EXERCISE 15.6

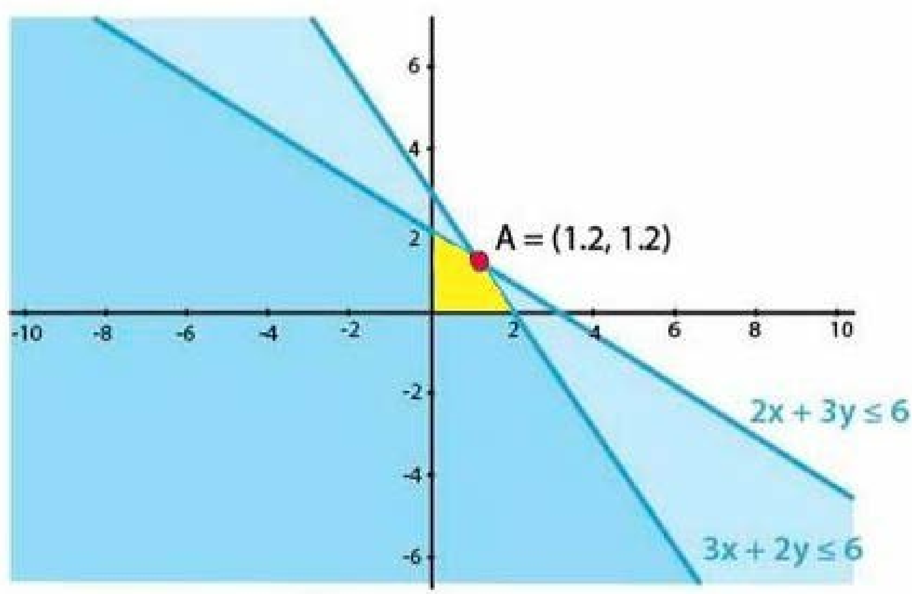
Solve the following systems of linear inequations graphically.
(i) $2x + 3y \leq 6, 3x + 2y \leq 6, x \geq 0, y \geq 0$
(ii) $2x + 3y \leq 6, x + 4y \leq 4, x \geq 0, y \geq 0$
(iii) $x - y \leq 1, x + 2y \leq 8, 2x + y \geq 2, x \geq 0, y \geq 0$
(iv) $x + y \geq 1, 7x + 9y \leq 63, x \leq 6, y \leq 5, x \geq 0, y \geq 0$
(v) $2x + 3y \leq 35, y \geq 3, x \geq 2, x \geq 0, y \geq 0$
Solution:
(i) $2x + 3y \leq 6, 3x + 2y \leq 6, x \geq 0, y \geq 0$
We shall plot the graph of the equation and shade the side containing solutions of the inequality,
You can choose any value but find the two mandatory values which are at x = 0 and y = 0, i.e., x and y–intercepts always,
$2x + 3y \leq 6$
So when,

x	0	1	3
y	2	1.33	0

$3x + 2y \leq 6$
So when,

x	0	1	2
y	3	1.5	0

$x \geq 0, y \geq 0$



(ii) $2x + 3y \leq 6$, $x + 4y \leq 4$, $x \geq 0$, $y \geq 0$

We shall plot the graph of the equation and shade the side containing solutions of the inequality,

You can choose any value but find the two mandatory values which are at $x = 0$ and $y = 0$, i.e., x and y–intercepts always,

$2x + 3y \leq 6$

So when,

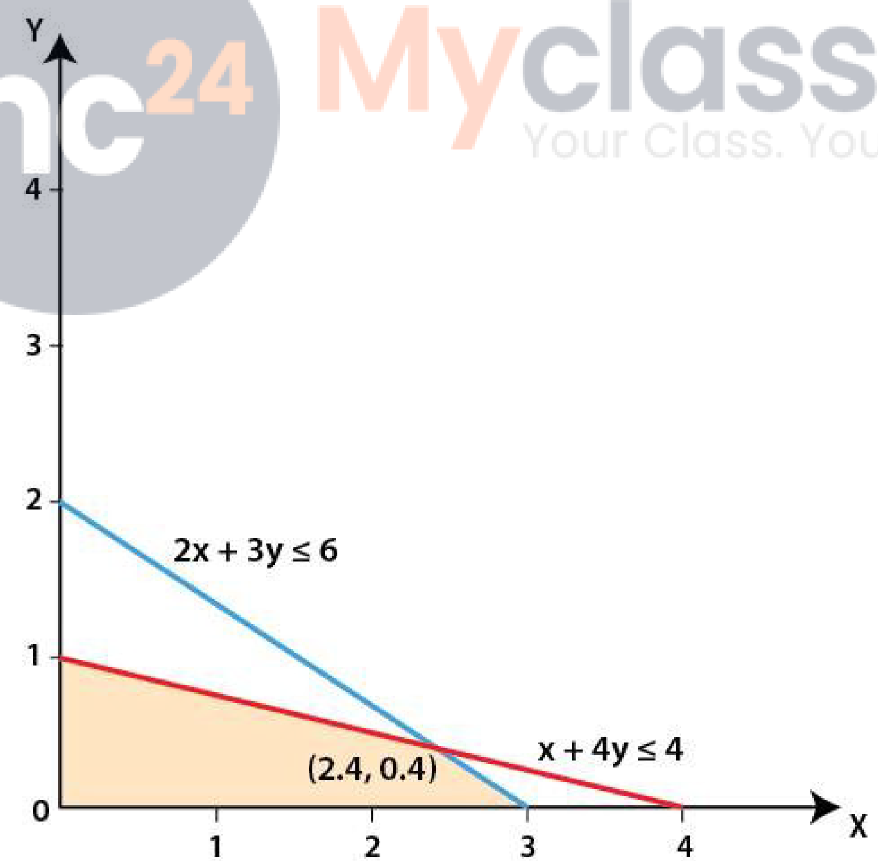
x	0	1	3
y	2	1.33	0

$x + 4y \leq 4$

So when,

x	0	2	4
y	1	0.5	0

$x \geq 0$, $y \geq 0$



(iii) $x - y \leq 1$, $x + 2y \leq 8$, $2x + y \geq 2$, $x \geq 0$, $y \geq 0$
We shall plot the graph of the equation and shade the side containing solutions of the inequality,
You can choose any value but find the two mandatory values which are at x = 0 and y = 0, i.e., x and y–intercepts always,
$x - y \leq 1$
So when,

x	0	2	1
y	-1	1	0

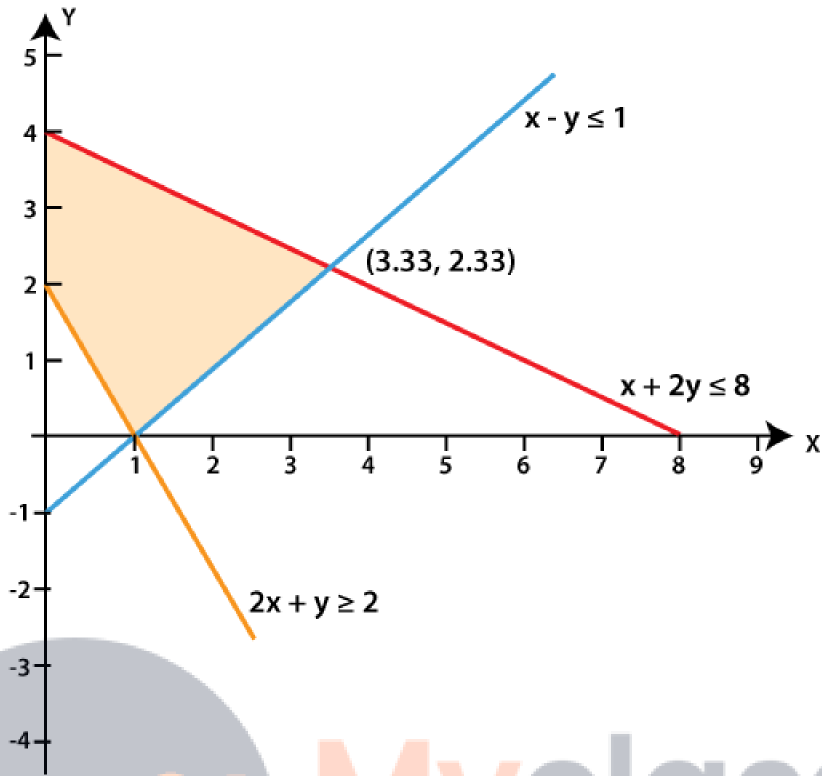
$x + 2y \leq 8$
So when,

x	0	4	8
y	4	2	0

$2x + y \geq 2$
So when,

x	0	2	1
y	2	-2	0

$x \geq 0$, $y \geq 0$



(iv) $x + y \geq 1$, $7x + 9y \leq 63$, $x \leq 6$, $y \leq 5$, $x \geq 0$, $y \geq 0$

We shall plot the graph of the equation and shade the side containing solutions of the inequality,

You can choose any value but find the two mandatory values which are at x = 0 and y = 0, i.e., x and y–intercepts always,

$x + y \geq 1$

So when,

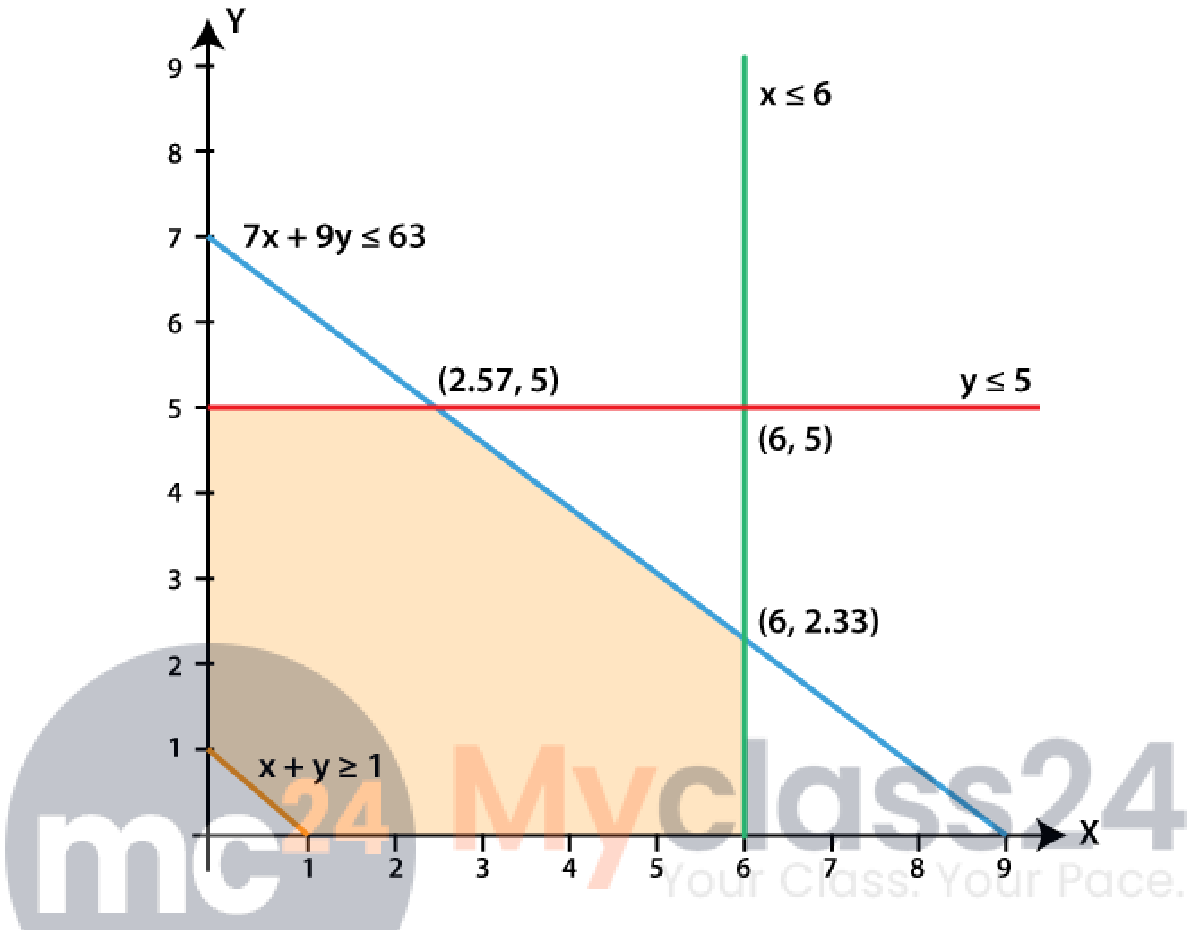
x	0	2	1
y	1	-1	0

$7x + 9y \leq 63$

So when,

x	0	5	9
y	7	3.11	0

$x \leq 6$, $y \leq 5$ and $x \geq 0$, $y \geq 0$



(v) $2x + 3y \le 35$, $y \ge 3$, $x \ge 2$, $x \ge 0$, $y \ge 0$

We shall plot the graph of the equation and shade the side containing solutions of the inequality,

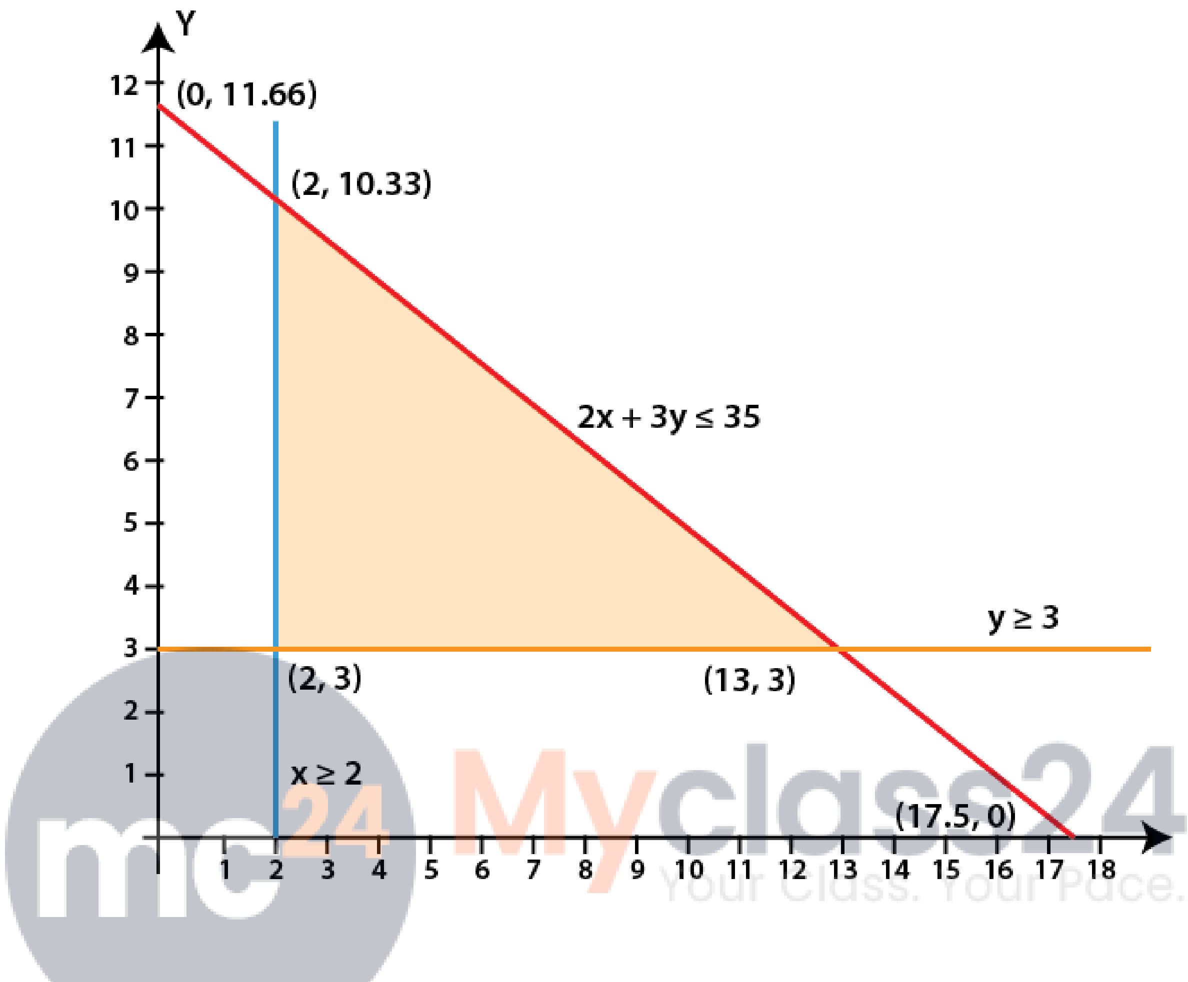
You can choose any value but find the two mandatory values which are at x = 0 and y = 0, i.e., x and y–intercepts always,

$2x + 3y \le 35$

So when,

x	0	5	17.5
y	11.667	8.33	0

$y \ge 3$, $x \ge 2$, $x \ge 0$, $y \ge 0$



2. Show that the solution set of the following linear inequations is empty set:

(i) $x - 2y \geq 0$, $2x - y \leq -2$, $x \geq 0$, $y \geq 0$

(ii) $x + 2y \leq 3$, $3x + 4y \geq 12$, $y \geq 1$, $x \geq 0$, $y \geq 0$

Solution:

(i) $x - 2y \geq 0$, $2x - y \leq -2$, $x \geq 0$, $y \geq 0$

We shall plot the graph of the equation and shade the side containing solutions of the inequality,

You can choose any value but find the two mandatory values which are at x = 0 and y = 0, i.e., x and y–intercepts always,

$x - 2y \geq 0$

So when,

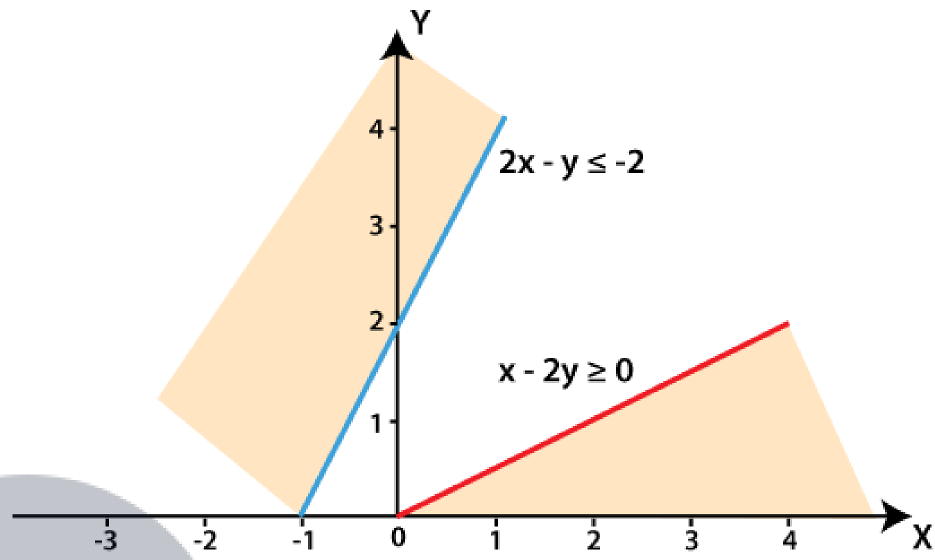
x	0	2	4
y	0	1	2

$2x - y \leq -2$

So when,

x	0	1	-1
y	2	4	0

$x \geq 0, y \geq 0$



The lines do not intersect each other for $x \geq 0, y \geq 0$
Hence, there is no solution for the given inequations.

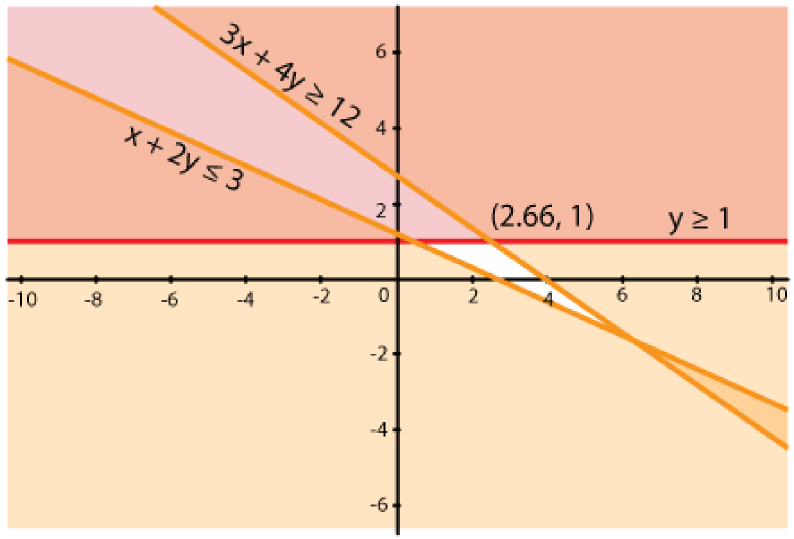
(ii) $x + 2y \leq 3, 3x + 4y \geq 12, y \geq 1, x \geq 0, y \geq 0$
We shall plot the graph of the equation and shade the side containing solutions of the inequality,
You can choose any value but find the two mandatory values which are at x = 0 and y = 0, i.e., x and y–intercepts always,
$x + 2y \leq 3$
So when,

x	0	1	3
y	1.5	1	0

$3x + 4y \geq 12$
So when,

x	0	2	4
y	3	1.5	0

$y \geq 1, x \geq 0, y \geq 0$



3. Find the linear inequations for which the shaded area in Fig. 15.41 is the solution set. Draw the diagram of the solution set of the linear inequations.

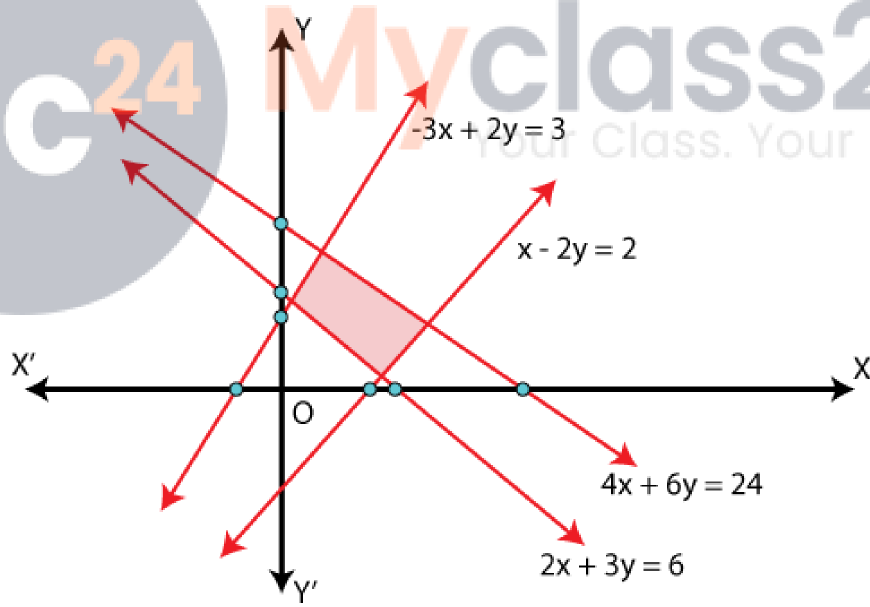


Fig 15.41

Solution:

Here, we shall apply the concept of a common solution area to find the signs of inequality by using their given equations and the given common solution area (shaded part).

We know that,

If a line is in the form ax + by = c and c is positive constant. (In case of negative c, the rule becomes opposite), so there are two cases which are,

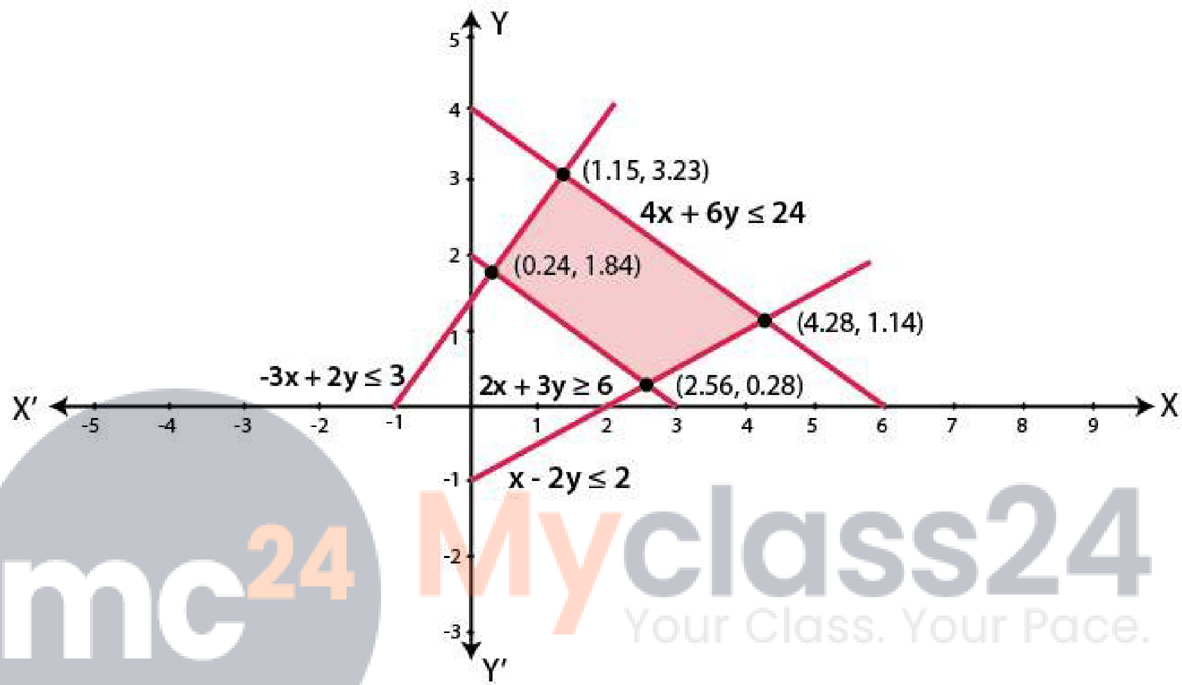
<u>If a line is above the origin:</u>

(i) If the shaded area is below the line then ax + by < c

(ii) If the shaded area is above the line then ax + by > c

<u>If a line is below the origin then the rule becomes opposite.</u>

So, according to the rules



4. Find the linear inequations for which the solution set is the shaded region given in Fig. 15.42.

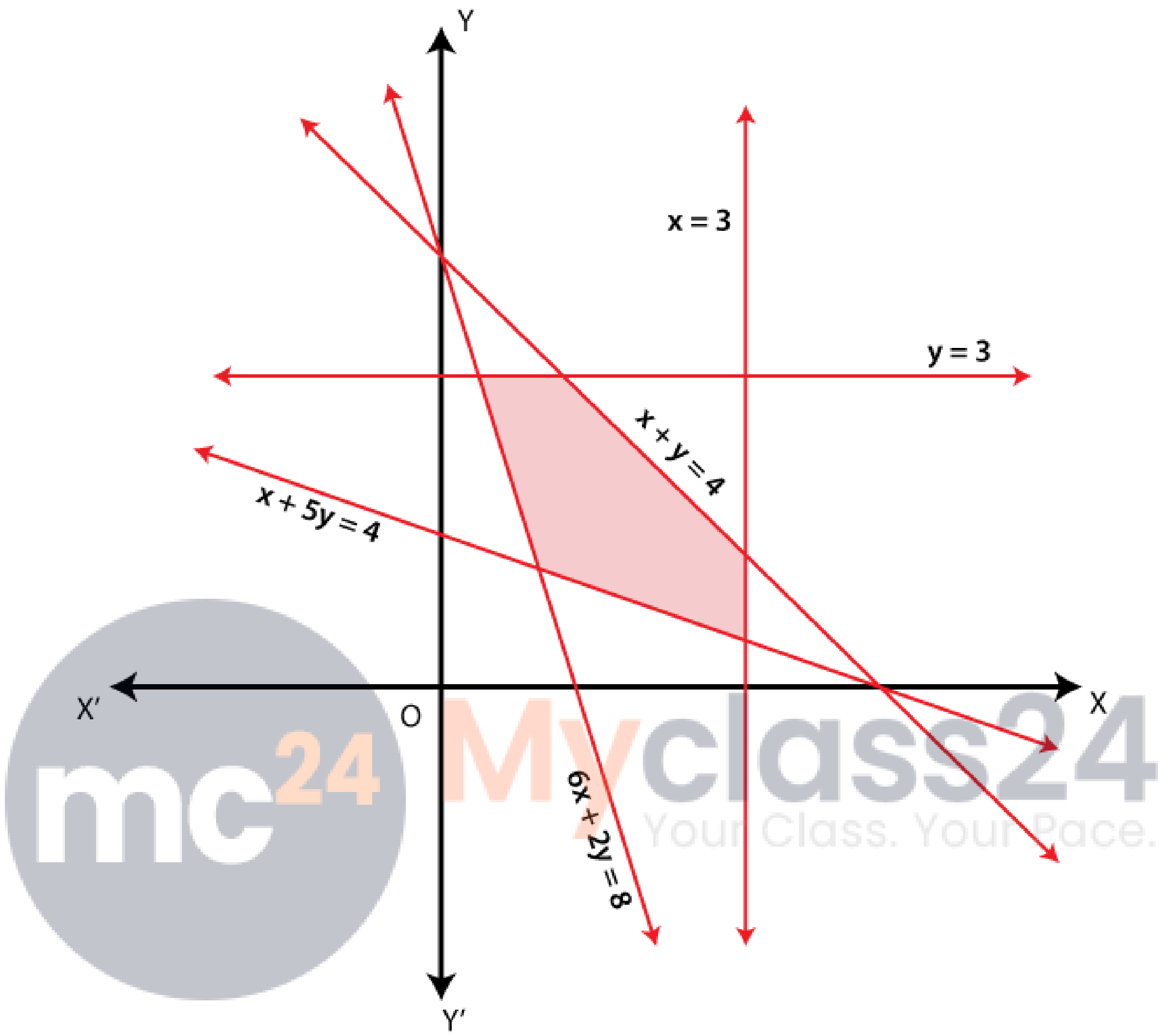
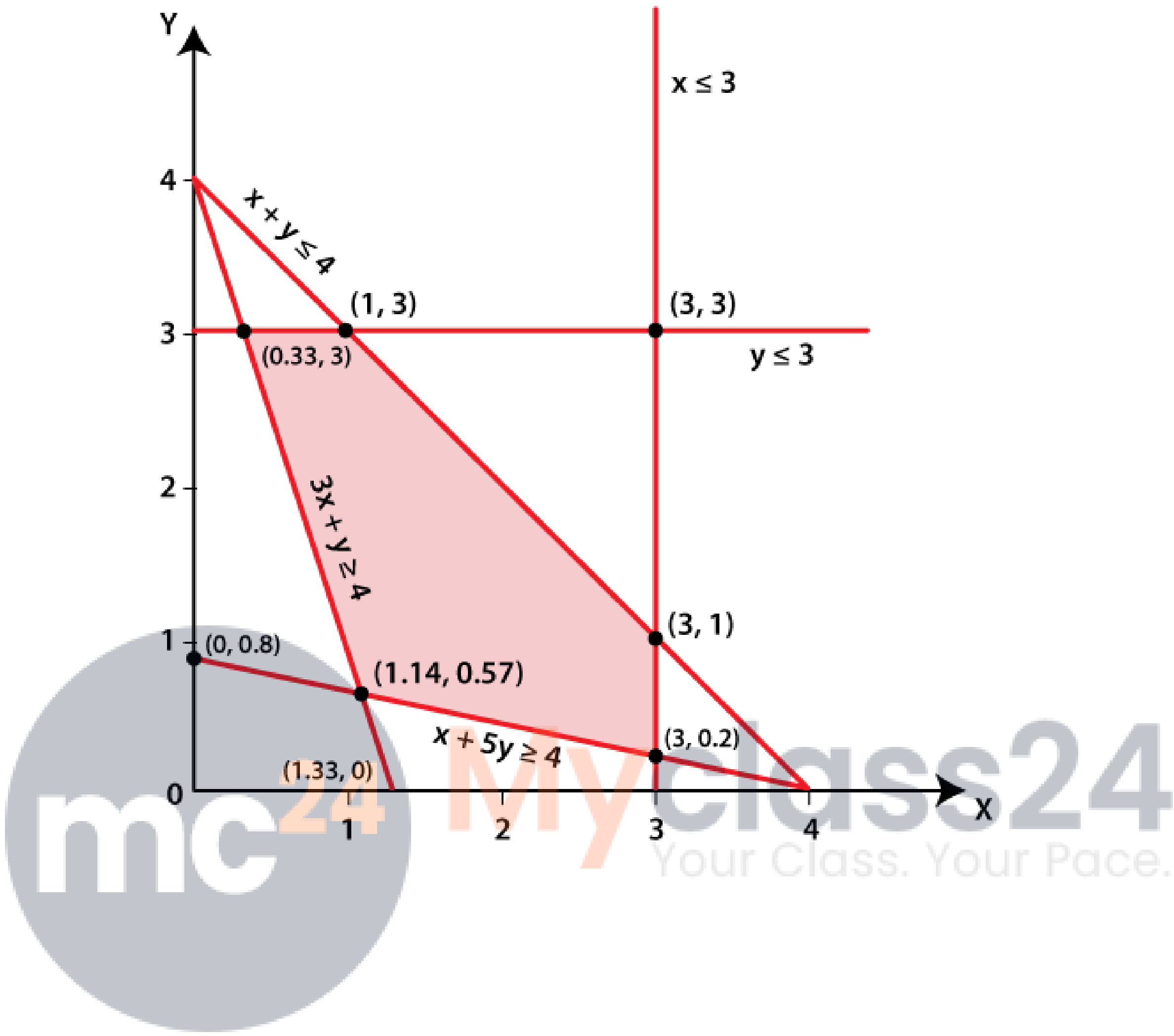


Fig 15.42

Solution:
Here, we shall apply the concept of a common solution area to find the signs of inequality by using their given equations and the given common solution area (shaded part).
We know that,
If a line is in the form ax + by = c and c is positive constant.
So, according to the rules


Y
X
x ≤ 3
y ≤ 3
x + y ≤ 4
3x + y ≥ 4
x + 5y ≥ 4
(1, 3)
(3, 3)
(0.33, 3)
(3, 1)
(0, 0.8)
(1.14, 0.57)
(3, 0.2)
(1.33, 0)
0
1
2
3
4
1
2
3
4