NCERT Solutions for Class-XII Maths

Chapter-12.1

NCERT Chemistry Class 12

1. Maximise $Z = 3x + 4y$ subject to the constraints : $x + y \leq 4$, $x \geq 0$, $y \geq 0$.

1. It is given in the question that,

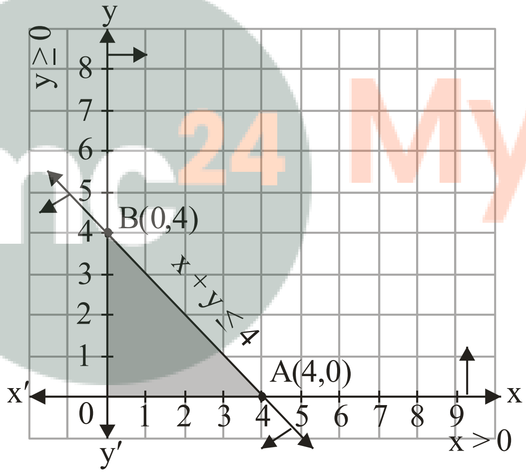
$Z = 3x + 4y$

We have to subject on the following equation:

$x \geq 0, y \geq 0, x + y \leq 4$

X	0	4
y	4	0

$(x, y) = (0, 4), (4, 0)$

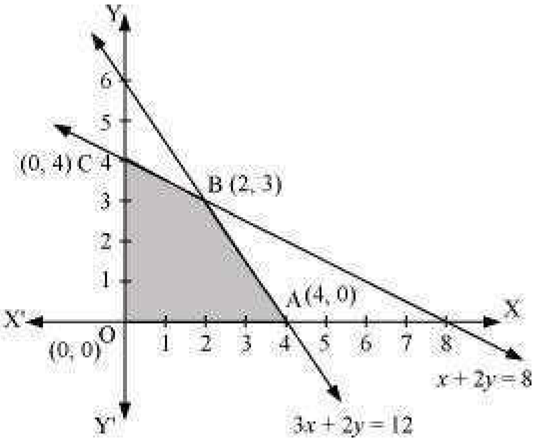


Corner Points	Value of Z = 3x + 4y
(0, 4)	16
(4, 0)	9
(0, 0)	0

We can clearly see that Z is maximum at (0, 4). Hence, maximum value of Z will be 16

2. Minimise $Z = -3x + 4y$ subject to $x + 2y \leq 8$, $3x + 2y \leq 12$, $x \geq 0$, $y \geq 0$.

2. The feasible region determined by the system of constraints, $x + 2y \leq 8, 3x + 2y \leq 12, x \geq 0$, and $y \geq 0$, is as follows.



The corner points of the feasible region are O (0, 0), A (4, 0), B (2, 3), and C (0, 4).
The values of Z at these corner points are as follows.

Corner point	Z = −3x + 4y	
0(0, 0)	0	
A(4, 0)	−12	→ Minimum
B(2, 3)	6	
C(0, 4)	16	

Therefore, the minimum value of Z is −12 at the point (4, 0).

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Therefore, the minimum value of Z is −12 at the point (4, 0).

3. Maximise Z = 5x + 3y subject to $3x + 5y \leq 15$, $5x + 2y \leq 10$, $x \geq 0$, $y \geq 0$.

3. It is given in the question that,

Z = 5x + 3y

We have to subject on the following equation:

$3x + 5y \leq 15$, $5x + 2y \leq 10$, $x \geq 0$, $y \leq 0$

$5x + 2y \leq 10$

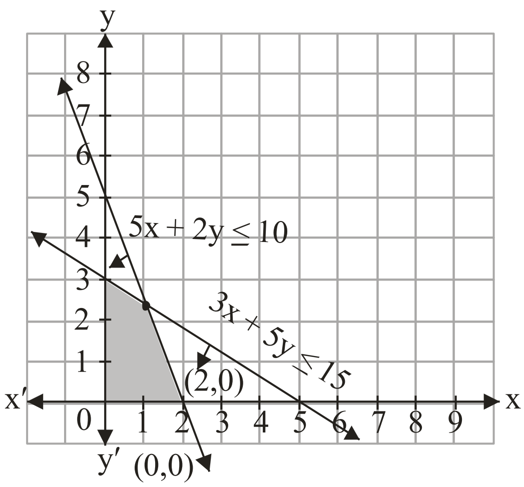
X	0	2
Y	5	0

(x, y) = (0, 5), (2, 0)

$3x + 5y \leq 15$

X	0	5
Y	3	0

(x, y) = (0, 3), (5, 0)



Corner Points	Value of Z
(0, 3)	9
$\left(\frac{20}{19}, \frac{45}{19}\right)$	$\frac{235}{19} = 12.36$
(2, 0)	10

We can clearly see that Z is maximum at $\left(\frac{20}{19}, \frac{45}{19}\right)$. Hence, maximum value of Z will be $\frac{235}{19} = 12.36$

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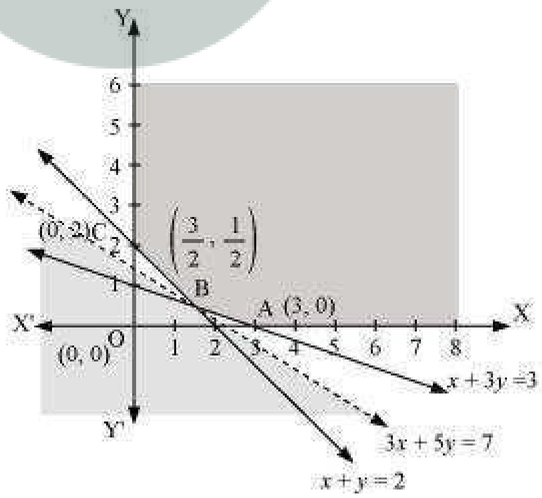
4. Minimize Z = 3x + 5y such that x + 3y ≥ 3, x + y ≥ 2, x, y ≥ 0.

4. The feasible region determined by the system of constraints, $x + 3y \geq 3, x + y \geq 2$, and x, $y \geq 0$, is as follows.



It can be seen that the feasible region is unbounded.

The corner points of the feasible region are $A(3,0)$, $B\left(\frac{3}{2},\frac{1}{2}\right)$, and $C(0,2)$. The values of Z at these corner points are as follows.

Corner point	**Z = 3x + 5y**	
A (3, 0)	9	
B $\left(\frac{3}{2}, \frac{1}{2}\right)$	7	→ Smallest
C (0, 2)	10	

As the feasible region is unbounded, therefore, 7 may or may not be the minimum value of Z.

For this, we draw the graph of the inequality, $3x + 5y < 7$, and check whether the resulting half plane has points in common with the feasible region or not.

It can be seen that the feasible region has no common point with $3x + 5y < 7$

Therefore, the minimum value of Z is 7 at $\left(\frac{3}{2}, \frac{1}{2}\right)$.

5. Maximize Z = 3x + 2y subject to x + 2y ≤ 10, 3x + y ≤ 15, x, y ≥ 0.

5. It is given in the question that,

Z = 3x + 2y

We have to subject on the following equation:

x +2y ≤ 10, 3x+y ≤ 15, x, y ≥ 0

3x+y ≤ 15

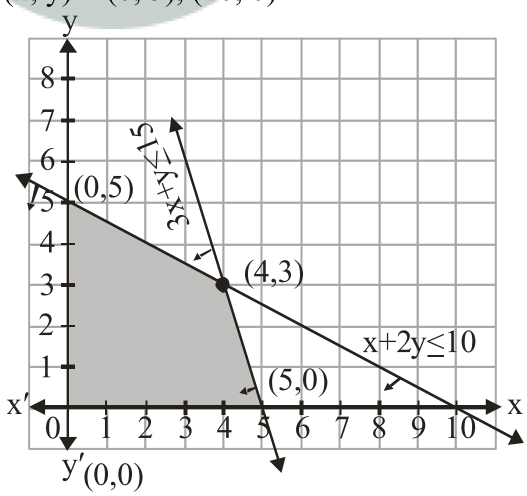
X	0	5
Y	15	0

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

$x + 2y \leq 10$

X	0	10
Y	5	0

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



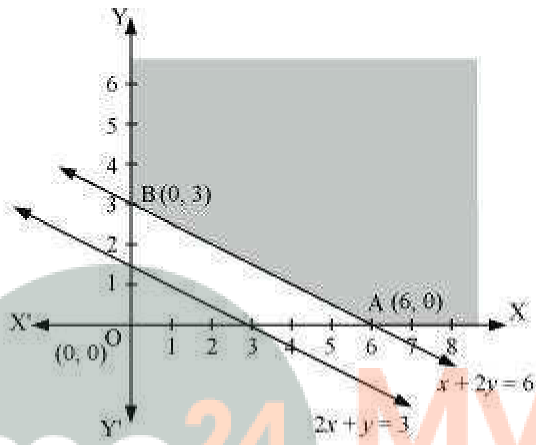
Corner Points	**Value of Z**
(5, 0)	15

(4, 3)	18
(0, 5)	10
(0, 0)	0

We can clearly see that Z is maximum at (4, 3). Hence, maximum value of Z will be 18

6. Minimize Z = x + 2y subject to 2x + y ≥ 3, x + 2y ≥ 6, x, y ≥ 0. Show that the minimum of Z occurs at more than two points.

6. The feasible region determined by the constraints, 2x + y ≥ 3, x + 2y ≥ 6, x ≥ 0, and y ≥ 0, is as follows.



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The corner points of the feasible region are A (6, 0) and B (0, 3).
The values of Z at these corner points are as follows.

Corner point	Z = x + 2y
A(6, 0)	6
B(0, 3)	6

It can be seen that the value of Z at points A and B is same. If we take any other point such as (2, 2) on line x + 2y = 6, then Z = 6
Thus, the minimum value of Z occurs for more than 2 points.
Therefore, the value of Z is minimum at every point on the line, x + 2y = 6

7. Minimize and Maximize Z = 5x + 10 y subject to x + 2y ≤ 120, x + y ≥ 60, x – 2y ≥ 0, x, y ≥ 0.

7. It is given in the question that,
Minimize and Maximize, Z = 5x + 10y
We have to subject on the following equation:
$x + 2y \le 120, x + y \ge 60, x - 2y \ge 0, x, y \ge 0$
$x + 2y \le 120$

X	0	120

Y	60	0

(x, y) = (0, 60), (120, 0)

$x - 2y \ \geq \ 0$

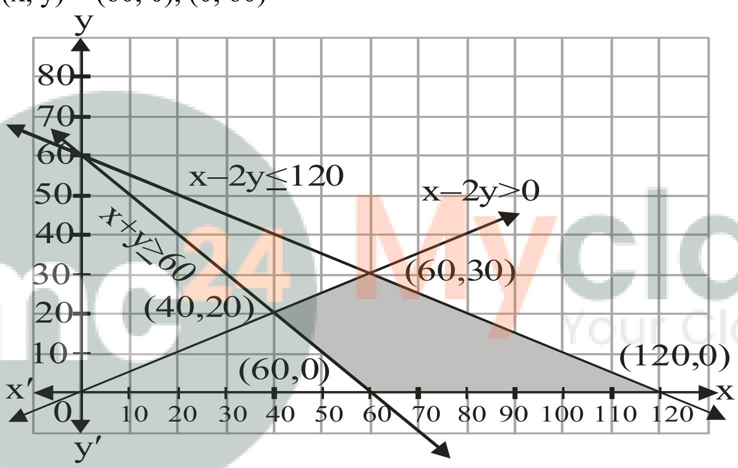
X	0	20
Y	0	10

(x, y) = (0, 0), (20, 10)

$x + y \ \geq \ 60$

X	60	0
Y	0	60

(x, y) = (60, 0), (0, 60)

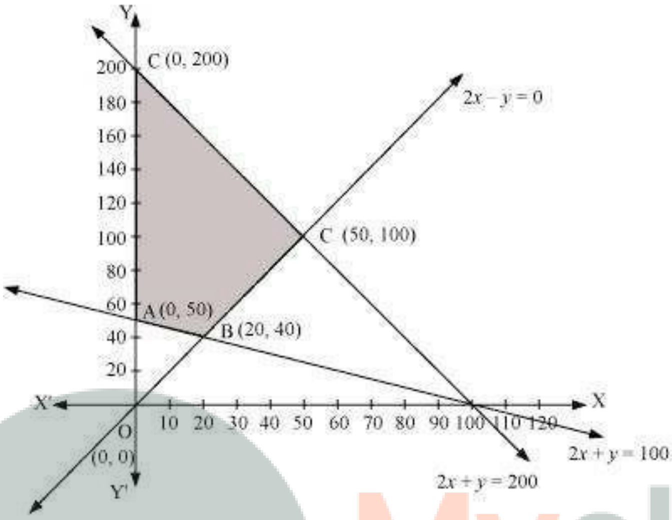


Corner Points	Value of Z
(60, 30)	600
(40, 20)	400
(60, 0)	300
(120, 0)	600

∴ It is clear that at (60, 0) Z has its minimum value i.e. 300
Also, Z is minimum at two pints (60, 30) and (120, 0)
Hence, the value of Z will be maximum at all points joining (60, 30) and (120, 0)

8. Minimize and Maximize Z = x + 2y subject to x + 2y ≥ 100, 2x – y ≤ 0, 2x + y ≤ 200; x, y ≥ 0.

8. The feasible region determined by the constraints, x + 2y ≥ 100, 2x − y ≤ 0, 2x + y ≤ 200, x ≥ 0, and y ≥ 0, is as follows.



The corner points of the feasible region are A(0, 50), B(20, 40), C(50, 100), and D(0, 200).

The values of Z at these corner points are as follows.

The maximum value of Z is 400 at (0, 200) and the minimum value of Z is 100 at all

Corner point	**Z = x + 2y**	
A(0, 50)	100	→ Minimum
B(20, 40)	100	→ Minimum
C(50, 100)	250	
D(0, 200)	400	→ Maximum

The maximum value of Z is 400 at (0, 200) and the minimum value of Z is 100 at all the points on the line segment joining the points (0, 50) and (20, 40).

9. Maximize Z = – x + 2y, subject to the constraints: x ≥ 3, x + y ≥ 5, x + 2y ≥ 6, y ≥ 0.

9. It is given in the question that,

Z = - x + 2y

We have to subject on the following equation:

$x \geq 3, x + y \geq 5, x + 2y \geq 6, y \geq 0$

$x + y \geq 5$

x	5	0

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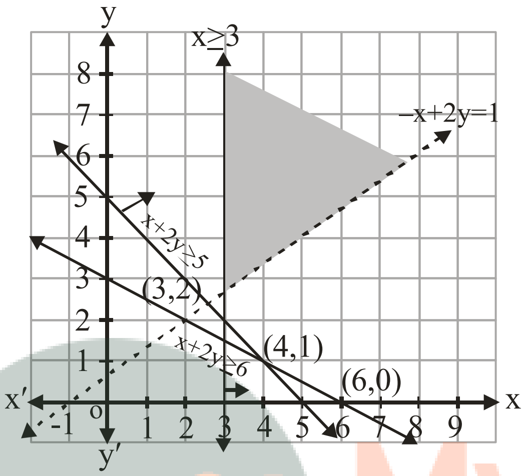
y	0	5

(x, y) = (5, 0), (0, 5)

$x + 2y \geq 6$

x	6	0
Y	0	3

(x, y) = (6, 0), (3, 0)



We can clearly see that the feasible region is unbounded and the corner points of the feasible region are (3, 2), (4, 1) and (6, 0)

Corner Points	**Value of Z**
(3, 2)	1
(4, 1)	- 2
(6, 0)	- 6

As per the table maximum value of Z is 1 but we can see that the feasible region is unbounded. Thus, 1 may or may not be the minimum value of Z

∴ We will plot the graph of inequality, $-x + 2y > 1$

Here we will see is the resulting half plane has common points with the feasible region or not.

As per the graph we can observe that the feasible region have some points in common with -x + 2y > 1.

Hence, there is no maximum value of Z

10. Maximize Z = x + y, subject to x – y ≤ –1, –x + y ≤ 0, x, y ≥ 0.

10. The region determined by the constraints, is as follows. There is no feasible region and thus, Z ha:

$x - y \leq -1, -x + y \leq 0, x, y \geq 0,$

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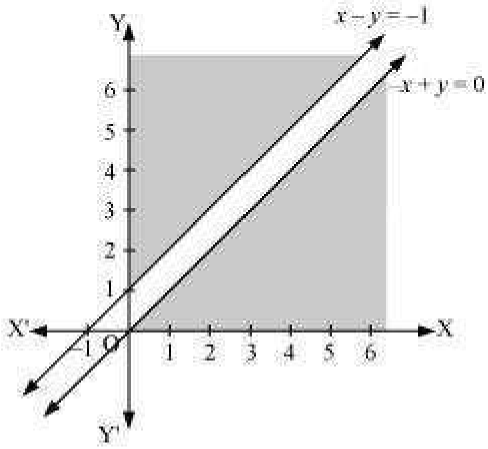

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