diet of the sick person must contain at least 4000 units of vitamin. Each unit of food F_1 contains 200 units of vitamin, whereas each unit of food F_2 contains 100 units of vitamins. Write an inequation to fulfill a sick person's requirements and represent the solution set graphically.
Solution:
Let the diet of the sick person contain, x units of food F_1 and y units of food F_2.
Since each unit of food F_1 contains 200 units of vitamins.
$\therefore$ x units of food F_1 contain 200x units of vitamins.
Also, each unit of food F_2 contains 100 units of vitamins.
y units of food F_2 contain 100y units of vitamins.
Now, Diet for a sick person must contain at least 4000 units of vitamins.

∴ he must take food F_1 and F_2 in such away that total vitamins must be greater than or equal to 4000.
∴ required inequation is $200x + 100y \geq 4000$
i.e., $2x + y \geq 40$
Also x and y cannot be negative.
∴ $x \geq 0, y \geq 0$
Corresponding equation is $2x + y = 40$
∴ $\frac{2x}{40}+\frac{y}{40}=\frac{40}{40}$
∴ $\frac{x}{20}+\frac{y}{40}=1$
∴ intersection of line with X-axis is A(20, 0)
intersection of line with Y-axis is B(0, 40)
Origin test:
Substituting $x = 0, y = 0$ in inequation, we get
$2(0) + (0) \geq 40$
∴ $0 \geq 40$ which is false
∴ all the points on the non origin side of the line and points on the line satisfy the inequation.
Also, $x \geq 0, y \geq 0$
∴ the solution set is as shown in the figure.

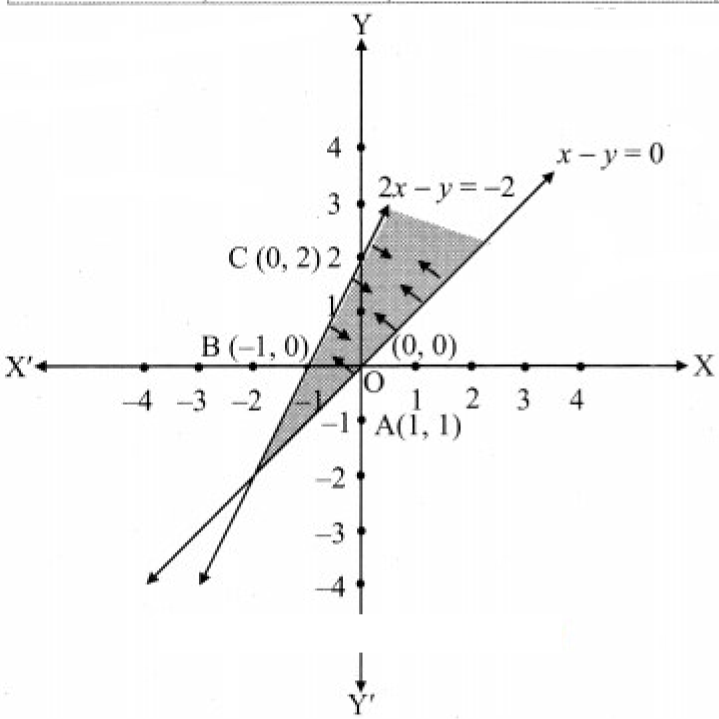


Maharashtra State Board 11th Commerce Maths Solutions Chapter 8 Linear Inequations Ex 8.3

Find the graphical solution for the following system of linear inequations.

Question 1.
$x - y \leq 0$, $2x - y \geq -2$
Solution:
To find a graphical solution, construct the table as follows:

Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x - y \leq 0$	$x - y = 0$	—	O (0, 0) A (1, 1)	$(0) - (0) \leq 0$ $\therefore 0 \leq 0$ $\therefore$ origin side
$2x - y \geq -2$	$2x - y = -2$	$\frac{2x}{-2} - \frac{y}{-2} = \frac{-2}{-2}$ i.e., $\frac{x}{-1} + \frac{y}{2} = 1$	B (−1, 0) C (0, 2)	$2(0) - (0) \geq -2$ $\therefore 0 \geq -2$ $\therefore$ origin side



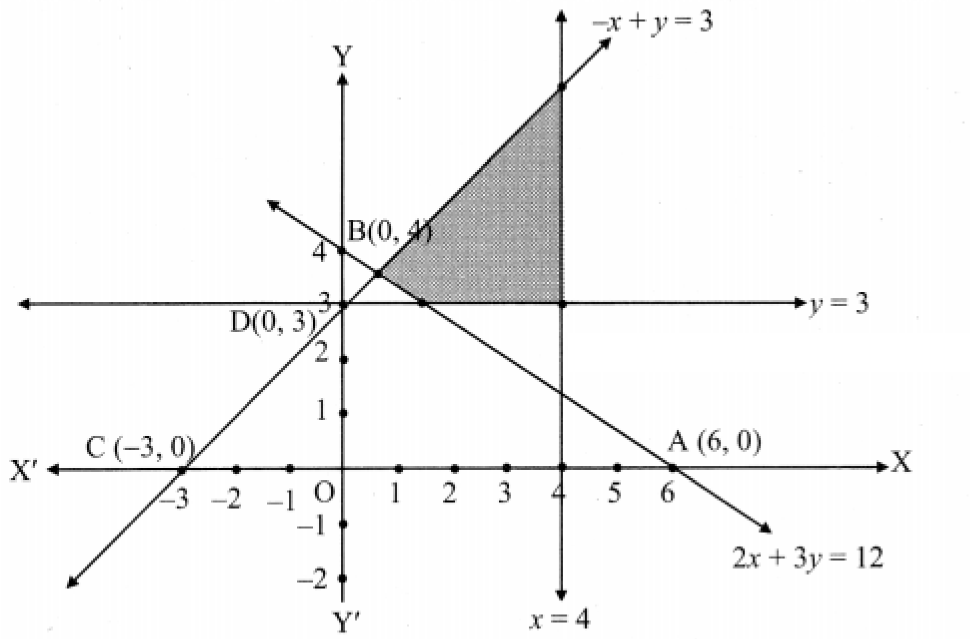
The shaded portion represents the graphical solution.

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

AllGuideSite :
Digvijay
Arjun

Solution:
To find a graphical solution, construct the table as follows:

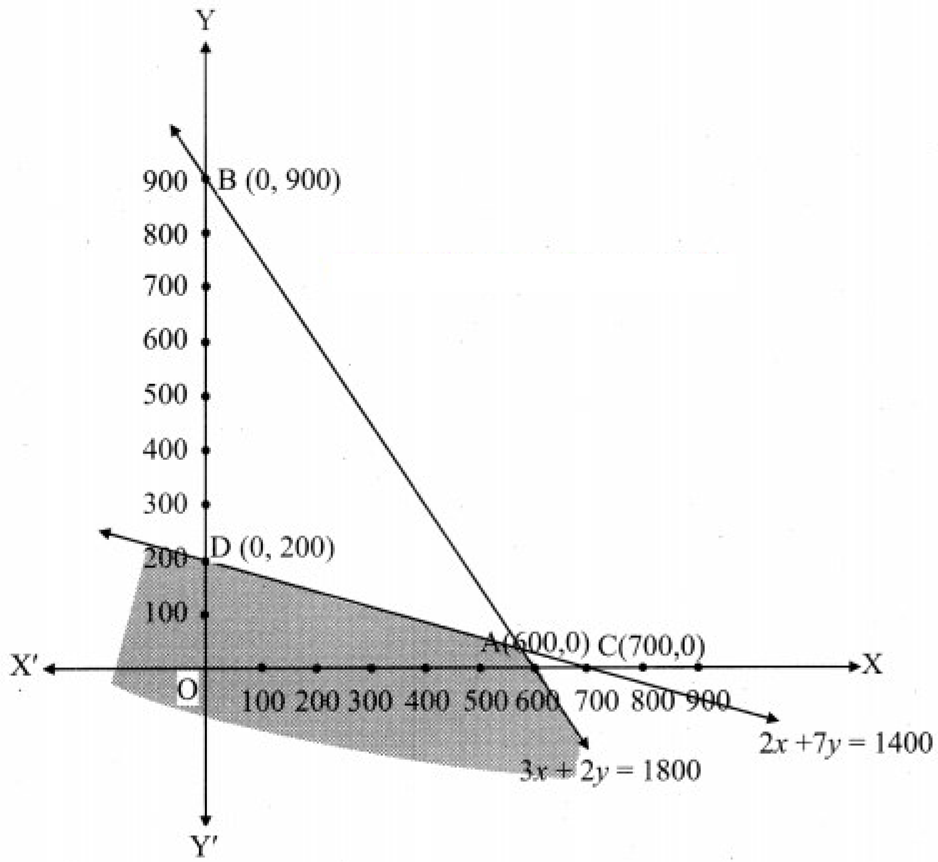
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$2x + 3y \geq 12$	$2x + 3y = 12$	$\frac{x}{6}+\frac{y}{4}=1$	A (6, 0) B (0, 4)	$2(0)+3(0) \ngeq 12$ $\therefore 0 \ngeq 12$ $\therefore$ non-origin side
$-x + y \leq 3$	$-x + y = 3$	$\frac{x}{-3}+\frac{y}{3}=1$	C (–3, 0) D (0, 3)	$-0 + (0) \leq 3$ $\therefore 0 \leq 3$ $\therefore$ origin side
$x \leq 4$	$x = 4$	—	—	$0 \leq 4$ $\therefore$ L.H.S. of line $x = 4$
$y \geq 3$	$y = 3$	—	—	$0 \ngeq 3$ $\therefore$ above line $y = 3$



The shaded portion represents the graphical solution.

Question 3.
$3x + 2y \leq 1800$, $2x + 7y \leq 1400$
Solution:
To find a graphical solution, construct the table as follows:

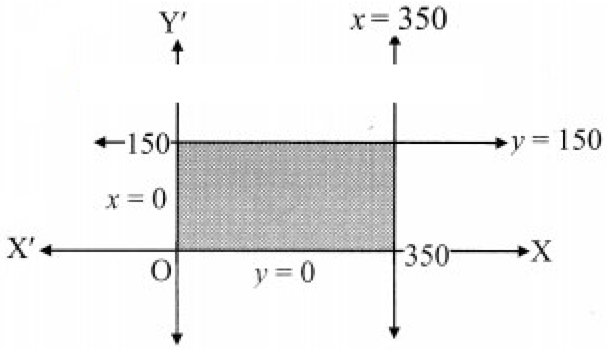
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$3x + 2y \leq 1800$	$3x + 2y = 1800$	$\frac{x}{600} + \frac{y}{900} = 1$	A (600, 0), B (0, 900)	$3(0) + 2(0) \leq 1800$ $\therefore 0 \leq 1800$ $\therefore$ origin side
$2x + 7y \leq 1400$	$2x + 7y = 1400$	$\frac{x}{700} + \frac{y}{200} = 1$	C (700, 0), D (0, 200)	$2(0) + 7(0) \leq 1400$ $\therefore 0 \leq 1400$ $\therefore$ origin side



The shaded portion represents the graphical solution.

Question 4.
$0 \leq x \leq 350$, $0 \leq y \leq 150$
Solution:
To find a graphical solution, construct the table as follows:

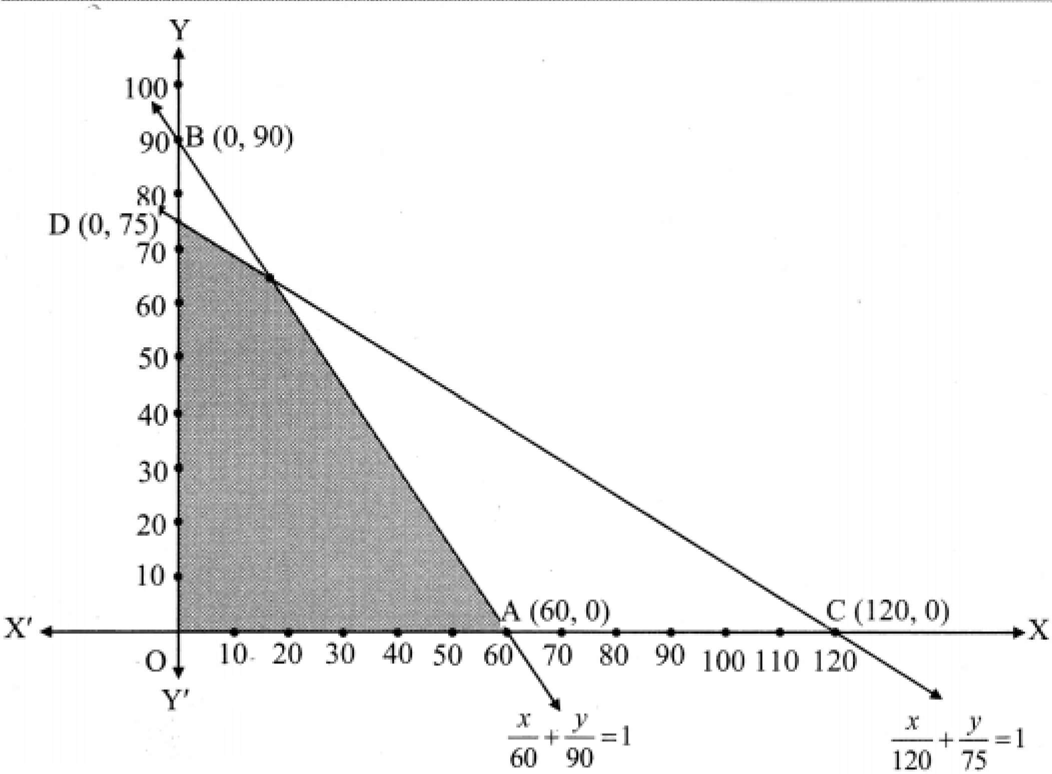
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$0 \leq x \leq 350$ i.e., $x \geq 0$ and $x \leq 350$	$x = 0$	—	—	R.H.S. of Y-axis
	$x = 350$	—	—	$0 \leq 350$ $\therefore$ L.H.S. of line $x_1 = 350$
$0 \leq y \leq 150$ i.e., $y \geq 0$ $y \leq 150$	$y = 0$	—	—	above X-axis
	$y = 150$	—	—	$0 \leq 150$ $\therefore$ below the line $x_2 = 150$



The shaded portion represents the graphical solution.

Question 5.
$\frac{x}{60}+\frac{y}{90} \leq 1$, $\frac{x}{120}+\frac{y}{75} \leq 1$, $x \geq 0$, $y \geq 0$
Solution:
To find a graphical solution, construct the table as follows:

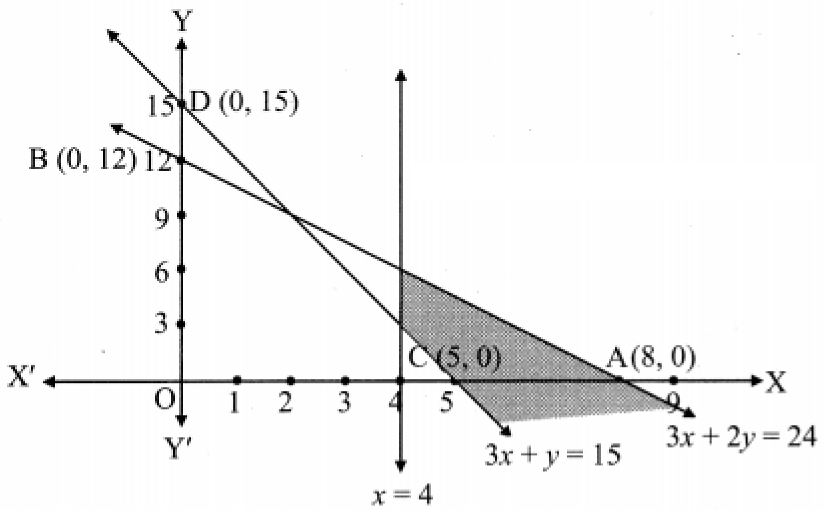
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$\frac{x}{60}+\frac{y}{90} \le 1$	$\frac{x}{60}+\frac{y}{90}=1$	$\frac{x}{60}+\frac{y}{90}=1$	A (60, 0), B (0, 90)	$\frac{(0)}{60}+\frac{(0)}{90} \le 1$ $\therefore 0 \le 1$ $\therefore$ origin side
$\frac{x}{120}+\frac{y}{75} \le 1$	$\frac{x}{120}+\frac{y}{75}=1$	$\frac{x}{120}+\frac{y}{75}=1$	C (120, 0), D (0, 75)	$\frac{(0)}{120}+\frac{(0)}{75} \le 1$ $\therefore 0 \le 1$ $\therefore$ origin side
$x \ge 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \ge 0$	$y = 0$	—	—	Above X-axis



The shaded portion represents the graphical solution.

Question 6.
$3x + 2y \le 24$, $3x + y \ge 15$, $x \ge 4$
Solution:
To find a graphical solution, construct the table as follows:

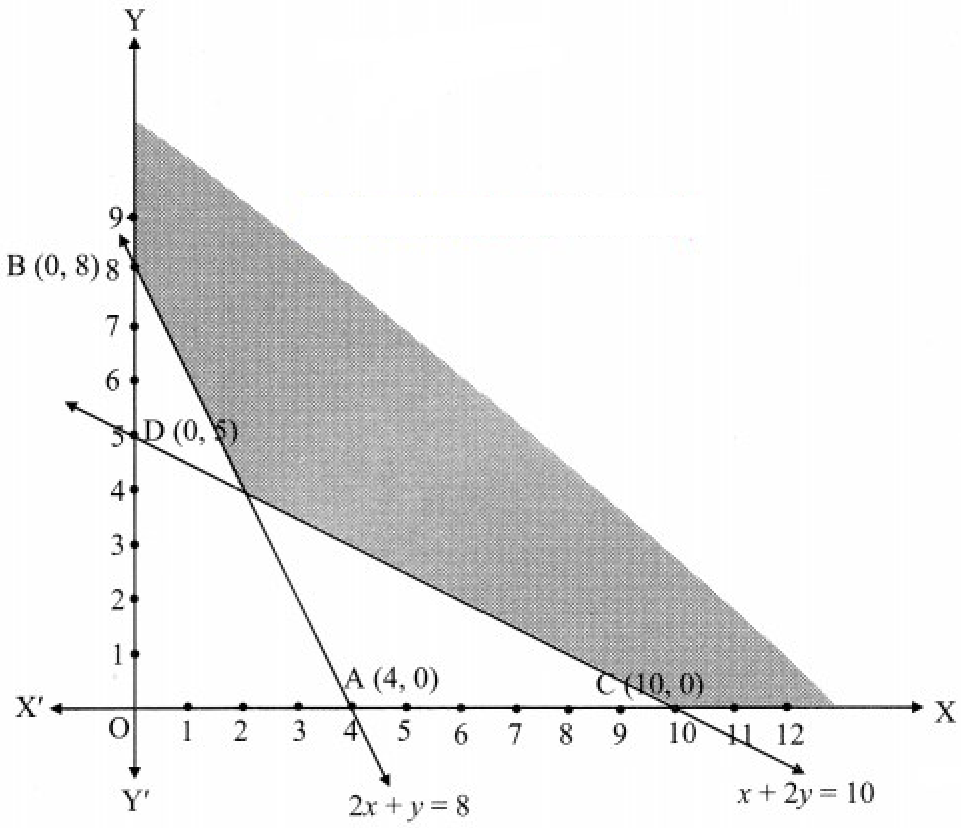
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$3x + 2y \leq 24$	$3x + 2y = 24$	$\frac{x}{8} + \frac{y}{12} = 1$	A (8, 0), B (0, 12)	$3(0) + 2(0) \leq 24$ $\therefore 0 \leq 24$ $\therefore$ origin side
$3x + y \geq 15$	$3x + y = 15$	$\frac{x}{5} + \frac{y}{15} = 1$	C (5, 0), D (0, 15)	$3(0) + (0) \not\geq 15$ $\therefore 0 \not\geq 15$ $\therefore$ non-origin side
$x \geq 4$	$x = 4$	—	—	$0 \not\geq 4$ $\therefore$ R.H.S of line $x = 4$



The shaded portion represents the graphical solution.

Question 7.
$2x + y \geq 8$, $x + 2y \geq 10$, $x \geq 0$, $y \geq 0$
Solution:
To find a graphical solution, construct the table as follows:

Inequation	Equation	Double Intercept form	Points (x, y)	Region
$2x + y \geq 8$	$2x + y = 8$	$\frac{x}{4} + \frac{y}{8} = 1$	A (4, 0), B (0, 8)	$2(0) + (0) \ngeq 8$ $\therefore\ 0 \ngeq 8$ $\therefore$ non-origin side
$x + 2y \geq 10$	$x + 2y = 10$	$\frac{x}{10} + \frac{y}{5} = 1$	C (10, 0), D (0, 5)	$10 + 2(0) \ngeq 10$ $\therefore\ 0 \ngeq 10$ $\therefore$ non-origin side
$x \geq 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \geq 0$	$y = 0$	—	—	Above X-axis



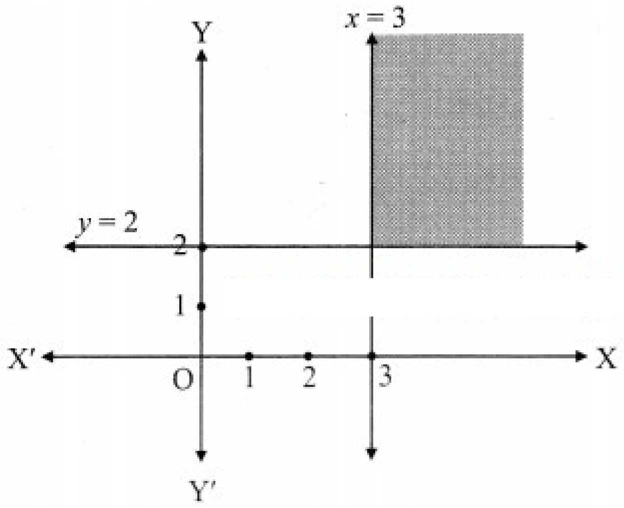
The shaded portion represents the graphical solution.

Maharashtra State Board 11th Commerce Maths Solutions Chapter 8 Linear Inequations Miscellaneous Exercise 8

Solve the following system of inequalities graphically.

Question 1.
$x \geq 3, y \geq 2$
Solution:
To find a graphical solution, construct the table as follows:

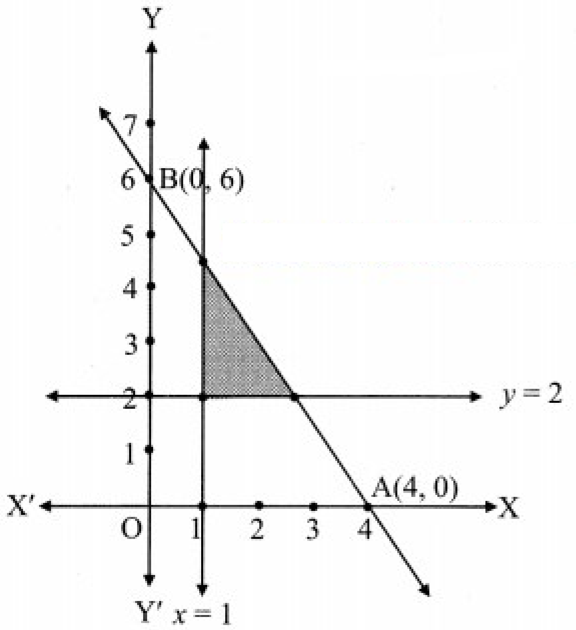
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x \geq 3$	$x = 3$	–	–	$0 \ngeq 3$ ∴ R.H.S. of line $x = 3$
$y \geq 2$	$y = 2$	–	–	$0 \ngeq 2$ ∴ above line $y = 2$



The shaded portion represents the graphical solution.

Question 2.
$3x + 2y \leq 12, x \geq 1, y \geq 2$
Solution:
To find a graphical solution, construct the table as follows:

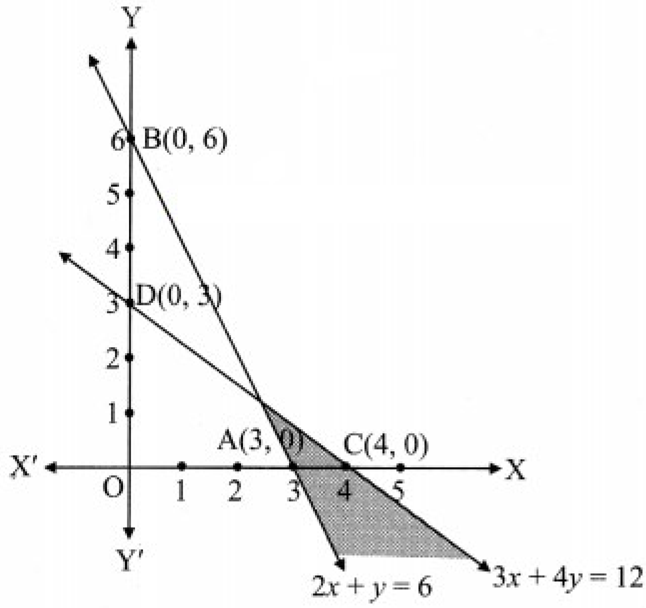
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$3x + 2y \leq 12$	$3x + 2y = 12$	$\frac{x}{4}+\frac{y}{6}=1$	A (4, 0), B (0, 6)	$3(0) + 2(0) \leq 12$ $\therefore 0 \leq 12$ $\therefore$ origin side
$x \geq 1$	$x = 1$	—	—	$0 \not\geq 1$ $\therefore$ R.H.S. of line $x = 1$
$y \geq 2$	$y = 2$	—	—	$0 \not\geq 2$ $\therefore$ above line $y = 2$



The shaded portion represents the graphical solution.

Question 3.
$2x + y \geq 6$, $3x + 4y < 12$
Solution:
To find a graphical solution, construct the table as follows:

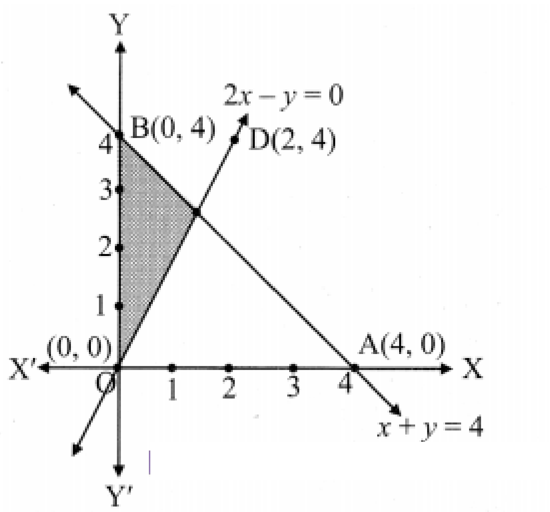
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$2x + y \geq 6$	$2x + y = 6$	$\frac{x}{3} + \frac{y}{6} = 1$	A (3, 0), B (0, 6)	$2(0) + 0 \ngeq 6$ $\therefore 0 \ngeq 6$ $\therefore$ non-origin side
$3x + 4y \leq 12$	$3x + 4y = 12$	$\frac{x}{4} + \frac{y}{3} = 1$	C (4, 0), D (0, 3)	$3(0) + 4(0) \leq 12$ $\therefore 0 \leq 12$ $\therefore$ origin side



The shaded portion represents the graphical solution.

Question 4.
x + y ≥ 4, 2x – y ≤ 0
Solution:
To find a graphical solution, construct the table as follows:

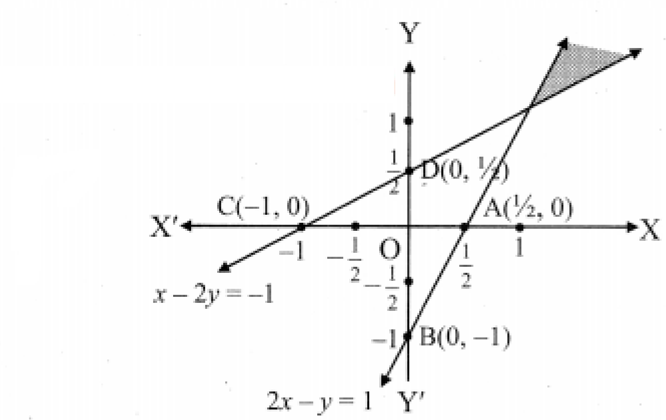
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x + y \geq 4$	$x + y = 4$	$\frac{x}{4} + \frac{y}{4} = 1$	A (4, 0), B (0, 4)	$0 + 0 \ngeq 4$ $\therefore 0 \ngeq 4$ $\therefore$ non-origin side
$x - y \leq 0$	$2x - y = 0$	—	O (0, 0), D (2, 4)	$2(0) - 0 \leq 0$ $\therefore 0 \leq 0$ $\therefore$ origin side



The shaded portion represents the graphical solution.

Question 5.
2x – y ≥1, x – 2y ≤ -1
Solution:
To find a graphical solution, construct the table as follows:

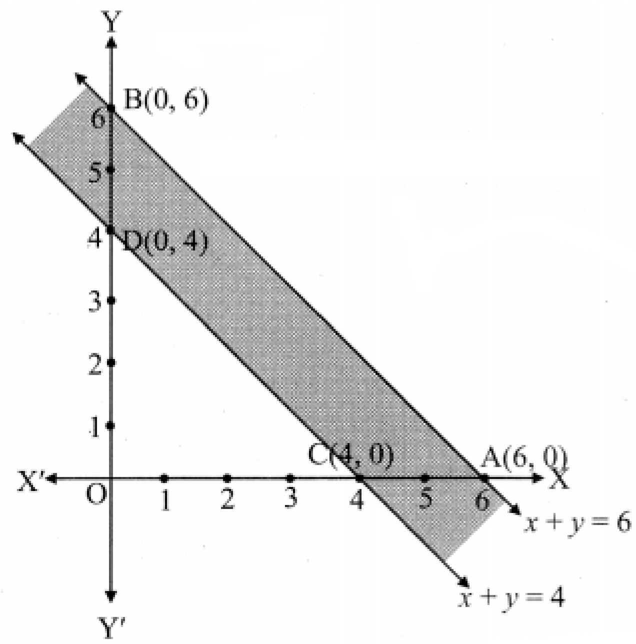
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$2x - y \geq 1$	$2x - y = 1$	$\frac{2x}{1} - \frac{y}{1} = 1$ i.e., $\frac{x}{\frac{1}{2}} + \frac{y}{-1} = 1$	A $\left(\frac{1}{2}, 0\right)$, B $(0, -1)$	$2(0) - 0 \not\geq 1$ $\therefore 0 \not\geq 1$ ∴ non-origin side
$x - 2y \leq -1$	$x - 2y = -1$	$\frac{x}{-1} - \frac{2y}{-1} = 1$ i.e., $\frac{x}{-1} + \frac{y}{\left(\frac{1}{2}\right)} = 1$	C $(-1, 0)$, D $\left(0, \frac{1}{2}\right)$	$0 - 2(0) \not\leq -1$ $\therefore 0 \not\leq -1$ ∴ non-origin side



The shaded portion represents the graphical solution.

Question 6.
$x + y \leq 6, x + y \geq 4$
Solution:
To find a graphical solution, construct the table as follows:

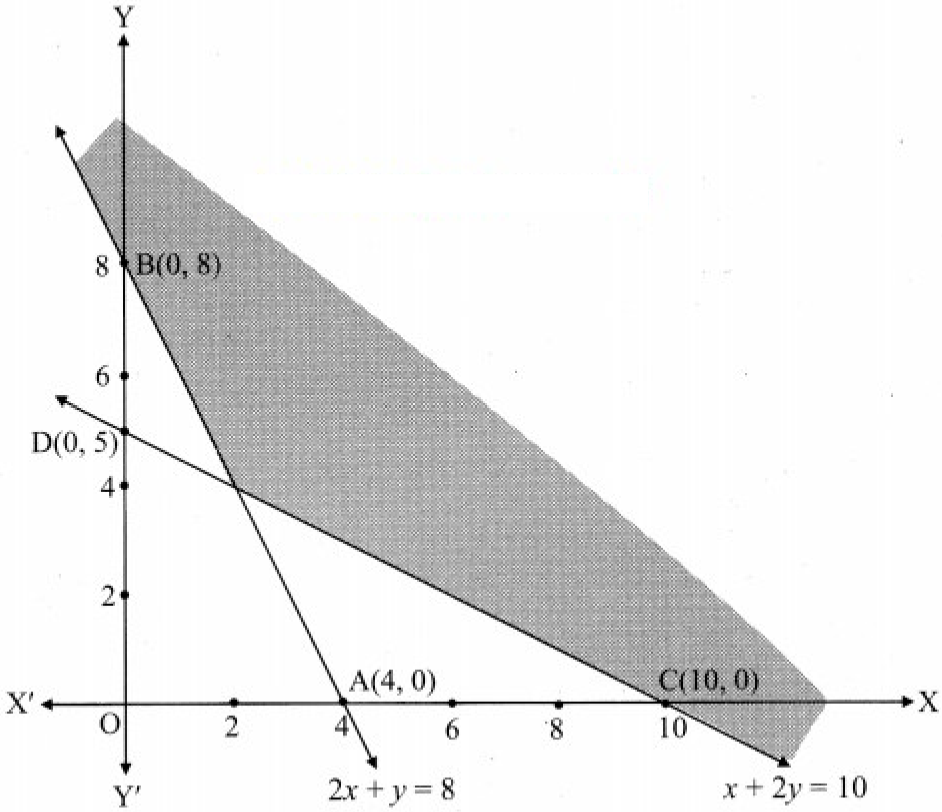
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x + y \leq 6$	$x + y = 6$	$\frac{x}{6} + \frac{y}{6} = 1$	A (6, 0), B (0, 6)	$0 + 0 \leq 6$ $\therefore 0 \leq 6$ $\therefore$ origin side
$x + y \geq 4$	$x + y = 4$	$\frac{x}{4} + \frac{y}{4} = 1$	C (4, 0), D (0, 4)	$0 + 0 \ngeq 4$ $\therefore 0 \ngeq 4$ $\therefore$ non-origin side



The shaded portion represents the graphical solution.

Question 7.
$2x + y \geq 8, x + 2y \geq 10$
Solution:
To find a graphical solution, construct the table as follows:

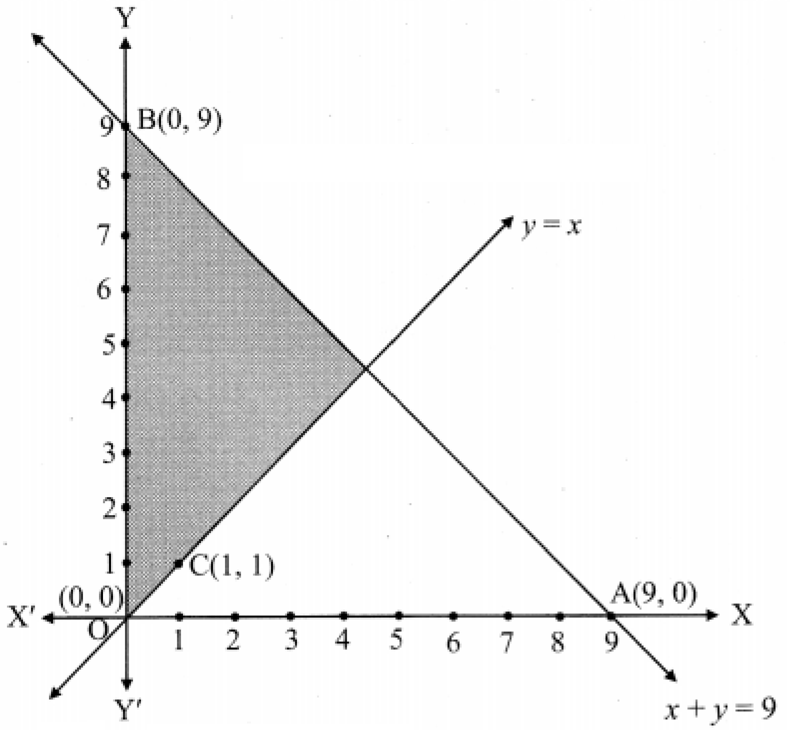
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$2x + y \geq 8$	$2x + y = 8$	$\frac{x}{4} + \frac{y}{8} = 1$	A (4, 0), B (0, 8)	$2(0) + 0 \ngeq 8$ $\therefore 0 \ngeq 8$ $\therefore$ non-origin side
$x + 2y \geq 10$	$x + 2y = 10$	$\frac{x}{10} + \frac{y}{5} = 1$	C (10, 0), D (0, 5)	$0 + 2(0) \ngeq 10$ $\therefore 0 \ngeq 10$ $\therefore$ non-origin side



The shaded portion represents the graphical solution.

Question 8.
$x + y \leq 9, y > x, x \geq 0$
Solution:
To find a graphical solution, construct the table as follows:

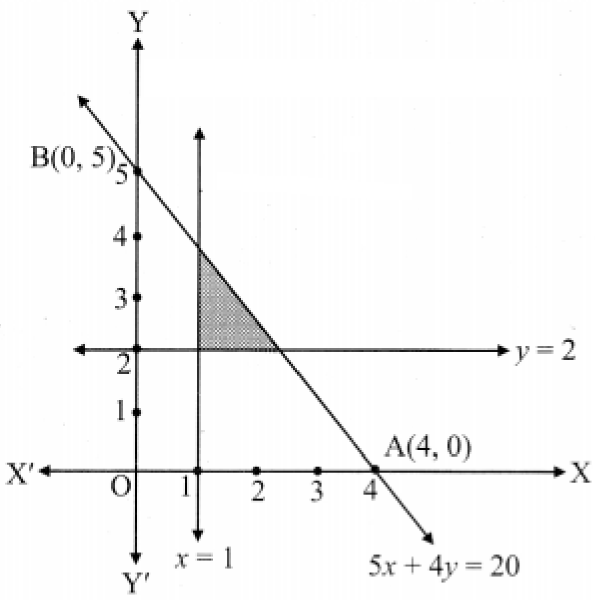
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x + y \leq 9$	$x + y = 9$	$\frac{x}{9} + \frac{y}{9} = 1$	A (9, 0), B (0, 9)	$0 + 0 \leq 9$ $\therefore 0 \leq 9$ $\therefore$ origin side
$y \geq x$	$y = x$	—	O (0, 0), C (1, 1)	$\therefore 0 \geq 0$ $\therefore$ origin side
$x \geq 0$	$x = 0$	—		R.H.S of Y-axis



The shaded portion represents the graphical solution.

Question 9.
$5x + 4y \leq 20$, $x \geq 1$, $y \geq 2$
Solution:
To find a graphical solution, construct the table as follows:

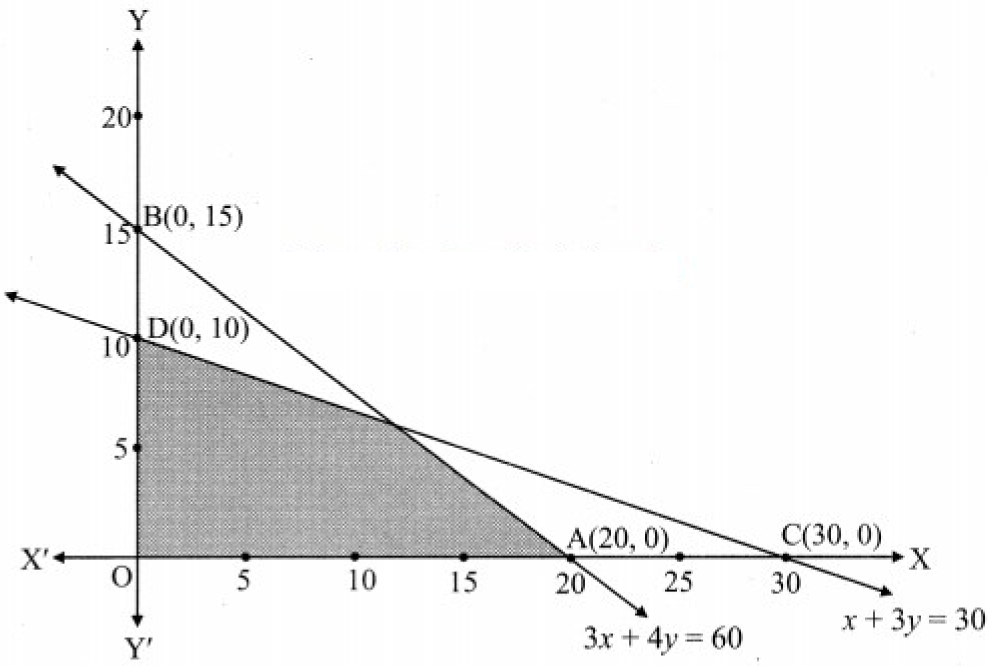
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$5x + 4y \le 20$	$5x + 4y = 20$	$\frac{x}{4} + \frac{y}{5} = 1$	A (4, 0), B (0, 5)	$5(0) + 4(0) \le 20$ $\therefore 0 \le 20$ $\therefore$ origin side
$x \ge 1$	$x = 1$	—	—	$\therefore 0 \ngeq 1$ $\therefore$ R.H.S. of line $x = 1$
$y \ge 2$	$y = 2$	—	—	$\therefore 0 \ngeq 2$ $\therefore$ above the line $y = 2$



The shaded portion represents the graphical solution.

Question 10.
$3x + 4y \le 60$, $x + 3y \le 30$, $x \ge 0$, $y \ge 0$
Solution:
To find a graphical solution, construct the table as follows:

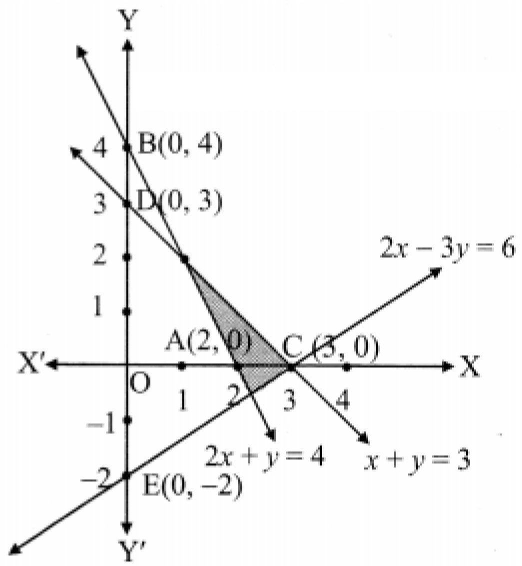
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$3x + 4y \leq 60$	$3x + 4y = 60$	$\frac{x}{20} + \frac{y}{15} = 1$	A (20, 0), B (0, 15)	$5(0) + 4(0) \leq 60$ $\therefore 0 \leq 60$ $\therefore$ origin side
$x + 3y \leq 30$	$x + 3y = 30$	$\frac{x}{30} + \frac{y}{10} = 1$	C (30, 0), D (0, 10)	$0 + 3(0) \leq 30$ $\therefore 0 \leq 30$ $\therefore$ origin side
$x \geq 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \geq 0$	$y = 0$	—	—	above X-axis



The shaded portion represents the graphical solution.

Question 11.
$2x + y \geq 4$, $x + y \leq 3$, $2x - 3y \leq 6$
Solution:
To find a graphical solution, construct the table as follows:

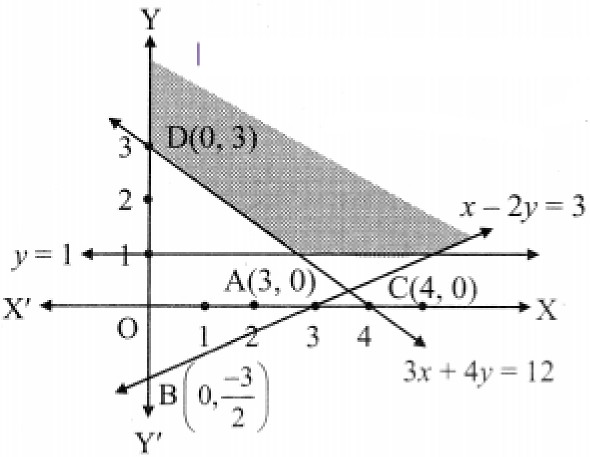
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$2x + y \geq 4$	$2x + y = 4$	$\frac{x}{2} + \frac{y}{4} = 1$	A (2, 0), B (0, 4)	$2(0) + 0 \ngeq 4$ $\therefore 0 \ngeq 4$ $\therefore$ non-origin side
$x + y \leq 3$	$x + y = 3$	$\frac{x}{3} + \frac{y}{3} = 1$	C (3, 0), D (0, 3)	$0 + 0 \leq 3$ $\therefore 0 \leq 3$ $\therefore$ origin side
$2x - 3y \leq 6$	$2x - 3y = 6$	$\frac{x}{3} - \frac{y}{2} = 1$ i.e., $\frac{x}{3} + \frac{y}{-2} = 1$	C (3, 0), E (0, –2)	$2(0) - 3(0) \leq 6$ $\therefore 0 \leq 6$ $\therefore$ origin side



The shaded portion represents the graphical solution.

Question 12.
$x - 2y \leq 3$, $3x + 4y \geq 12$, $x \geq 0$, $y \geq 1$
Solution:
To find a graphical solution, construct the table as follows:

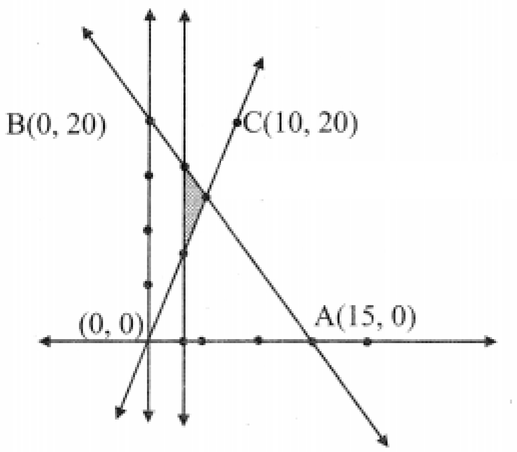
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x - 2y \leq 3$	$x - 2y = 3$	$\frac{x}{3} - \frac{2y}{3} = 1$ i.e., $\frac{x}{3} + \frac{y}{\left(\frac{-3}{2}\right)} = 1$	A (3, 0), B $\left(0, \frac{-3}{2}\right)$	$0 - 2(0) \leq 3$ $\therefore 0 \leq 3$ $\therefore$ origin side
$3x + 4y \geq 12$	$3x + 4y = 12$	$\frac{x}{4} + \frac{y}{3} = 1$	C (4, 0), D (0, 3)	$3(0) + 4(0) \ngeq 12$ $\therefore 0 \ngeq 12$ $\therefore$ non-origin side
$x \geq 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \geq 1$	$y = 1$	—	—	$0 \ngeq 1$ Above the line $y = 1$



The shaded portion represents the graphical solution.

Question 13.
4x + 3y ≤ 60, y ≥ 2x, x ≥ 3, x, y ≥ 0
Solution:
To find a graphical solution, construct the table as follows:

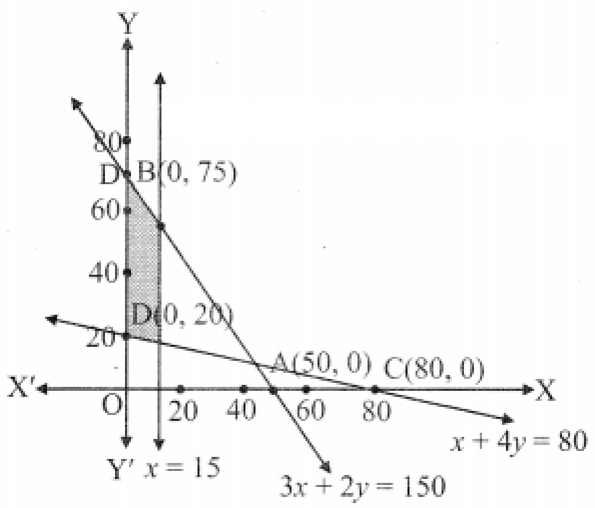
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$4x + 3y \leq 60$	$4x + 3y = 60$	$\frac{x}{15} + \frac{y}{20} = 1$	A (15, 0), B (0, 20)	$4(0) + 3(0) \leq 60$ $\therefore 0 \leq 60$ $\therefore$ origin side
$y \geq 2x$	$y = 2x$	—	O (0, 0), C (10, 20)	$0 \geq 2(0)$ $\therefore 0 \geq 0$ $\therefore$ origin side
$x \geq 3$	$x = 3$	—	—	$0 \ngeq 3$ $\therefore$ R.H.S. of the line $x = 3$
$x \geq 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \geq 0$	$y = 0$	—	—	Above X-axis



The shaded portion represents the graphical solution.

Question 14.
$3x + 2y \leq 150$, $x + 4y \geq 80$, $x \leq 15$, $y \geq 0$, $x \geq 0$
Solution:
To find a graphical solution, construct the table as follows:

Inequation	Equation	Double Intercept form	Points (x, y)	Region
$3x + 2y \leq 150$	$3x + 2y = 150$	$\frac{x}{50} + \frac{y}{75} = 1$	A (50, 0), B (0, 75)	$3(0) + 2(0) \leq 150$ ∴ $0 \leq 150$ ∴ origin side
$x + 4y \geq 80$	$x + 4y = 80$	$\frac{x}{80} + \frac{y}{20} = 1$	C (80, 0), D (0, 20)	$0 + 4(0) \ngeq 80$ ∴ $0 \ngeq 80$ ∴ non-origin side
$x \leq 15$	$x = 15$	—	—	$0 \leq 15$ ∴ L.H.S. of the line $x = 15$
$x \geq 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \geq 0$	$y = 0$	—	—	Above X-axis



The shaded portion represents the graphical solution.

Question 15.
$x + 2y \leq 10, x + y \geq 1, x - y \leq 0, x \geq 0, y \geq 0$
Solution:
To find a graphical solution, construct the table as follows:

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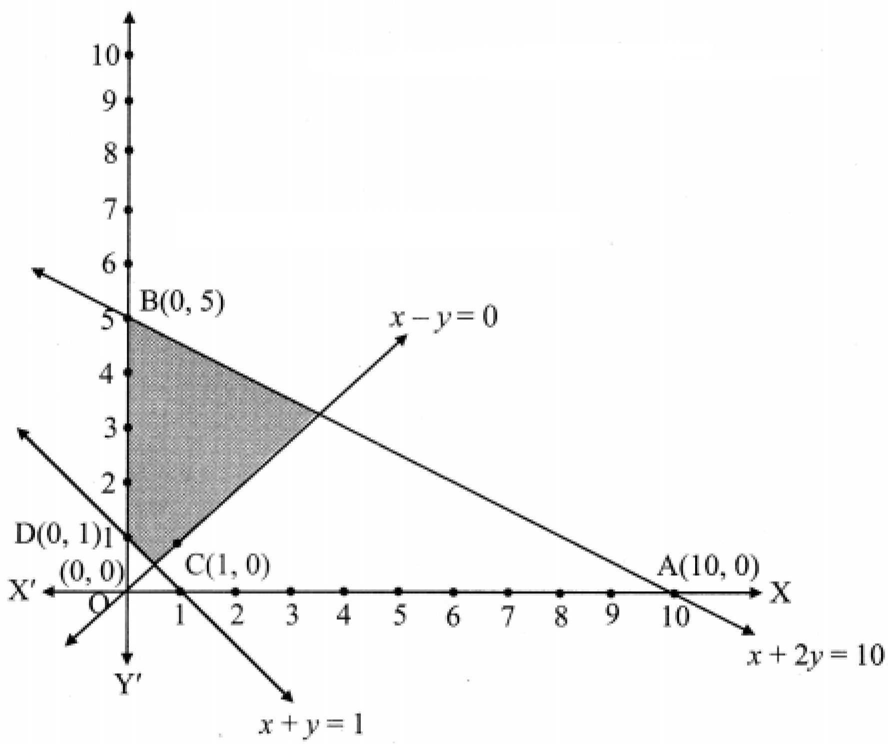
Inequation	Equation	Double Intercept form	Points (x, y)	Region
$x + 2y \leq 10$	$x + 2y = 10$	$\frac{x}{10}+\frac{y}{5}=1$	A (10, 0), B (0, 5)	$0 + 2(0) \leq 10$ $\therefore 0 \leq 10$ $\therefore$ origin side
$x + y \geq 1$	$x + y = 1$	$\frac{x}{1}+\frac{y}{1}=1$	C (1, 0), D (0, 1)	$0 + 0 \ngeq 1$ $\therefore 0 \ngeq 1$ $\therefore$ non-origin side
$x - y \leq 0$	$x - y = 0$	—	O(0,0), E(1,1)	$0 - 0 \leq 0$ $\therefore 0 \leq 0$ $\therefore$ origin side
$x \geq 0$	$x = 0$	—	—	R.H.S. of Y-axis
$y \geq 0$	$y = 0$	—	—	Above X-axis



The shaded portion represents the graphical solution.