Linear Programming

Question1

Consider the following statements:

Statement (I): In a LPP, the objective function is always linear.

Statement (II): Ina LPP, the linear inequalities on variables are called constraints. Which of the following is correct?

KCET 2025

Options:

A. Statement (I) is true, Statement (II) is true

B. Statement (I) is true, Statement (II) is false

C. Both Statements (I) and (II) are false

D. Statement (I) is false, Statement (II) is true

Answer: A

Solution:

Option A. Both statements are true.

Reasoning:

By definition, a Linear Programming Problem (LPP) has a linear objective function, for example

$\max z = c_1x_1 + c_2x_2 + \cdots + c_nx_n.$

The restrictions on the variables take the form of linear inequalities (or equalities), such as

$a_{i1}x_1 + a_{i2}x_2 + \cdots + a_{in}x_n \ \leq \ b_i,$

and these are called constraints.

Question2

The maximum value of $z = 3x + 4y$, subject to the constraints $x + y \leq 40, x + 2y \leq 60$ and $x, y \geq 0$ is

KCET 2025

Options:

A. 130

B. 120

C. 140

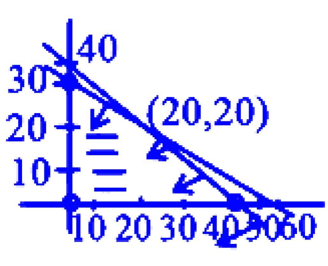
D. 40

Answer: C

Solution:

$z = 3x + 4y$
$x + y \leq 40$
$x + 2y \leq 60$
$y = 20$
$x = 20$

Z	(40,0)	(0,30)	(20,20)
3x+4y	120	120	140



Question3

Corner points of the feasible region for an LPP are $(0, 2), (3, 0), (6, 0), (6, 8)$ and $(0, 5)$. Let $Z = 4x + 6y$ be the objective function. The minimum value of z occurs at

KCET 2024

Options:

A. Only $(0, 2)$

B. Only $(3, 0)$

C. The mid-point of the line segment joining the points $(0, 2)$ and $(3, 0)$

D. Any point on the line segment joining the points $(0, 2)$ and $(3, 0)$

Answer: D

Solution:

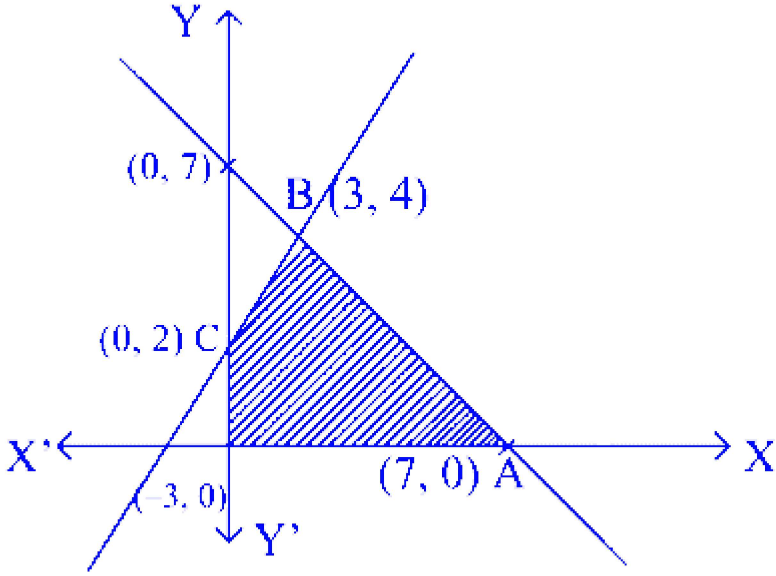
S. No.	Corner points	Value of $\mathrm{Z} = 4\mathrm{x} + 6\mathrm{y}$
(i)	(0, 2)	$Z = 4 \times 0 + 6 \times 2 = 12$ (minimum)
(ii)	(3, 0)	$Z = 4 \times 3 + 6 \times 0 = 12$ (minimum)
(iii)	(6, 0)	$Z = 4 \times 6 + 6 \times 0 = 24$
(iv)	(6, 8)	$Z = 4 \times 6 + 6 \times 8 = 72$
(v)	(0, 5)	$Z = 4 \times 0 + 6 \times 5 = 30$

$\therefore$ Minimum of Z occur at $(0, 2)$ and $(3, 0)$.

$\therefore$ Minimum value of Z occur at any point on the line segment $(0, 2)$ and $(3, 0)$.

Question4

The shaded region in the figure given is the solution of which of the inequations?



KCET 2023

Options:

A. $x+y \geq 7, 2x-3y+6 \leq 0, x \geq 0, y \geq 0$

B. $x+y \geq 7, 2x-3y+6 \geq 0, x \geq 0, y \geq 0$

C. $x+y \leq 7, 2x-3y+6 \leq 0, x \geq 0, y \geq 0$

D. $x+y \leq 7, 2x-3y+6 \geq 0, x \geq 0, y \geq 0$

Answer: D

Solution:

The line joining $A(7,0)$ and $(0,7)$ is

$x+y=7$ ..... (i)

And the line jo ing $C(0,2)$ and $B(3,4)$ is

$2x-3y+6=0$
$x, y \geq 0$ .... (ii)

The shaded region is bounded by $x+y \leq 7, 2x-3y+6 \geq 0, x \geq 0, y \geq 0$

Hence, option (d) is correct option.

Question5

The corner points of the feasible region of an LPP are $(0,2),(3,0),(6,0),(6,8)$ and $(0,5)$, then the minimum value of $z=4x+6y$ occurs at

KCET 2022

Options:

A. Finite number of points

B. Infinite number of points

C. Only one point

D. Only two points

Answer: D

Solution:

Given, the corner points of the feasible region of an LPP are $(0,2),(3,0),(6,0),(6,8)$ and $(0,5)$

Corner points	$Z=4x+6y$
(0, 2)	$4\times0+6\times=0+12=12$ (min)
(3, 0)	$4\times3+6\times10=12$ (min)
(6, 0)	$4\times6+6\times0=24$
(6, 8)	$4\times6+6\times8=72$
(0, 5)	$4\times0+6\times5=30$

Minimum value of z occurs at $(0,2)$ and $(3,0)$.

Hence, minimum value of z lies at any point on the line joining two points $(0,2)$ and $(3,0)$.

Question6

A dietician has to develop a special diet using two foods X and Y. Each packet (containing 30 g) of food. X contains 12 units of calcium, 4 units of iron, 6 units of cholesterol and 6 units of vitamin

A. Each packet of the same quantity of food Y contains 3 units of calcium, 20 units of iron, 4 units of cholesterol and 3 units of vitamin A. The diet requires at least 240 units of calcium, atleast 460 units of iron and atmost 300 units of cholesterol. The corner points of the feasible region are

KCET 2022

Options:

A. $(2,72),(40,15),(15,20)$

B. $(2,72),(15,20),(0,23)$

C. $(0,23),(40,15),(2,72)$

D. $(2,72),(40,15),(115,0)$

Answer: A

Solution:

Let x and y be the number of packets of food X and Y

$$x \geq 0, y \geq 0 \Rightarrow 12x + 3y \geq 240$$
$$\Rightarrow \quad 4x + y \geq 80 \quad .... \text{(i)}$$
$$4x + 20y \geq 460$$
$$\Rightarrow \quad x + 5y \geq 115 \quad .... \text{(ii)}$$
$$6x + 4y \leq 300$$
$$\Rightarrow \quad 3x + 2y \leq 150 \quad .... \text{(iii)}$$
$$\Rightarrow \quad x \geq 0, y \geq 0 \quad .... \text{(iv)}$$
$$4x + y \geq 80$$

$\Rightarrow$

x	0	20
y	80	0

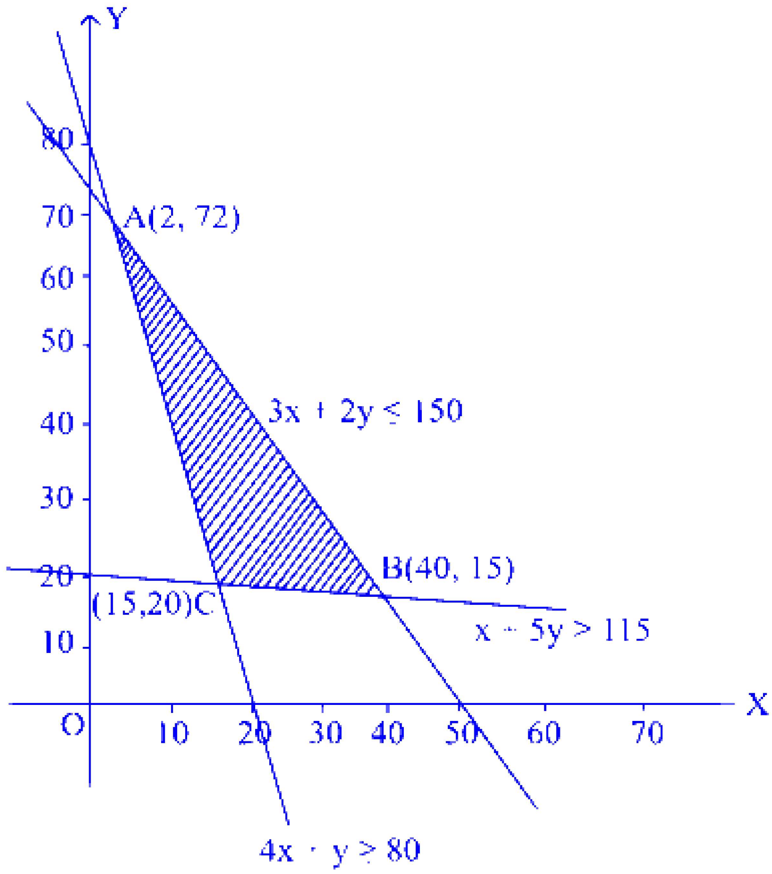
$x + 5y \geq 115$

x	0	115
y	23	0

$3x + 2y \leq 150$

x	0	50
y	75	0

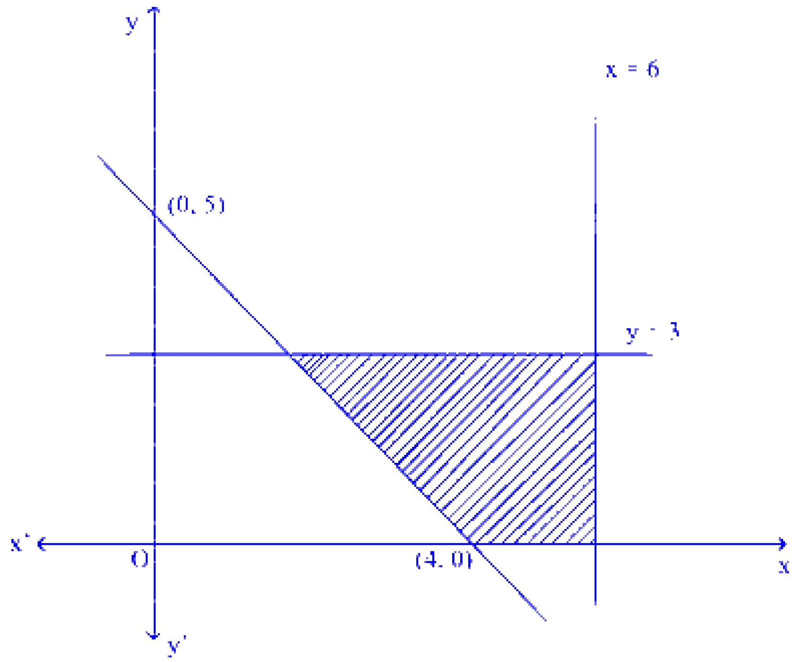
Intersection points of the lines are shown in the graph



we can see that corner point of the feasible region A, B and C are $(2, 72), (40, 15), (15, 20)$.

Question7

The shaded region is the solution set of the inequalities



KCET 2021

Options:

A. $5x + 4y \geq 20, x \leq 6, y \geq 3, x \geq 0, y \geq 0$

B. $5x + 4y \leq 20, x \leq 6, y \leq 3, x \geq 0, y \geq 0$

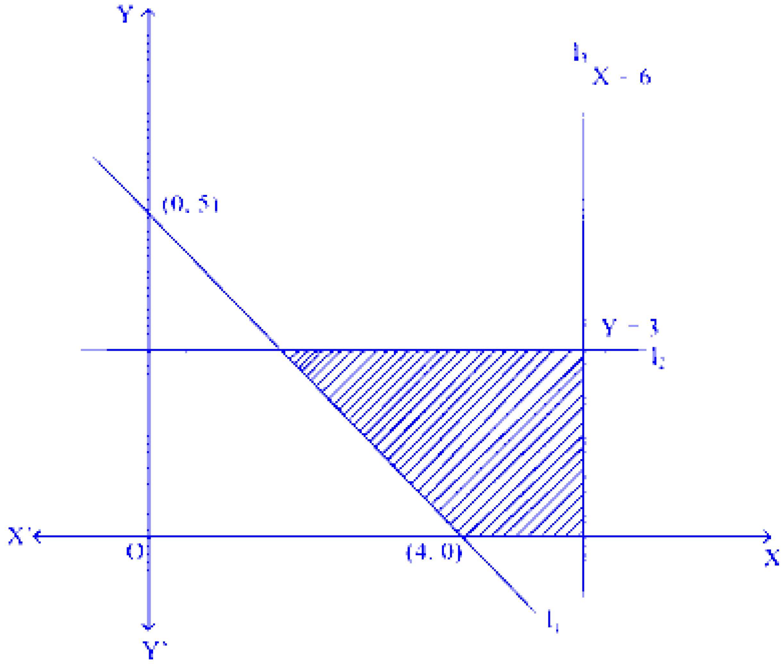
C. $5x + 4y \geq 20, x \leq 6, y \leq 3, x \geq 0, y \geq 0$

D. $5x + 4y \geq 20, x \geq 6, y \leq 3, x \geq 0, y \geq 0$

Answer: C

Solution:

Lets draw the given shaded region,



Line $l_1 \Rightarrow \frac{x}{4} + \frac{y}{5} = 1$ (intercept form)

$$\Rightarrow \quad \frac{5x+4y}{4 \times 5} = 1$$
$$\Rightarrow \quad 5x + 4y = 20$$

As, origin is not in the feasible region.

$\therefore \quad 5x + 4y \geq 20$

Line $l_2 \Rightarrow y \leq 3$ (from the graph)

Line $l_3 \Rightarrow x \leq 6$ (from the graph)

and coordinate axes $x \geq 0, y \geq 0$

Hence, inequalities are $5x + 4y \geq 20, y \leq 3, x \leq 6, x \geq 0, y \geq 0$.

Question8

Corner points of the feasible region determined by the system of linear constraints are $(0,3),(1,1)$ and $(3,0)$. Let $z = px = qy$, where, $p, q > 0$. Condition on p and q, so that the minimum of z occurs at $(3,0)$ and $(1,1)$ is

KCET 2020

Options:

A. $p=2q$

B. $p=\frac{q}{2}$

C. $p=3q$

D. $p=q$

Answer: B

Solution:

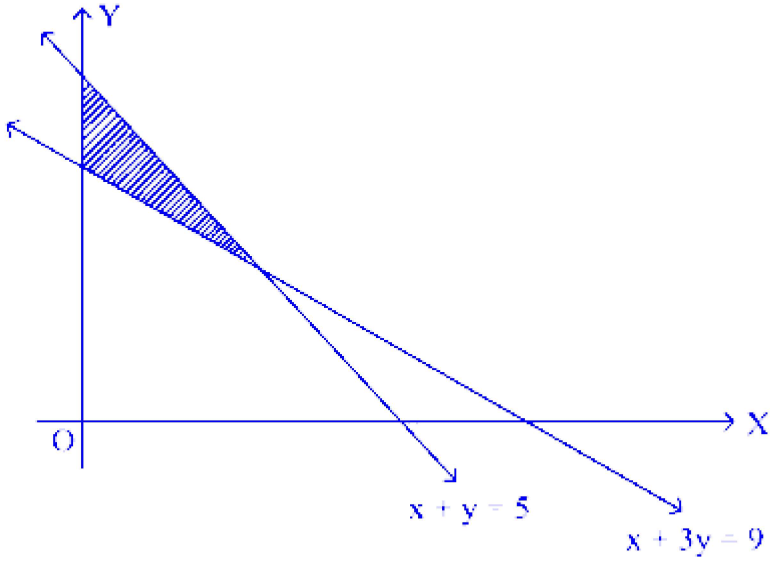
The minimum value of z is unique.

It is given that the minimum value of z occurs at two points $(3,0)$ and $(1,1)$

$$\begin{aligned} \Rightarrow \quad & p(3)+q(0)=p(1)+q(1) \\ \Rightarrow \quad & 3p=p+q \\ \Rightarrow \quad & 2p=q \\ \Rightarrow \quad & p=q/2 \end{aligned}$$

Question9

The feasible region of an LPP is shown in the figure. If $z=11x+7y$, then the maximum value of Z occurs at



KCET 2020

Options:

A. (0, 5)

B. (3, 3)

C. (5, 0)

D. (3, 2)

Answer: D

Solution:

Given, maximize $z = 11x + 7y$

Intersecting point of lines $x + y = 5$ and $x + 3y = 9$ is $(3, 2)$.

$\therefore$ Corner point is $B(3, 2)$

For corner points of the feasible region

We put,

$x = 0$ in $x + 3y = 9$
$y = 3$

$\Rightarrow$ corner point is $A(0, 3)$

and put $x = 0$ in $x + y = 5$, we get $y = 5$

$\Rightarrow$ corner point is $C(0, 5)$

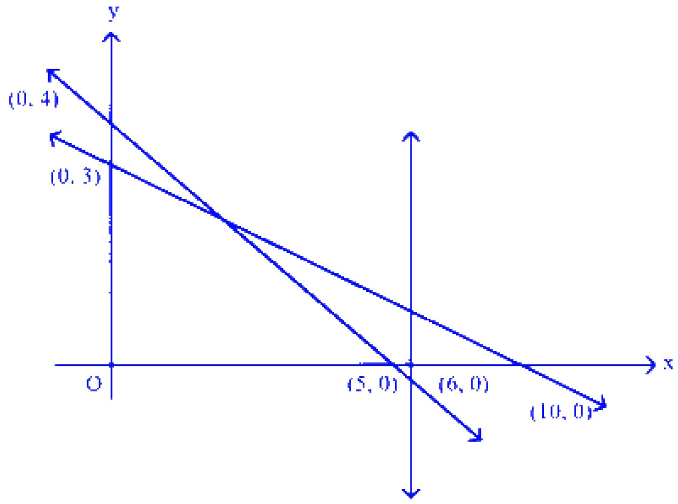
The values of z at these corner points are as follows

Corner points	$z = 11x + 7y$
$A(0, 3)$	$11 \times 0 + 7 \times 3 = 21$
$B(3, 2)$	$11 \times 3 + 7 \times 2 = 47$
$C(0, 5)$	$11 \times 0 + 7 \times 5 = 35$

Therefore, maximum value of z is 47 at (3, 2).

Question10

The shaded region in the figure is the solution set of the inequations.



KCET 2019

Options:

A. $4x + 5y \leq 20, 3x + 10y \leq 30, x \leq 6, x, y \geq 0$

B. $4x + 5y \geq 20, 3x + 10y \leq 30, x \leq 6, x, y \geq 0$

C. $4x + 5y \leq 20, 3x + 10y \leq 30, x \geq 6, x, y \geq 0$

D. $4x + 5y \geq 20, 3x + 10y \leq 30, x \geq 6, x, y \geq 0$

Answer: B

Solution:

From the given shaded region, we have

$\frac{x}{10} + \frac{y}{3} = 1 \Rightarrow 3x + 10y = 30$ ..... (i)

Since, feasible region towards the origin

$\therefore$ required inequality $3x + 10y \leq 30$

Now, $\frac{x}{5} + \frac{y}{4} = 1 \Rightarrow 4x + 5y = 20$ .... (ii)

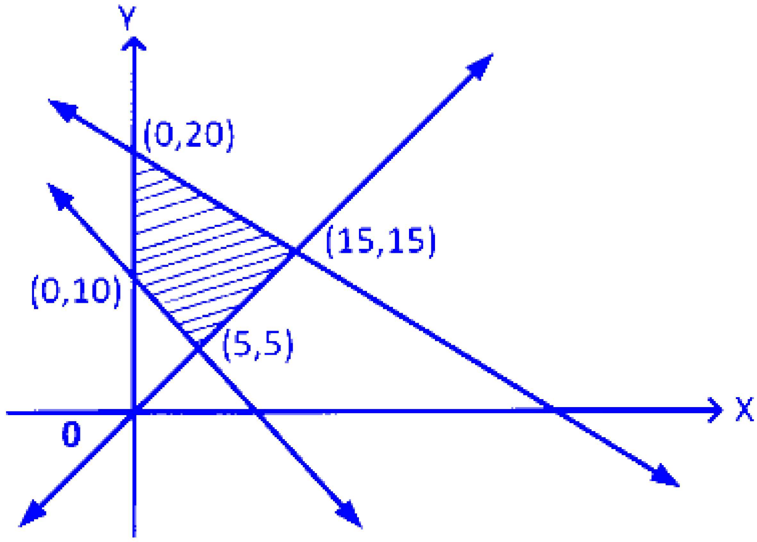
Since, feasible region away from the origin :required inequality $4x + 5y \geq 20$

And also, $x \leq 6; x, y \geq 0$

$\therefore$ required inequalities are$3x + 10y \leq 30; 4x + 5y \geq 20; x \leq 6; x, y \geq 0$

Question11

The feasible region of an LPP is shown in the figure. If $z = 3x + 9y$, then the minimum value of z occurs at



KCET 2018

Options:

A. $(5, 5)$

B. $(0, 10)$

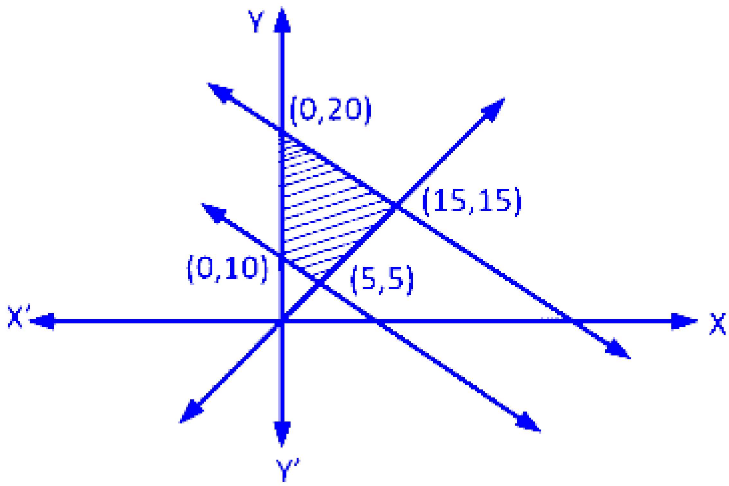
C. $(0, 20)$

D. $(15, 15)$

Answer: A

Solution:

We have, $z = 3x + 9y$



Cornor point	z=3x + 9y
(5,5)	15+45=60
(0,10)	0+90-=90
(0,20)	0+180=180
(15,15)	45+135=180

minimum value of z is 60 at $(5,5)$.

Question12

For the LPP, maximize $z=x+4y$ subject to the constraints $x+2y \leq 2, x+2y \geq 8, x, y \geq 0$

KCET 2018

Options:

A. $z_{\max}=4$

B. $z_{\max} \quad =8$

C. $z_{\max}=16$

D. has no feasible solution

Answer: D

Solution:

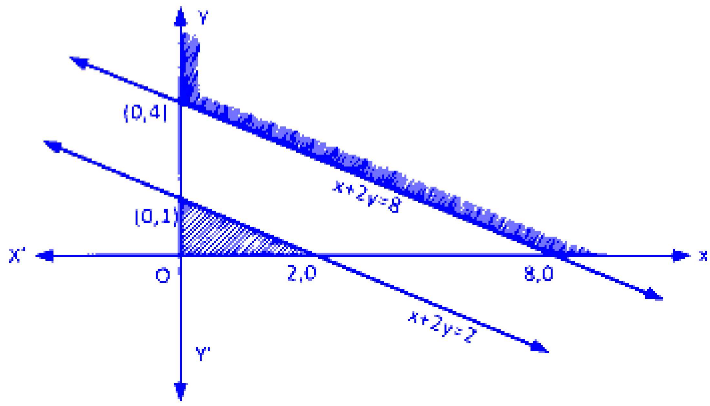
We have,

Maximize $z = x + 4y$

subject to constraints

$x + 2y \leq 2$
$x + 2y \geq 0$
$x, y \geq 0$

The graph of inequalities are



$\therefore$ Clearly from graph there has no feasible solution.

Question13

If an LPP admits optimal solution at two consecutive vertices of a feasible region, then

KCET 2017

Options:

A. the LPP under consideration is not solvable

B. the LPP under consideration must be reconstructed

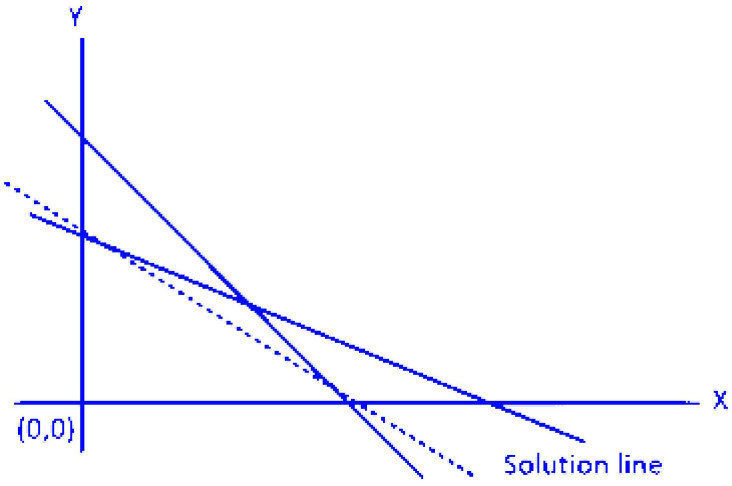
C. the required optimal solution is at the mid-point of the line joining two points

D. the optimal solution occurs at every point on the line joining these two points

Answer: D

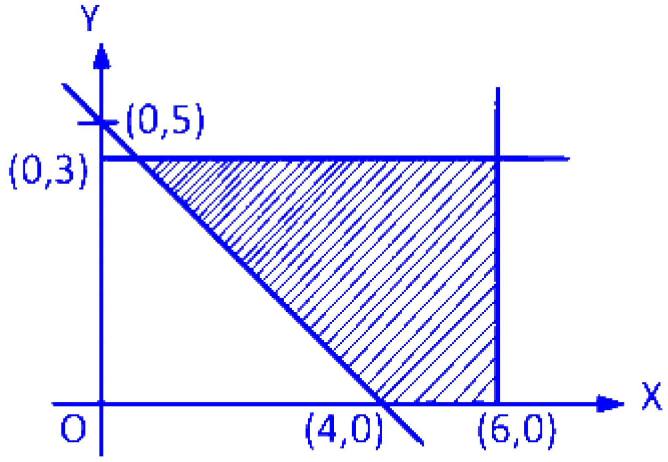
Solution:

If an LPP admits optimal solution at two consecutive vertices of a feasible region, then the optimal solution occurs at every point on the line joining these two points.



Question14

The shaded region in the figure is the solution set of the inequations



KCET 2017

Options:

A. $5x + 4y \leq 20, x \leq 6, y \leq 3, x \geq 0, y \geq 0$

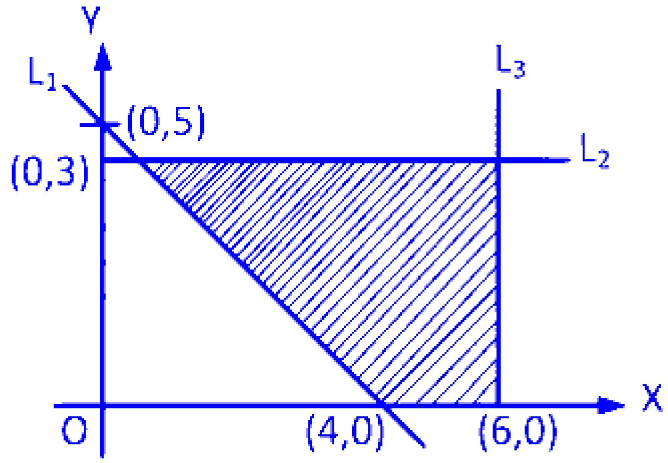
B. $5x + 4y \geq 20, x \geq 6, y \leq 3, x \geq 0, y \geq 0$

C. $5x + 4y \geq 20, x \leq 6, y \leq 3, x \geq 0, y \geq 0$

D. $5x + 4y \geq 20, x \leq 6, y \geq 3, x \geq 0, y \geq 0$

Answer: C

Solution:



Equation of line L_1 is given by

$$\begin{aligned} y-0 &= \frac{5-0}{0-4}(x-4) \\ \Rightarrow \quad y &= \frac{-5}{4}(x-4) \\ \Rightarrow \quad 4y &= -5x+20 \\ \Rightarrow \quad 5x+4y &= 20 \end{aligned}$$

Since, $(0,0)$ and shaded region lies on opposite sides, so we have one inequation

$5x+4y \geq 20$

Now, equation of line L_2 is $y=3$. Since shaded region and $(0,0)$ lies on same side, so we have second inequation

$y \leq 3$

Again, equation of line L_3 is $x=6$. Since, shaded region and $(0,0)$ lies on same side, so we have third inequation

$x \leq 6$

Also, shaded region lies in first quadrant, so $x \geq 0, y \geq 0$.
