

Solve the L.P.P graphically.

आलेख द्वारा निम्न रैखिक प्रोग्रामन समस्या को हल कीजिए:

1. Maximize $z = 4x + y$ s.t. $x + y \leq 50$,

$$3x + y \leq 90$$

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

निम्न अवरोधों के अंतर्गत $z = 4x + y$ का अधिकतम मान ज्ञात कीजिए : $x + y \leq 50$, $3x + y \leq 90$
 $x \geq 0, y \geq 0$

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

निम्न अवरोधों के अंतर्गत $Z = -3x + 4y$ का न्यूनतमीकरण कीजिए :
 $x + 2y \leq 8$, $3x + 2y \leq 12$,
 $x \geq 0, y \geq 0$

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

निम्न अवरोधों के अंतर्गत $Z = 3x + 2y$ का अधिकतम मान ज्ञात कीजिए –

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

4. Find Maximum and Minimum value of
 $Z = 5x + 10y$ subject to $x + 2y \leq 120$,

$$x + y \geq 60, x - 2y \geq 0 \quad x, y \geq 0$$

निम्न अवरोधों के अंतर्गत $Z = 5x + 10y$ का न्यूनतमीकरण तथा अधिकतमीकरण कीजिए :

$$x + 2y \leq 120,$$

$$x + y \geq 60, x - 2y \geq 0 \quad x, y \geq 0$$

5. Maximize $Z = y - 2x$ subject to
 $x \leq 2, x + y \leq 3, -2x + y \leq 1 \quad x, y \geq 0$

निम्न अवरोधों के अंतर्गत $Z = y - 2x$

का अधिकतमीकरण कीजिए –

$$x \leq 2, x + y \leq 3, -2x + y \leq 1 \quad x, y \geq 0.$$

6. Minimize and Maximize $Z = x + 2y$ subject to
 $x + 2y \geq 100$, $2x - y \leq 0$, $2x + y \leq 200$.
 $x, y \geq 0$

निम्न अवरोधों के अंतर्गत $Z = x + 2y$ का न्यूनतमीकरण तथा अधिकतमीकरण कीजिए :
 $x + 2y \geq 100$, $2x - y \leq 0$, $2x + y \leq 200$
 $x, y \geq 0$

5 MARKS SOLUTION

1.

Sol -

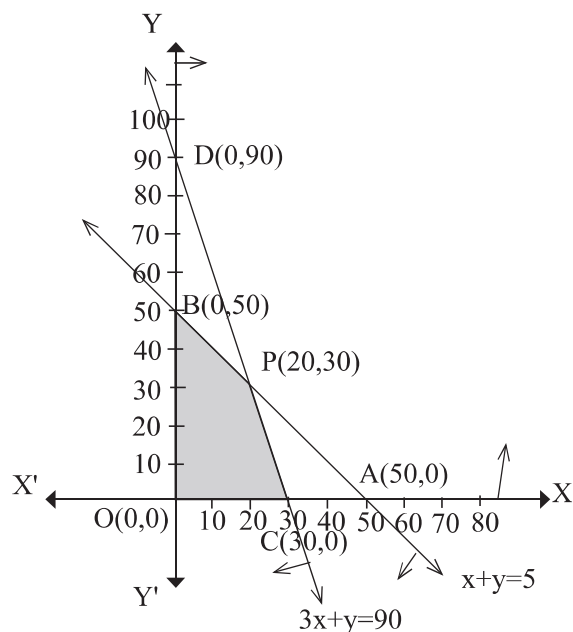
Convert all the constraints into equation, we get,

$$x + y = 50, 3x + y = 90, x = 0, y = 0$$

$$\Rightarrow \frac{x}{50} + \frac{y}{50} = 1, \frac{x}{30} + \frac{y}{90} = 1$$

Hence Eqⁿ $x + y = 50$ cuts the x -axis at A(50,0) and y -axis at B(0,50)

Similarly eqⁿ $3x + y = 90$ cuts the x -axis at C(30,0) and y -axis at D(0,90).



Check the region at (0,0) we get

$$0 + 0 \leq 50 \text{ \& } 0 + 0 \leq 90$$

$\therefore$ all inequation satisfies (0,0)

Corner point	objective function $Z_{\max} = 4x + y$
O(0,0)	$Z = 0$
C(30,0)	$Z = 4.30 + 0 = 120$ (Max ^m)
P(20,30)	$Z = 4.20 + 30 = 110$
B(0,50)	$Z = 0 + 50 = 50$

$\therefore$ Z is maximum at C(30,0)

$$\therefore Z_{\max} = 120$$

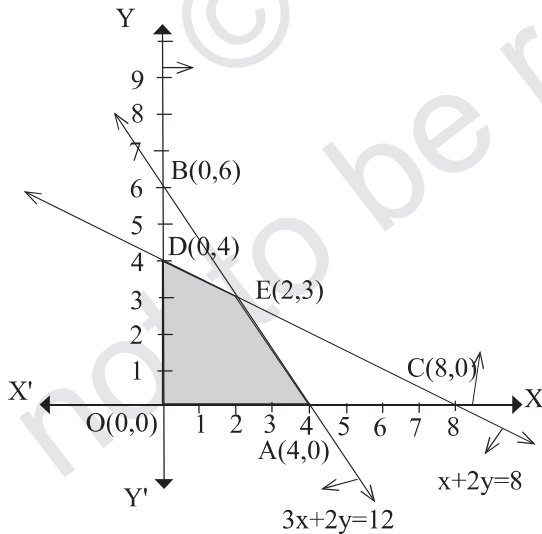
2. Convert all the constraints into eqⁿ-

$$x + 2y = 8, 3x + 2y = 12, x = 0, y = 0$$

Draw the graph-

x	8	0
y	0	4

x	4	0
y	0	6



put (0,0) into equation

$$\text{we get, } 0 \leq 8, 0 \leq 12$$

All the equation satisfies (0,0)

The corner points of the feasible region are

O(0,0), A(4,0), E(2,3) and D(0,4)

The values of Z at these corner points are-

Corner points	$Z = -3x + 4y$
O(0,0)	$Z = 0$
A(4,0)	$Z = -12 + 0 = -12$ (Min ^m)
E(2,3)	$Z = -6 + 12 = 6$
D(0,4)	$Z = 0 + 16 = 16$

The minimum value of Z is -12 at (4,0).

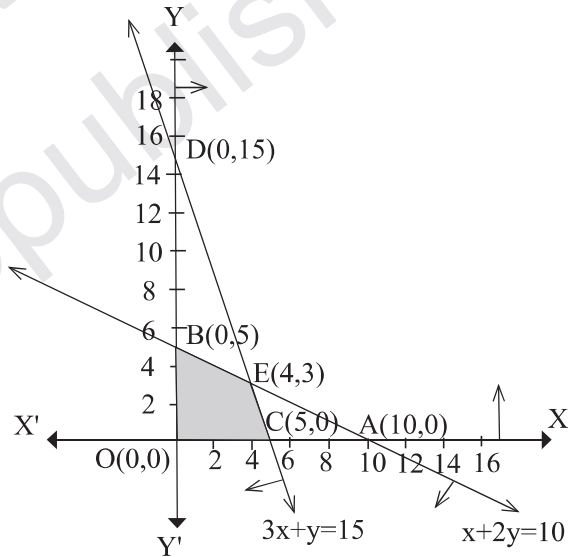
3. Convert all the constraints into eqⁿ.

$$x + 2y = 10, 3x + y = 15, x = 0, y = 0$$

Draw the graph-

x	10	0
y	0	5

x	5	0
y	0	15



The corner points of the feasible region are

O(0,0), C(5,0), E(4,3) and B(0,5)

The values of Z at these corner points are-

Corner points	$Z = 3x + 2y$
O(0,0)	$Z = 0 + 0 = 0$
C(5,0)	$Z = 3.5 + 0 = 15$
E(4,3)	$Z = 3.4 + 2.3 = 18$ (Max ^m)
B(0,5)	$Z = 0 + 2.5 = 10$

$\therefore$ The maximum value of Z is 18 at the point (4,3)

4. Convert all the constraints into eqⁿ-

We get,

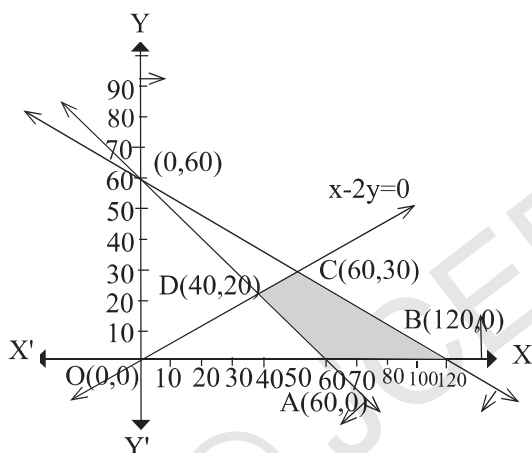
$$x + 2y = 120, x + y = 60, x - 2y = 0,$$

$$x = y = 0$$

$$\Rightarrow \frac{x}{120} + \frac{y}{60} = 1, \frac{x}{60} + \frac{y}{60} = 1,$$

$$x = 2y$$

Hence the equation $x+2y=120$ cut at (120,0) and (0, 60) and $x+y=60$ cuts x-axis at (60, 0) and y-axis at (0,60) and $x=2y$ passes through the origin and all equation satisfies (0.0)



The corner points of the feasible region are A(60,0), B(120,0), C(60,30) and D(40,20)

The value of z at these corner points are-

Corner points	$Z=5x+10y$
A(60,0)	$Z=5.60+0=300$ (Min ^m)
B(120,0)	$Z=5.120+0=600$ (Max ^m)
C(60,30)	$Z=5.60+10.30=600$ (Max ^m)
D(40,20)	$Z=5.40+10.20=400$

The minimum value of Z is 300 at (60,0) and the maximum value of Z is 600 at all the points on the line segment joining (120,0) and (60,30).

5. Sol- Convert all the constraints into eqⁿ-

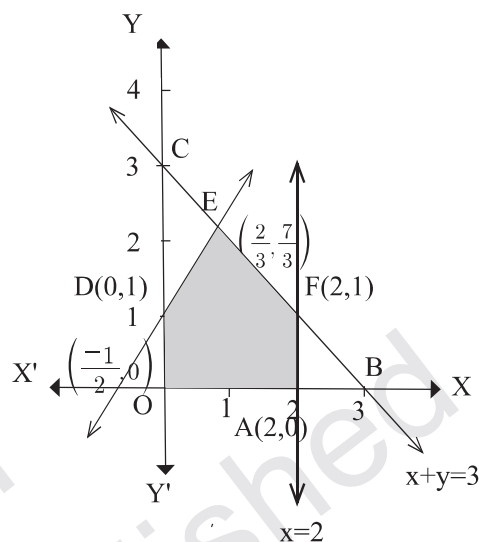
We, get

$$x = 2, x + y = 3, -2x + y = 1, x = 0, y = 0$$

$$\Rightarrow \frac{x}{3} + \frac{y}{3} = 1, \frac{x}{(-\frac{1}{2})} + \frac{y}{1} = 1$$

Hence, the equation $x=2$ cut x-axis at (2,0) and parallel to y-axis, eqⁿ $x+y=3$ cuts x-axis at (3,0) and y-axis at (0,3) and $-2x+y=1$ cuts x-axis at $(-\frac{1}{2}, 0)$ and y-axis at (0,1) and all

inequation satisfies at (0,0).



The corner points of the feasible region are O(0,0), A(2,0), F(2,1), $E(\frac{2}{3}, \frac{7}{3})$ and D(0,1)

The value of Z at these corner points are-

Corner points	$Z=y-2x$
O(0,0)	$0+0=0$
A(2,0)	$0-4=-4$
F(2,1)	$1-4=-3$
$E(2/3, 7/3)$	$\frac{7}{3} - \frac{4}{3} = 1$ (Max ^m)
D(0,1)	$1-0=1$ (Max ^m)

The maximum value of Z is 1 at all points on the line segment joining D(0,1) and $E(\frac{2}{3}, \frac{7}{3})$

6. Convert all the constraints into eqⁿ-

We get,

$$x + 2y = 100, 2x - y = 0, 2x + y = 200,$$

$$x = y = 0$$

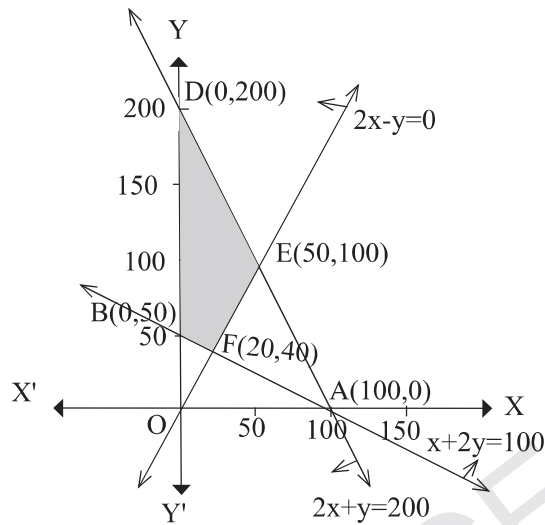
$$\Rightarrow \frac{x}{100} + \frac{y}{50} = 1, 2x = y \quad \frac{x}{100} + \frac{y}{200} = 1$$

Equation $x+2y=100$ cuts x-axis at points

A(100,0) and y axis at B(0,50).

Equation $2x=y$ passes through origin and equation $2x+y=200$ cuts x-axis at point C(100,0)

and y-axis at D(0,200) and all the equation satisfies (0,0).



The Corner points of the feasible region are B(0,50), E(50,100), F(20,40) and D(0,200).

The value of Z at these corner points are -

Corner points	$Z=x+2y$
B(0,50)	$Z=0+2.50=100$ (Min ^m)
F(20,40)	$Z=20+80=100$ (Min ^m)
E(50,100)	$Z=50+200=250$
D(0,200)	$Z=0+400=400$ (Max ^m)

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