12. Linear Programming

(Previou years Questions 2017 -2025 Solutions)

2022 MCQ's :

1.

The corner points of the feasible region determined by the system of linear inequalities are (0, 0), (4, 0), (2, 4) and (0, 5). If the maximum value of $z = ax + by$, where $a, b > 0$ occurs at both (2, 4) and (4, 0), then

(A) $a = 2b$

(B) $2a = b$

(C) $a = b$

(D) $3a = b$

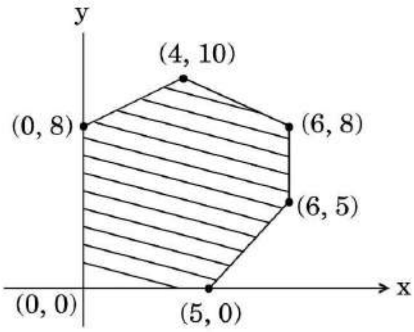
2.

The corner points of the feasible region of an LPP are (0, 0), (0, 8), (2, 7), (5, 4) and (6, 0). The maximum profit $P = 3x + 2y$ occurs at the point ______________ .

3.

The feasible region for an LPP is shown below :

Let $z = 3x - 4y$ be the objective function. Minimum of z occurs at



(A) (0, 0)

(B) (0, 8)

(C) (5, 0)

(D) (4, 10)

4.

In an LPP, if the objective function $z = ax + by$ has the same maximum value on two corner points of the feasible region, then the number of points at which z_{max} occurs is

(a) 0 (b) 2 (c) finite (d) infinite

5.

The graph of the inequality $2x + 3y > 6$ is

(a) half plane that contains the origin.

(b) half plane that neither contains the origin nor the points of the line $2x + 3y = 6$.

(c) whole XOY – plane excluding the points on the line $2x + 3y = 6$.

(d) entire XOY plane.

6.

The objective function of an LPP is

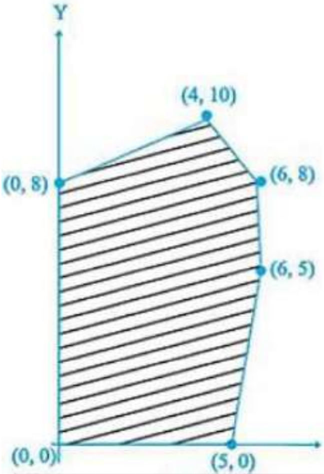
(A) a constant

(B) a linear function to be optimised

(C) an inequality

(D) a quadratic expression

7.



In the given graph, the feasible region for a LPP is shaded.
The objective function $Z = 2x – 3y$, will be minimum at:

a) (4, 10)	b) (6, 8)
c) (0, 8)	d) (6, 5)

8.

A linear programming problem is as follows:

$Minimize\ Z = 30x + 50y$

subject to the constraints,

$$3x + 5y \geq 15$$
$$2x + 3y \leq 18$$
$$x \geq 0, y \geq 0$$

In the feasible region, the minimum value of Z occurs at

a) a unique point	b) no point
c) infinitely many points	d) two points only

2023 March:

1.

The corner points of the feasible region in the graphical representation of a linear programming problem are (2, 72), (15, 20) and (40, 15). If z = 18x + 9y be the objective function, then :

(a) z is maximum at (2, 72), minimum at (15, 20)

(b) z is maximum at (15, 20), minimum at (40, 15)

(c) z is maximum at (40, 15), minimum at (15, 20)

(d) z is maximum at (40, 15), minimum at (2, 72)

2.

The number of corner points of the feasible region determined by the constraints $x - y \geq 0$, $2y \leq x + 2$, $x \geq 0$, $y \geq 0$ is :

(a) 2 (b) 3

(c) 4 (d) 5

3.

The objective function Z = ax + by of an LPP has maximum value 42 at (4, 6) and minimum value 19 at (3, 2). Which of the following is true ?

(A) a = 9, b = 1 (B) a = 5, b = 2

(C) a = 3, b = 5 (D) a = 5, b = 3

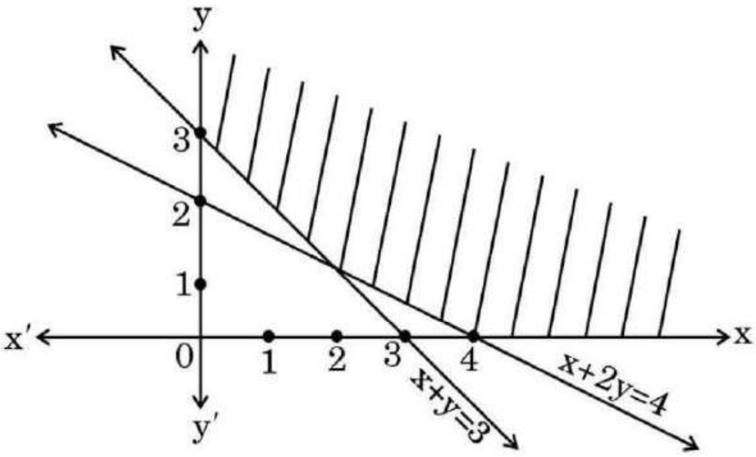
4.

The corner points of the feasible region of a linear programming problem are (0, 4), (8, 0) and $\left(\frac{20}{3}, \frac{4}{3}\right)$. If Z = 30$x$ + 24y is the objective function, then (maximum value of Z – minimum value of Z) is equal to

(A)	40	(B)	96
(C)	120	(D)	136

5.

The feasible region of a linear programming problem is shown in the figure below :



Which of the following are the possible constraints ?

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

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

(c) $x + 2y \geq 4, \ x + y \geq 3, \ x \geq 0, \ y \geq 0$

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

6.

The number of feasible solutions of the linear programming problem given as

Maximize z = 15x + 30y subject to constraints :

$3x + y \leq 12, \ x + 2y \leq 10, \ x \geq 0, y \geq 0$ is

(a)	1	(b)	2
(c)	3	(d)	infinite

7.

The solution set of the inequation $3x + 5y < 7$ is :

(a) whole xy-plane except the points lying on the line $3x + 5y = 7$.

(b) whole xy-plane along with the points lying on the line $3x + 5y = 7$.

(c) open half plane containing the origin except the points of line $3x + 5y = 7$.

(d) open half plane not containing the origin.

8.

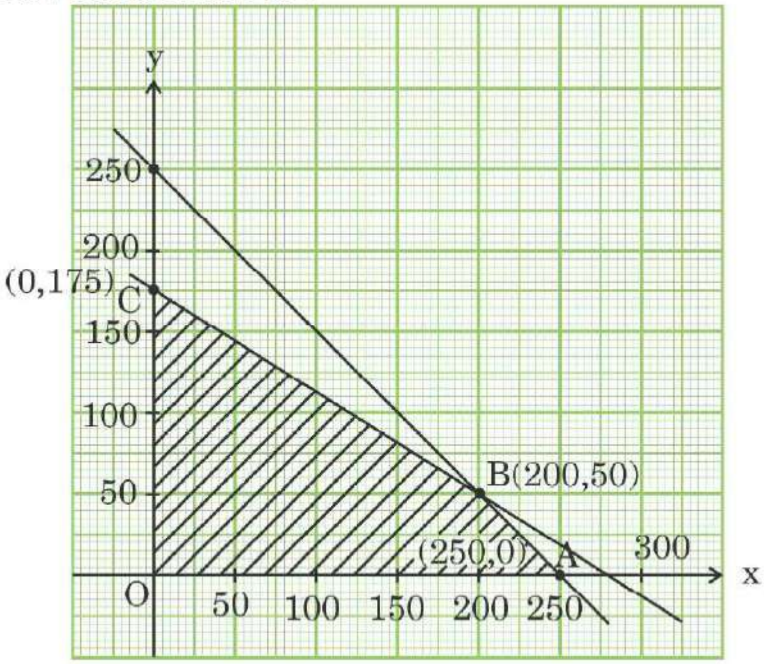
The point which lies in the half-plane $2x + y - 4 \leq 0$ is :

(a) (0, 8) (b) (1, 1)

(c) (5, 5) (d) (2, 2)

9.

The corner points of the bounded feasible region of an LPP are O(0, 0), A(250, 0), B(200, 50) and C(0, 175). If the maximum value of the objective function $Z = 2ax + by$ occurs at the points A(250, 0) and B(200, 50), then the relation between a and b is :



(a) $2a = b$ (b) $2a = 3b$ (c) $a = b$ (d) $a = 2b$

8.

Which of the following points satisfies both the inequations $2x + y \leq 10$ and $x + 2y \geq 8$?

(a) $(-2, 4)$ (b) $(3, 2)$

(c) $(-5, 6)$ (d) $(4, 2)$

9.

The point which lies in the half-plane $2x + y - 4 \leq 0$ is :

(a) $(0, 8)$ (b) $(1, 1)$

(c) $(5, 5)$ (d) $(2, 2)$

10.

The maximum value of the function $z = 7x + 5y$, subject to constraints $x \leq 3, y \leq 2, x \geq 0, y \geq 0$, is :

(a) 21 (b) 10

(c) 31 (d) 37

11.

The solution set of the inequation $2x + y \geq 5$ is :

(a) half plane that contains the origin

(b) open half plane not containing the origin and not containing the points on the line $2x + y = 5$.

(c) whole xy-plane except the points lying on the line $2x + y = 5$.

(d) open half plane not containing the origin, but containing the points on the line $2x + y = 5$.

12.

The minimum value of $z = 3x + 8y$ subject to the constraints $x \leq 20, y \geq 10$ and $x \geq 0, y \geq 0$ is :

(a) 80 (b) 140

(c) 0 (d) 60

13.

The point which does not lie in the half plane $2x + 3y - 12 \leq 0$ is

(a) (1,2) (b) (2,1) (c) (2,3) (d)$(-3, 2)$

2024 March :

1.

A linear programming problem deals with the optimization of a/an :

(A) logarithmic function (B) linear function

(C) quadratic function (D) exponential function

2.

The number of corner points of the feasible region determined by constraints $x \geq 0, y \geq 0, x + y \geq 4$ is :

(A) 0 (B) 1

(C) 2 (D) 3

3.

The common region determined by all the constraints of a linear programming problem is called :

(A) an unbounded region (B) an optimal region

(C) a bounded region (D) a feasible region

4.

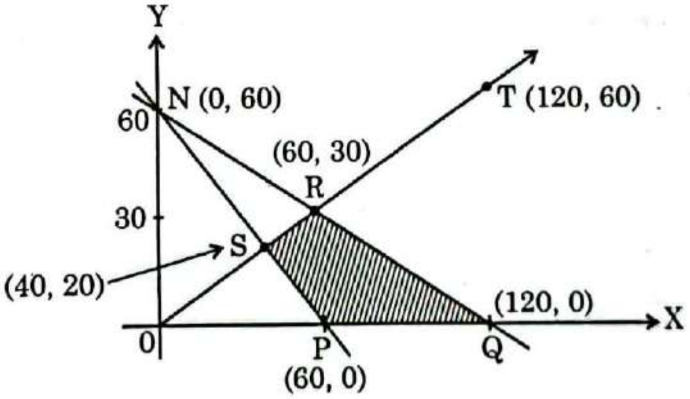
The restrictions imposed on decision variables involved in an objective function of a linear programming problem are called :

(A) feasible solutions (B) constraints

(C) optimal solutions (D) infeasible solutions

5.

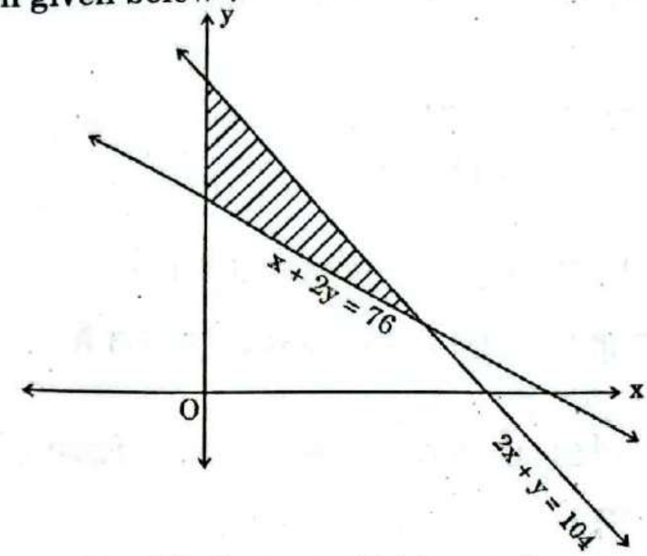
Assertion (A) : The corner points of the bounded feasible region of a L.P.P. are shown below. The maximum value of $Z = x + 2y$ occurs at infinite points.



Reason (R) : The optimal solution of a LPP having bounded feasible region must occur at corner points.

6.

Of the following, which group of constraints represents the feasible region given below ?



(A) $x + 2y \leq 76, 2x + y \geq 104, x, y \geq 0$

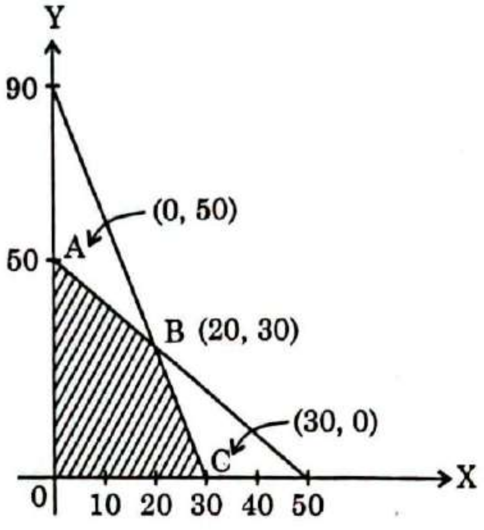
(B) $x + 2y \leq 76, 2x + y \leq 104, x, y \geq 0$

(C) $x + 2y \geq 76, 2x + y \leq 104, x, y \geq 0$

(D) $x + 2y \geq 76, 2x + y \geq 104, x, y \geq 0$

7.

The maximum value of $Z = 4x + y$ for a L.P.P. whose feasible region is given below is :



(A) 50

(B) 110

(C) 120

(D) 170

2025 March :

1.

The corner points of the feasible region in graphical representation of a L.P.P. are (2, 72), (15, 20) and (40, 15). If $Z = 18x + 9y$ be the objective function, then

(A) Z is maximum at (2, 72), minimum at (15, 20)
(B) Z is maximum at (15, 20) minimum at (40, 15)
(C) Z is maximum at (40, 15), minimum at (15, 20)
(D) Z is maximum at (40, 15), minimum at (2, 72)

2.

If the feasible region of a linear programming problem with objective function $Z = ax + by$, is bounded, then which of the following is correct ?

(A) It will only have a maximum value.
(B) It will only have a minimum value.
(C) It will have both maximum and minimum values.
(D) It will have neither maximum nor minimum value.

3.

A factory produces two products X and Y. The profit earned by selling X and Y is represented by the objective function $Z = 5x + 7y$, where x and y are the number of units of X and Y respectively sold. Which of the following statement is correct ?

(A) The objective function maximizes the difference of the profit earned from products X and Y.
(B) The objective function measures the total production of products X and Y.
(C) The objective function maximizes the combined profit earned from selling X and Y.
(D) The objective function ensures the company produces more of product X than product Y.

4.

Assertion (A) : Every point of the feasible region of a Linear Programming Problem is an optimal solution.

Reason (R) : The optimal solution for a Linear Programming Problem exists only at one or more corner point(s) of the feasible region.

5.

The corner points of the feasible region of a Linear Programming Problem are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). If $Z = ax + by$; $(a, b > 0)$ be the objective function, and maximum value of Z is obtained at (0, 2) and (3, 0), then the relation between a and b is :

(A)	$a = b$	(B)	$a = 3b$
(C)	$b = 6a$	(D)	$3a = 2b$

6.

Assertion (A) : In a Linear Programming Problem, if the feasible region is empty, then the Linear Programming Problem has no solution.

Reason (R) : A feasible region is defined as the region that satisfies all the constraints.

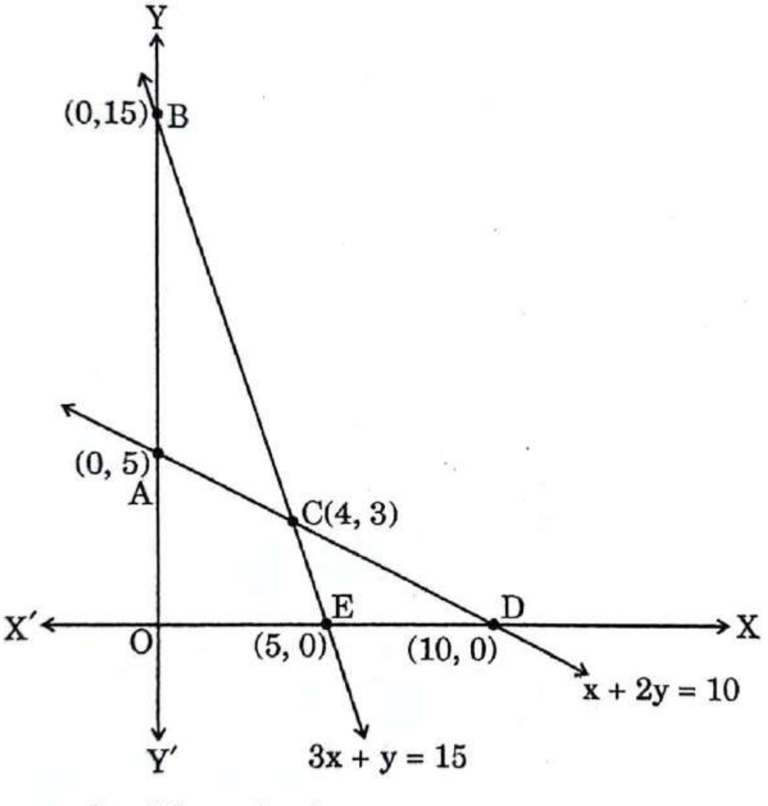
7.

For a Linear Programming Problem (LPP), the given objective function $Z = 3x + 2y$ is subject to constraints :

$x + 2y \leq 10$

$3x + y \leq 15$

$x, y \geq 0$

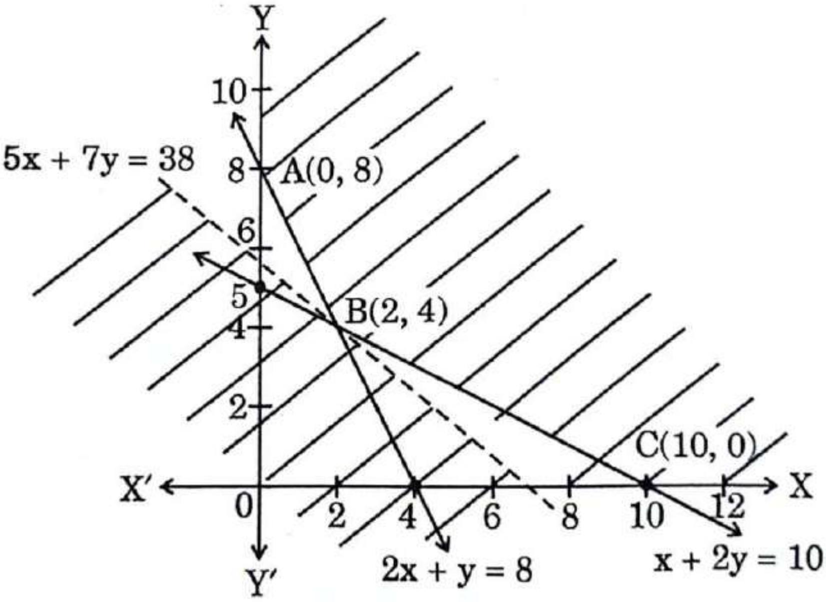


The correct feasible region is :

(A)	ABC	(B)	AOEC
(C)	CED	(D)	Open unbounded region BCD

8.

Assertion (A) : The shaded portion of the graph represents the feasible region for the given Linear Programming Problem (LPP).



Min $Z = 50x + 70y$

subject to constraints

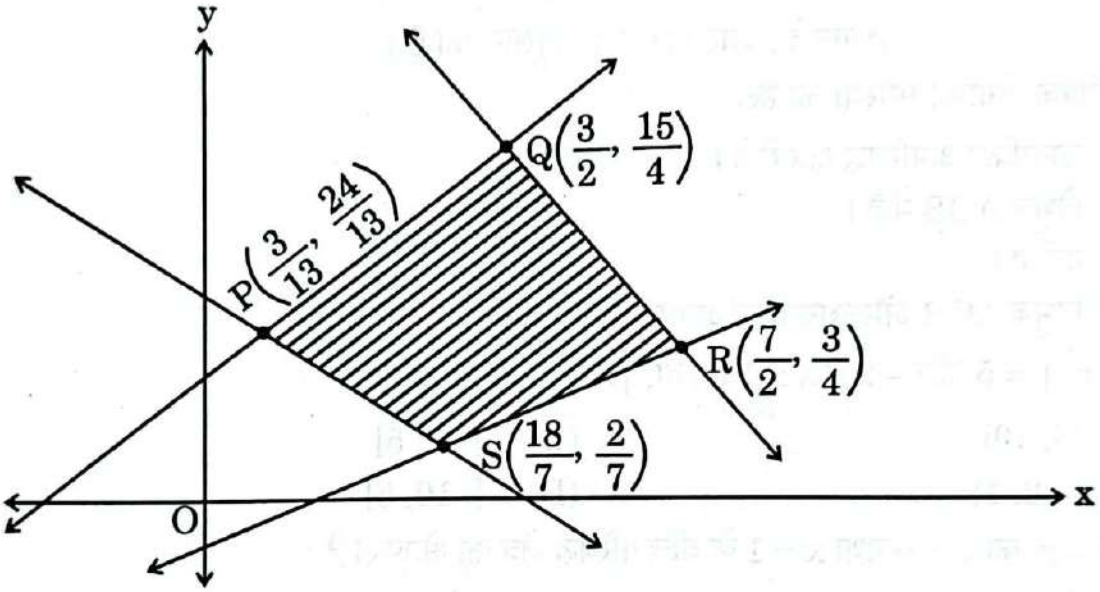
$2x + y \geq 8,\ x + 2y \geq 10,\ x, y \geq 0$

$Z = 50x + 70y$ has a minimum value = 380 at B(2, 4).

Reason (R) : The region representing $50x + 70y < 380$ does not have any point common with the feasible region.

9.

For a Linear Programming Problem (LPP), the given objective function is $Z = x + 2y$. The feasible region PQRS determined by the set of constraints is shown as a shaded region in the graph.



(Note : The figure is not to scale)

$$P \equiv \left(\frac{3}{13}, \frac{24}{13}\right), Q \equiv \left(\frac{3}{2}, \frac{15}{4}\right), R \equiv \left(\frac{7}{2}, \frac{3}{4}\right), S \equiv \left(\frac{18}{7}, \frac{2}{7}\right)$$

Which of the following statements is correct ?

(A) Z is minimum at $S\left(\frac{18}{7}, \frac{2}{7}\right)$

(B) Z is maximum at $R\left(\frac{7}{2}, \frac{3}{4}\right)$

(C) (Value of Z at P) > (Value of Z at Q)

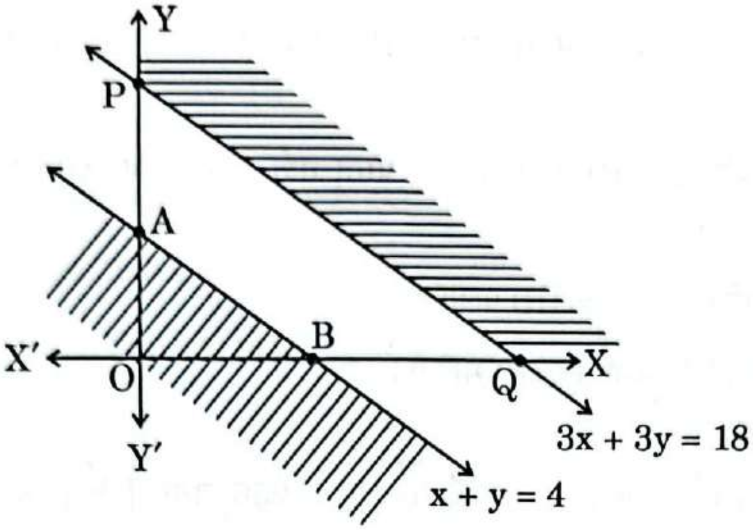
(D) (Value of Z at Q) < (Value of Z at R)

10.

In a Linear Programming Problem (LPP), the objective function $Z = 2x + 5y$ is to be maximised under the following constraints :

$$x + y \leq 4,\ \ 3x + 3y \geq 18,\ \ x, y \geq 0$$

Study the graph and select the correct option.



(Note : The figure is not to scale)

The solution of the given LPP :

(A) lies in the shaded unbounded region.

(B) lies in Δ AOB.

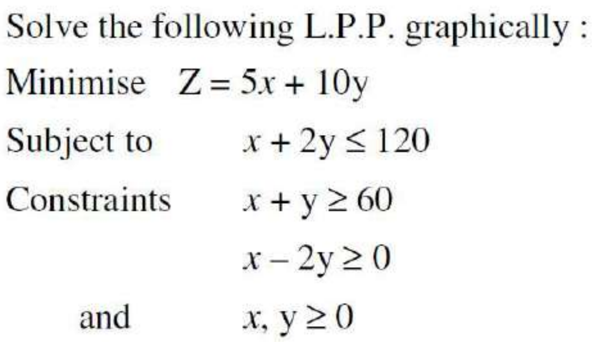
(C) does not exist.

(D) lies in the combined region of Δ AOB and unbounded shaded region.

3 Marks :

Maximise/Minimise :

1.



Solve the following L.P.P. graphically :

Minimise $Z = 5x + 10y$

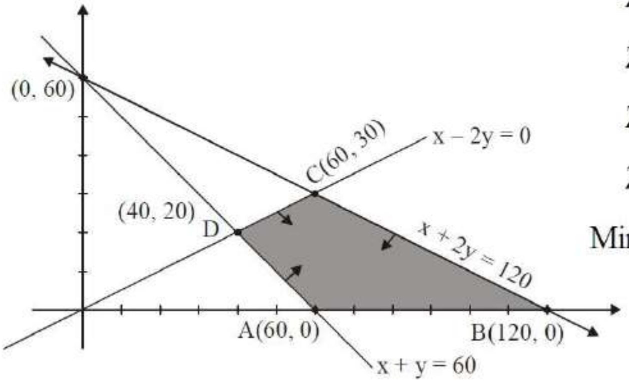
Subject to $x + 2y \leq 120$

Constraints $x + y \geq 60$

$x - 2y \geq 0$

and $x, y \geq 0$

Sol.



$Z = 5x + 10y$

$Z|_{A(60,\ 0)} = 300$

$Z|_{B(120,\ 0)} = 600$

$Z|_{C(60,\ 30)} = 600$

$Z|_{D(40,\ 20)} = 400$

Minimum value of $Z = 300$ at $x = 60$, $y = 0$

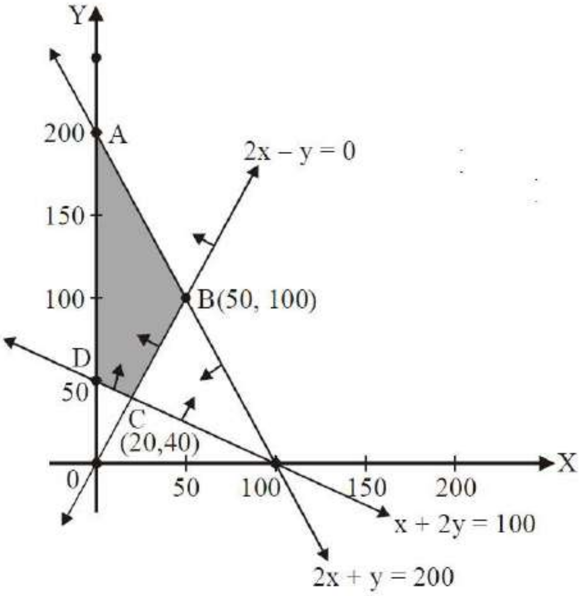
2.

Maximise $Z = x + 2y$
subject to the constraints

$$x + 2y \geq 100$$
$$2x - y \leq 0$$
$$2x + y \leq 200$$
$$x, y \geq 0$$

Solve the above LPP graphically.

Sol.



$Z = x + 2y$

s.t $x + 2y \geq 100,\ 2x - y \leq 0,$

$2x + y \leq 200,\ x, y \geq 0$

$Z(A) = 0 + 400 = 400$

$Z(B) = 50 + 200 = 250$

$Z(C) = 20 + 80 = 100$

$Z(D) = 0 + 100 = 100$

$\therefore$ Max (= 400) at $x = 0,\ y = 200$

prepared by : **BALAJI KANCHI**

3.

Solve the following linear programming problem graphically :

Maximise Z = 34x + 45y

under the following constraints

$$x + y \leq 300$$

$$2x + 3y \leq 70$$

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

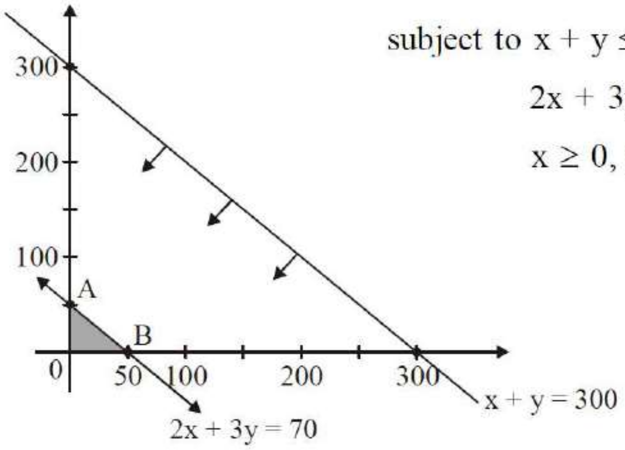
Sol.

Maximise: $z = 34x + 45y$

subject to $x + y \leq 300$,

$2x + 3y \leq 70$,

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



$$z(A) = z\left(0, \frac{70}{3}\right) = 1050$$

$$z(B) = z(35, 0) = 1190$$

$$\Rightarrow \text{ max } (1190) \text{ at } x = 35,\ y = 0.$$

Prepared by : BALAJI KANCHI

4.

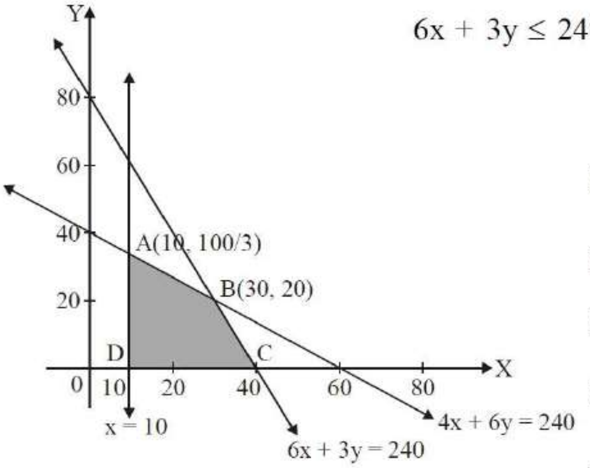
Solve the following linear programming problem graphically :

Maximise $Z = 7x + 10y$

subject to the constraints

$$4x + 6y \leq 240$$
$$6x + 3y \leq 240$$
$$x \geq 10$$
$$x \geq 0, y \geq 0$$

Maximise $z = 7x + 10y$, subject to $4x + 6y \leq 240$; $6x + 3y \leq 240$; $x \geq 10$, $x \geq 0$, $y \geq 0$



$$Z(A) = Z\left(10, \frac{200}{6}\right) = 70 + 10 \times \frac{100}{3} = 403\frac{1}{3}$$

$$Z(B) = Z(30, 20) = 210 + 200 = 410$$

$$Z(C) = Z(40, 0) = 280 + 0 = 280$$

$$Z(D) = Z(10, 0) = 70 + 0 = 70$$

$$\Rightarrow \text{Max } (= 410) \text{ at } x = 30, y = 20$$

Prepared by : BALAJI KANCHI

5.

Solve the following linear programming problem graphically :

Maximise z = 3x + 9y

subject to constraints

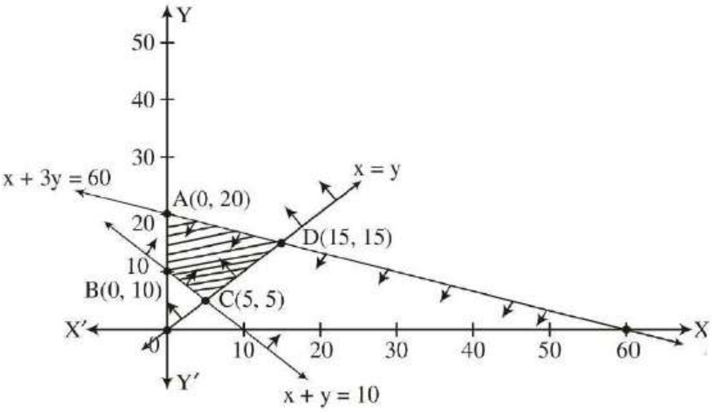
$x + 3y \leq 60$

$x + y \geq 10$

$x \leq y$

$x, y \geq 0$

Ans.



Value of z at corner points

z(A) = 3(0) + 9(20) = 180

z(B) = 0 + 90 = 90

z(C) = 15 + 45 = 60

z(D) = 45 + 45 = 180

Max(z) = 180 at any point on AD.

6.

Solve the following linear programming problem graphically :

Minimize : $z = 3x + 9y$

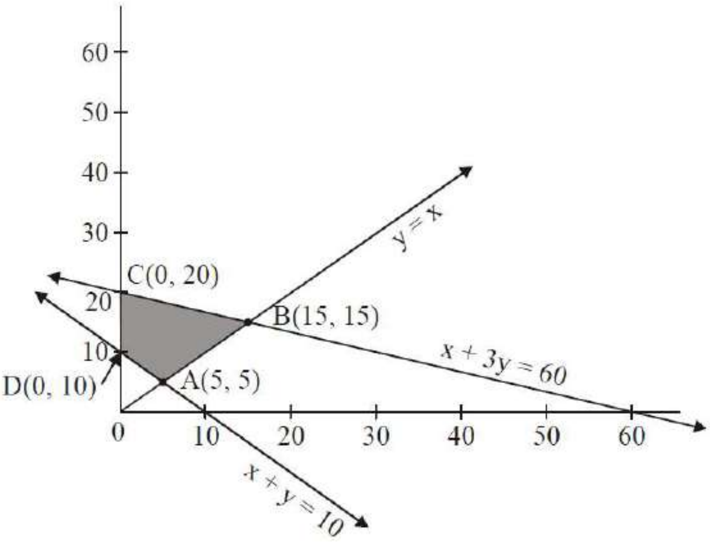
When : $x + 3y \leq 60$

$x + y \geq 10$

$x \leq y$

$x \geq 0, y \geq 0$

Sol.



$Z(A) = 60$

$Z(B) = 180$

$Z(C) = 180$

$Z(D) = 90$

$\therefore$ Minimum value of z is 60

when $x = 5, y = 5$

7.

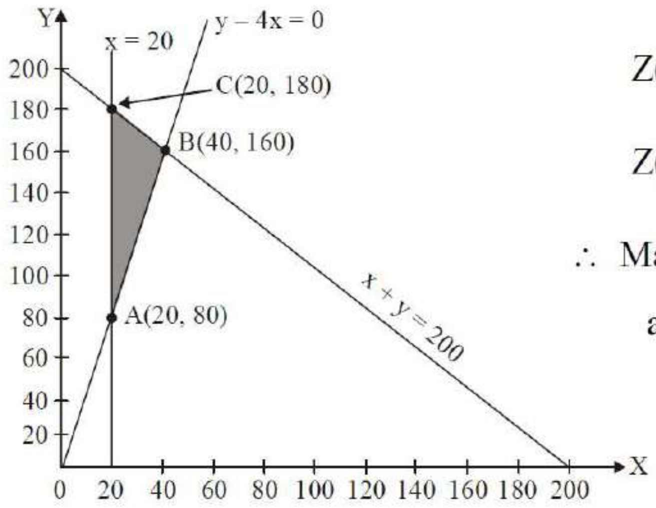
Solve the following LPP graphically :

Maximise $Z = 1000x + 600y$

subject to the constraints

$$x + y \leq 200$$
$$x \geq 20$$
$$y - 4x \geq 0$$
$$x, y \geq 0.$$

Ans.



$Z(A) = 68,0000$

$Z(B) = 1,36,000$

$Z(C) = 1,28,000$

$\therefore$ Maximum value of $Z = 1,36,000$

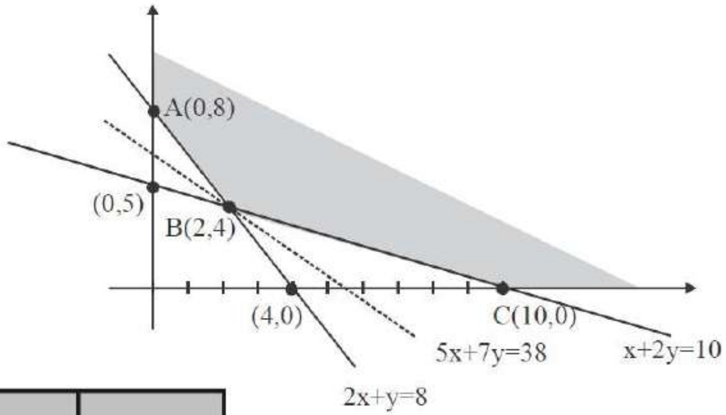
at $x = 40$, $y = 160$

8.

Solve the following LPP graphically:
Minimise $z = 5x + 7y$
subject to the constraints

$$2x + y \geq 8$$
$$x + 2y \geq 10$$
$$x, y \geq 0$$

Ans:



Corner Points	Z
A (0, 8)	56
B (2, 4)	38
C (10, 0)	50

← Smallest value

To verify whether the smallest value of $z = 38$ is the minimum value we draw open half plane.

$5x + 7y < 38$. Since there is no common point with the possible feasible region except (2, 4).

Hence minimum value of $z = 38$ at $x = 2$ and $y = 4$.

9.

Maximize $Z = 600x + 400y$

subject to

$x + 2y \leq 12$

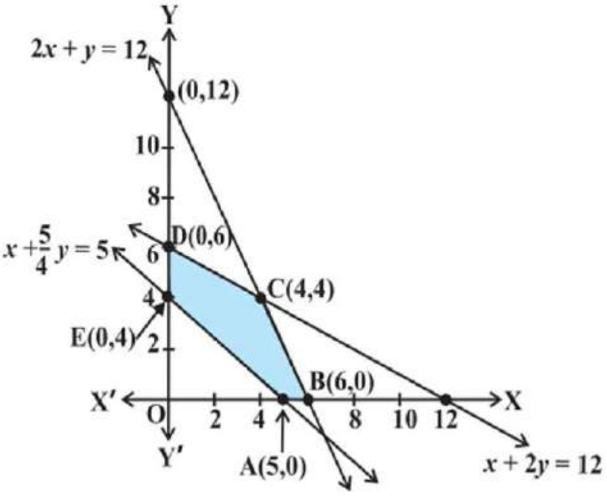
$2x + y \leq 12$

$x + 1.25y \geq 5$

$x \geq 0, y \geq 0$

Answer:

Let x units of item M and y units of item N are produced.



Maximize $Z = 600x + 400y$

subject to

$x + 2y \leq 12$

$2x + y \leq 12$

$x + 1.25y \geq 5$

$x \geq 0, y \geq 0$

Corner points values:

$Z_{A(5,0)} = 3000, Z_{B(6,0)} = 3600$

$Z_{C(4,4)} = 4000, Z_{D(0,6)} = 2400$

$Z_{E(0,4)} = 1600$

$\therefore$ 4 units each of M and N must be produced to get maximum profit of Rs 4,000

2023 March :

10.

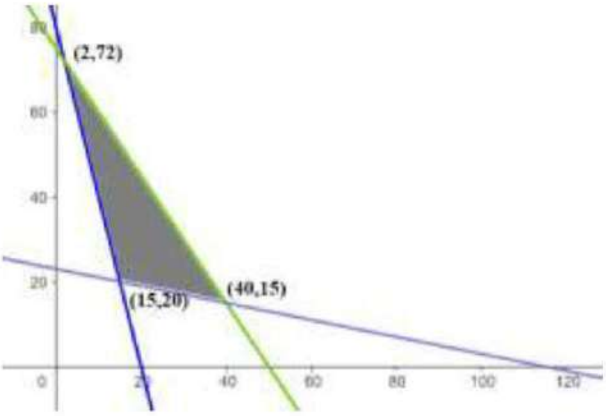
Solve graphically the following linear programming problem :

Maximise $z = 6x + 3y$,

subject to the constraints

$$4x + y \geq 80,$$
$$3x + 2y \leq 150,$$
$$x + 5y \geq 115,$$
$$x \geq 0, y \geq 0.$$

Sol.



Corner points	Value of Z
(2, 72)	(12 + 216 = 228)
(15, 20)	(90 + 60 = 150)
(40, 15)	(240 + 45 = 285) Maximum

11.2023

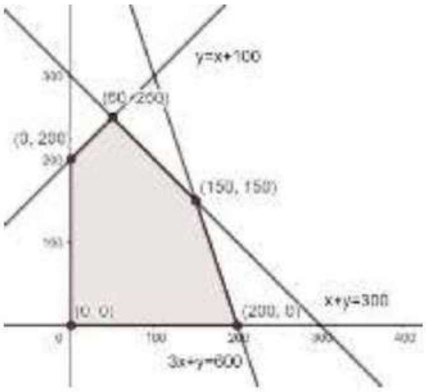
Solve the following linear programming problem graphically :

Maximize P = 100x + 5y

subject to the constraints

$$x + y \leq 300,$$
$$3x + y \leq 600,$$
$$y \leq x + 200,$$
$$x, y \geq 0.$$

Sol.



Corner points	Value of Z = 100x + 5y
(0, 0)	0
(200, 0)	20000 → Maximum
(150, 150)	15750
(50, 250)	6250
(0, 200)	1000

12.

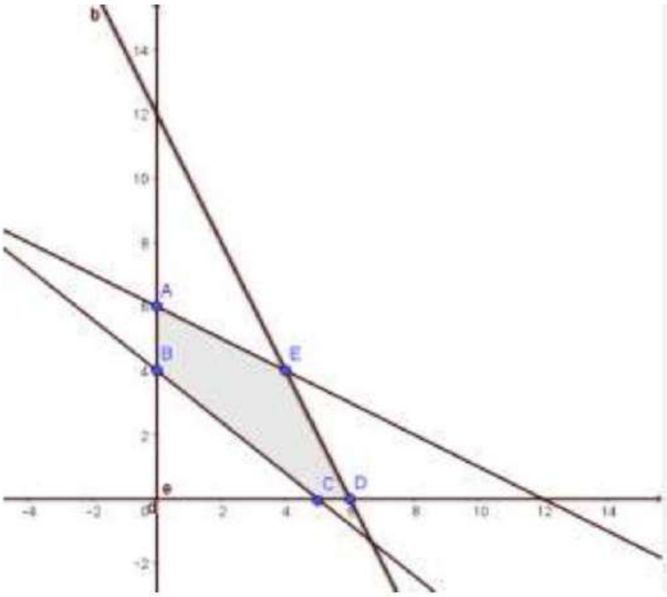
Solve the following linear programming problem graphically :

Maximize z = 600x + 400y

subject to the constraints :

$$x + 2y \leq 12,$$
$$2x + y \leq 12,$$
$$x + 1{\cdot}25y \geq 5,$$
$$x, y \geq 0$$

Sol.



Corner points	Value of Z
(0, 4)	1600
(0, 6)	2400
(4, 4)	4000 → Maximum
(5, 0)	3000
(6, 0)	3600

13.2023

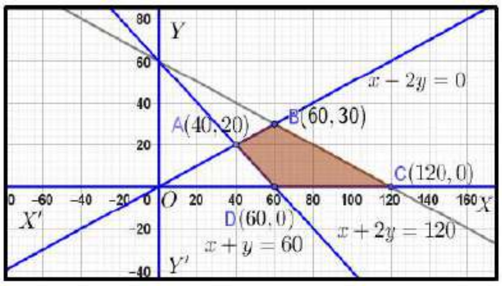
Solve the following linear programming problem graphically :

Minimize : $Z = 5x + 10y$

subject to constraints : $x + 2y \leq 120,\ x + y \geq 60,\ x - 2y \geq 0,$

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

Sol.



Corner points	Value of Z
A (40,20)	400
B (60,30)	600
C (120,0)	600
D (60,0)	300 (Min)

Min(Z) = 300 at x = 60; y = 0

prepared by : **BALAJI KANCHI**

14. 2023

Solve the following linear programming problem graphically :

Maximize : $Z = x + 2y$

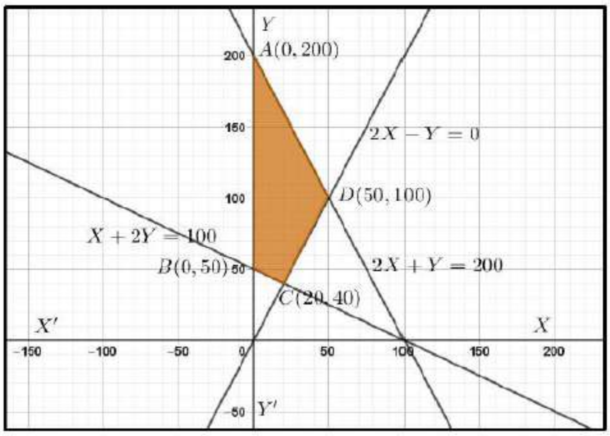
subject to constraints : $x + 2y \geq 100,$

$2x - y \leq 0,$

$2x + y \leq 200,$

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

Sol.



Correct Graph

Corner points	Value of Z
A (0,200)	400 (Max)
B (0,50)	100
C (20,40)	100
D (50,100)	250

Min(Z) = 400 at x = 0; y = 200

prepared by : **BALAJI KANCHI**

15. 2023

Solve the following Linear Programming problem graphically :

Maximize : $Z = 3x + 3.5y$

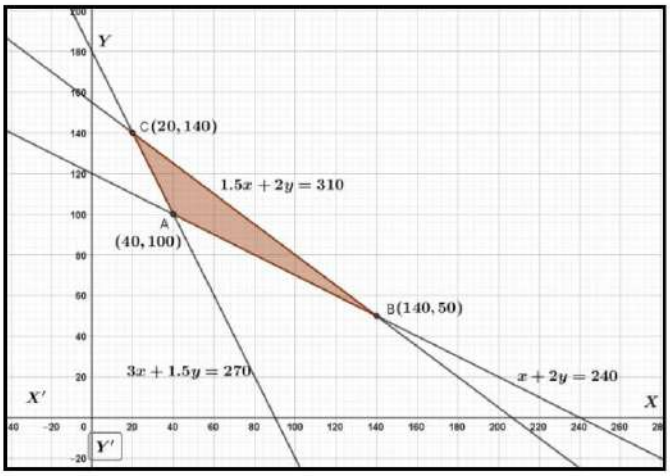
subject to constraints : $x + 2y \geq 240,$

$3x + 1.5y \geq 270,$

$1.5x + 2y \leq 310,$

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

Sol.



Correct Graph

Corner points	Value of Z
A (40,100)	470
B (140,50)	595 (Max)
C (20,140)	550

Max(Z) = 595 at x = 140 ; y = 50

prepared by : **BALAJI KANCHI**

16. 2023

Determine graphically the minimum value of the following objective function :

$z = 500x + 400y$

subject to constraints

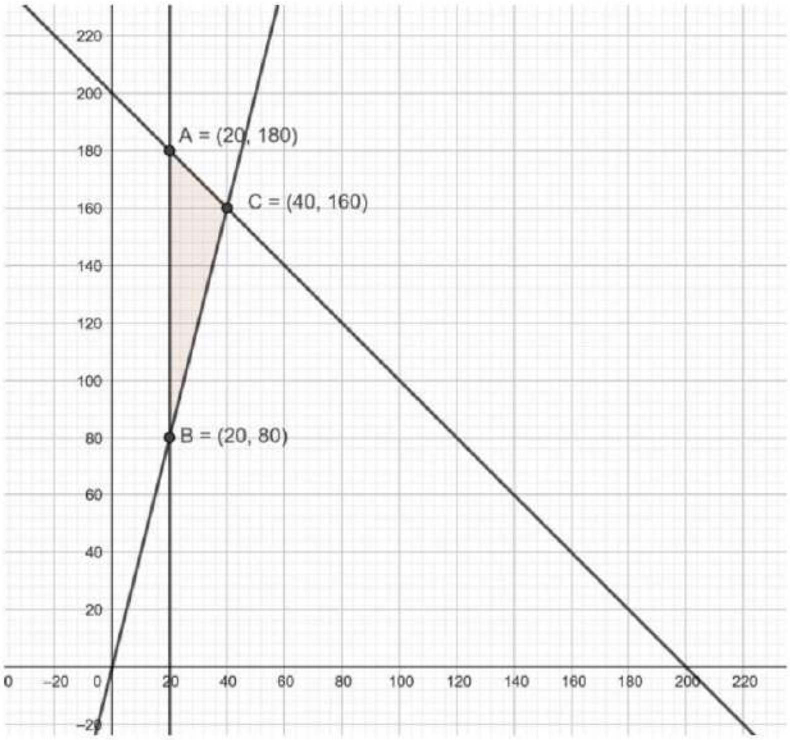
$x + y \leq 200,$

$x \geq 20,$

$y \geq 4x,$

$y \geq 0.$

Sol.



Corner points	Value of Z = 500x + 400y
(20, 180)	82000
(40, 160)	84000
(20, 80)	42000 → Minimum

prepared by : BALAJI KANCHI

17. 2023

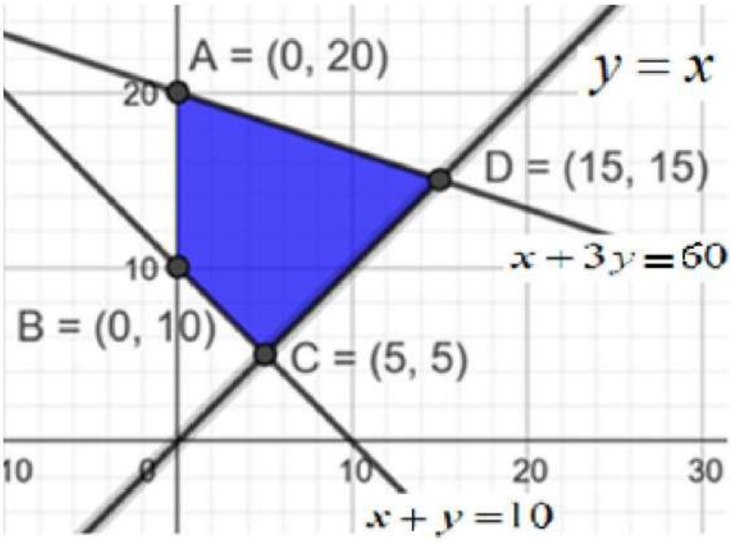
Solve the following linear programming problem graphically :

Maximize z = 3x + 9y

subject to the constraints

$$x + y \geq 10,$$
$$x + 3y \leq 60,$$
$$x \leq y,$$
$$x \geq 0,\ y \geq 0.$$

Sol.



Corner points	Value of Z = 3x + 9y
A(0, 20)	180 → Maximum
B(0, 10)	90
C(5, 5)	60
D(15, 15)	180 → Maximum

Maximum lies at every point on the line segment AD.

prepared by : BALAJI KANCHI

18. 2023

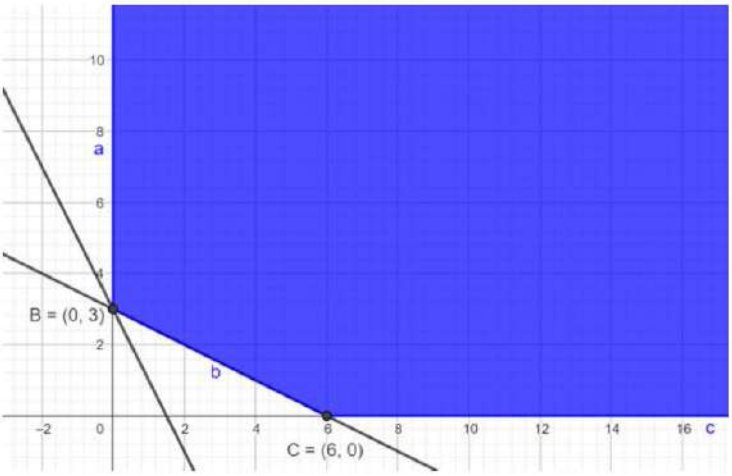
Solve the following linear programming problem graphically :

Minimize $z = x + 2y$

subject to the constraints

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

Sol.



Corner points	Value of $Z = x + 2y$
$(0, 3)$	$6 \rightarrow$ Minimum
$(6, 0)$	$6 \rightarrow$ Minimum

The half plane $x + 2y < 6$ has no point common with feasible region.
Hence, minimum $z = 6$ at all points on line segment AB

prepared by : BALAJI KANCHI

19. 2023

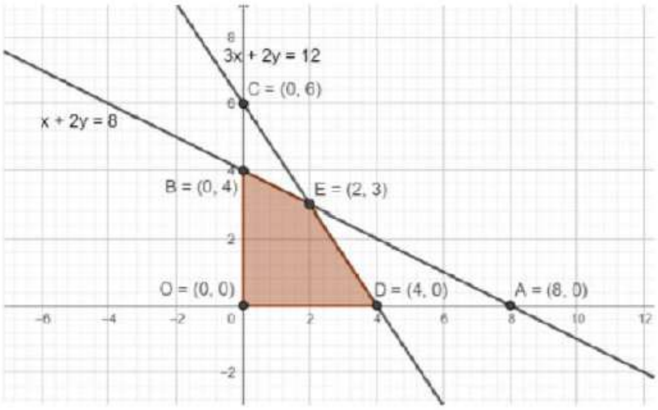
Solve the following linear programming problem graphically :

Minimise : $z = -3x + 4y$

subject to the constraints

$$x + 2y \leq 8,$$
$$3x + 2y \leq 12,$$
$$x, y \geq 0.$$

Ans.



Corner Points	Value of Z
O(0,0)	0
B(0,4)	16
D(4,0)	-12 → Min
E(2,3)	6

Prepared by : BALAJI KANCHI

20. 2023

Solve the following linear programming problem graphically :

Maximise z = 5x + 3y

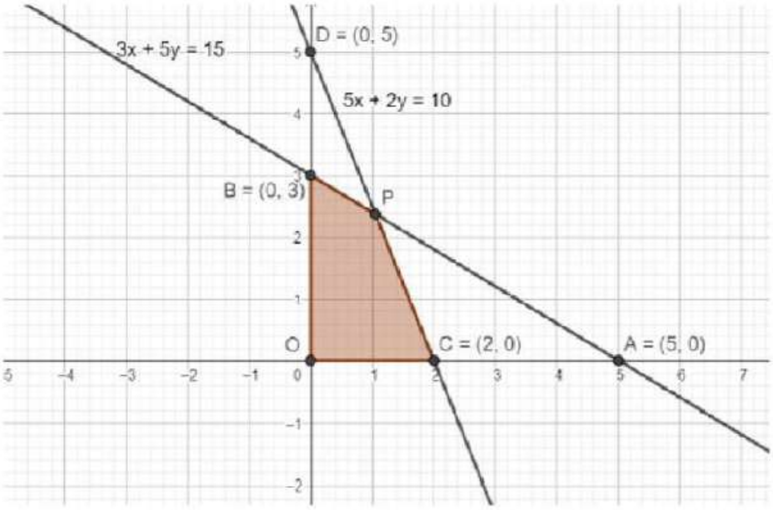
subject to the constraints

$$3x + 5y \leq 15,$$

$$5x + 2y \leq 10,$$

$$x, y \geq 0.$$

Ans.



Corner Points	Value of Z
O(0,0)	0
B(0,3)	9
C(2,0)	10
P(20/19,45/19)	$\frac{235}{19}$ →Max

21. 2023

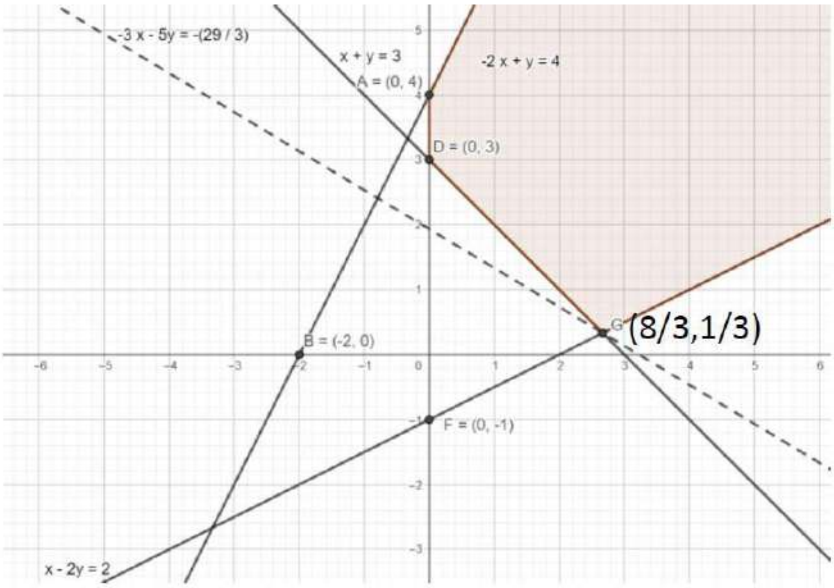
Solve the following linear programming problem graphically :

Maximise $z = -3x - 5y$

subject to the constraints

$$-2x + y \leq 4,$$
$$x + y \geq 3,$$
$$x - 2y \leq 2,$$
$$x \geq 0, \; y \geq 0.$$

Ans.



Corner Points	Value of Z
A (0,4)	-20
D (0,3)	-15
G (8/3,1/3)	-29/3 → Max

Since feasible region is unbounded and $-\frac{29}{3}$ is the maximum value of z at corner $\left(\frac{8}{3}, \frac{1}{3}\right)$. So, we consider the open half plane $-3x - 5y > -\frac{29}{3}$, which

22. 2023

Solve the following Linear Programming Problem graphically :

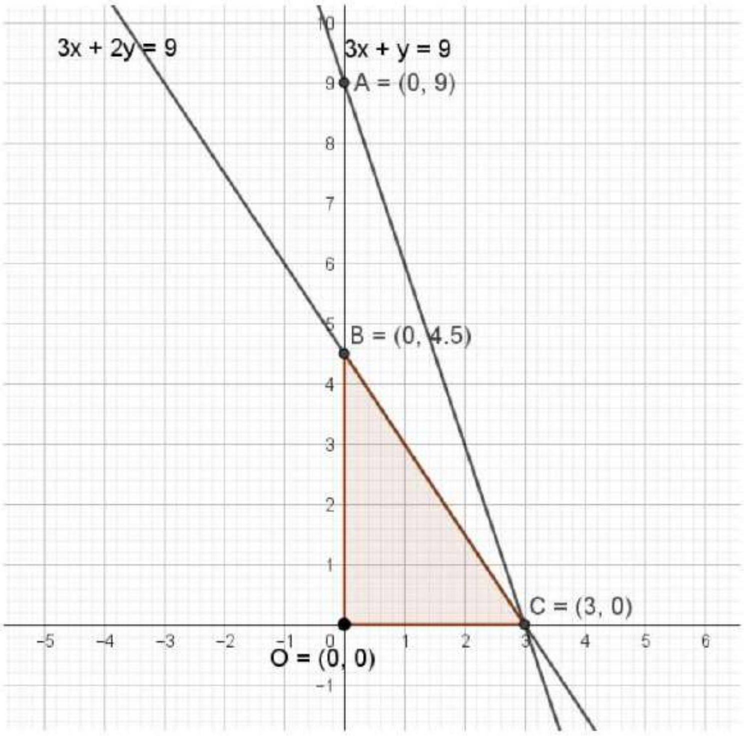
Maximize : $P = 70x + 40y$

subject to : $3x + 2y \leq 9,$

$3x + y \leq 9,$

$x \geq 0, y \geq 0$

Ans.



Corner Points	Value of P
O (0,0)	0
B (0,4.5)	180
C (3,0)	210 → Max Value

Maximum value of P =210 at $x = 3$ and y=0

prepared by : **BALAJI KANCHI**

23. 2023

Solve the following Linear Programming Problem graphically :

Minimise z = 3x + 8y

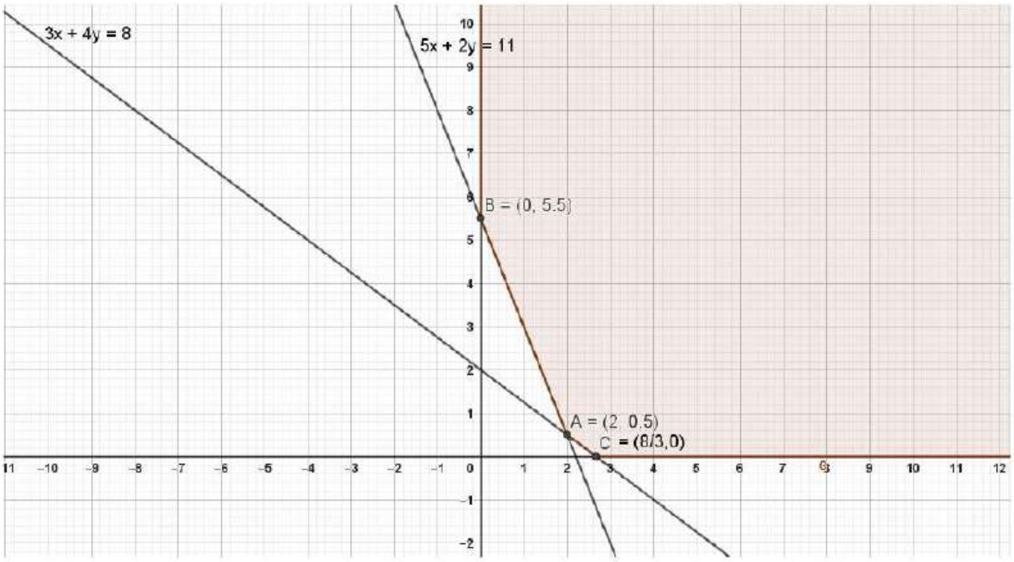
subject to the constraints

$$3x + 4y \geq 8$$

$$5x + 2y \geq 11$$

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

Ans.



$Z = 60x + 80y$

$Z_B = 0 + 440 = 440$

$Z_A = 120 + 40 = 160$

$Z_C = 160$

Minimum $Z = 160$ at all points of the line AC

24. 2023

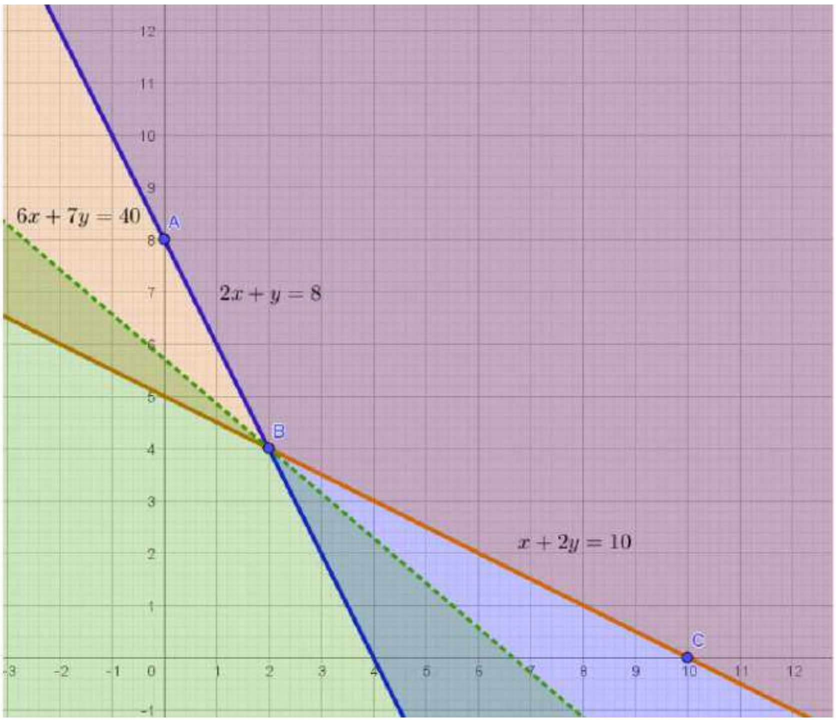
Solve the following Linear Programming Problem graphically:

Minimise $z = 6x + 7y$

subject to the constraints

$$2x + y \geq 8$$
$$x + 2y \geq 10$$
$$x, y \geq 0$$

Sol.



Corner Point	$z=6x+7y$
$A(0,8)$	**56**
$B(2,4)$	**40**
$C(10,0)$	**60**

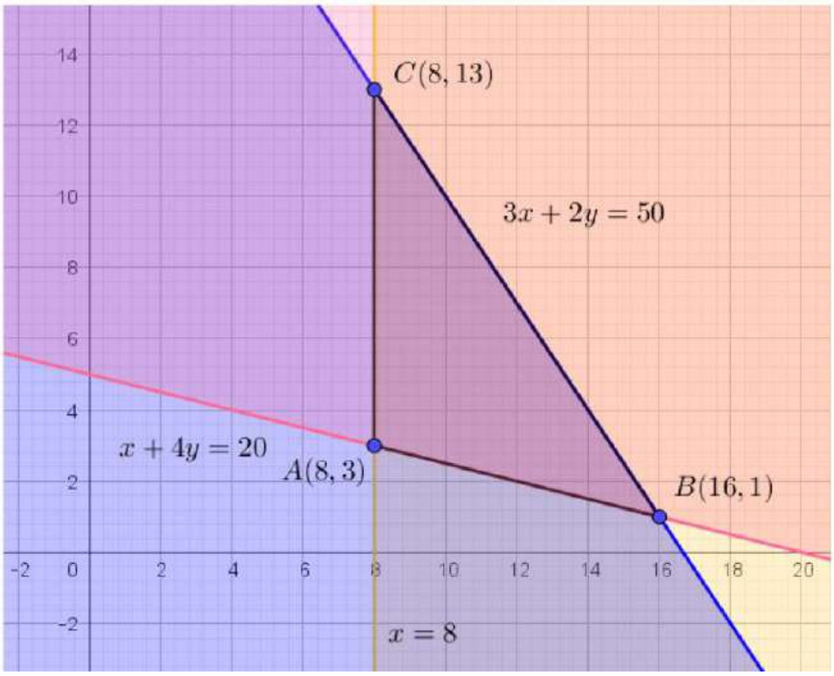
since $6x+7y<40$ do not have any point in common with the feasible region,
$z_{\min}=40$ when $x=2$, $y=4$

25. 2023

Solve the following Linear Programming Problem graphically:
Maximise z = 10x + 15y
subject to the constraints :

$$3x + 2y \le 50$$
$$x + 4y \ge 20$$
$$x \ge 8,\ \ y \ge 0$$

Sol.



Corner Point	$z=10x+15y$
$A(8,3)$	125
$B(16,1)$	175
$C(8,13)$	275

$z_{\max}$ is 275 when $x=8$, $y=13$

26. 2023

While solving the linear programming problem Minimise and Maximise Z = 3x + 9y, subject to the constraints $x + 3y \le 60$, $x + y \ge 10$, $x \le y$ and $x \ge 0$, $y \ge 0$ graphically, the corner points of the feasible region ABCD are A(0, 10), B(5, 5), C(15, 15) and D(0, 20). Find the minimum value and the maximum value of Z along with the corresponding corner points.

Sol.

$\mathbf{Z(A)=90\,;\,Z(B)=60\,;\,Z(C)=180\,;\,Z(D)=180}$

Min(Z) = 60at B(5, 5) ; Max(Z) = 180 at C(15, 15) and D(0, 20)

27. 2023

The objective function z = 4x + 3y of a linear programming problem under some constraints is to be maximized and minimized. The corner points of the feasible region are A(0, 700), B(100, 700), C(200, 600) and D(400, 200). Find the point at which z is maximum and the point at which z is minimum. Also, find the corresponding maximum and minimum values of z.

Ans.

Corner Point	Value of $z = 4x + 3y$
$A(0,700)$	2100
$B(100,700)$	2500
$C(200,600)$	2600
$D(400,200)$	2200

$z_{\min} = 2100 \text{ at } A(0,700) \text{ and } z_{\max} = 2600 \text{ at } C(200,600)$

2024 March :

28.2024

Solve the following linear programming problem graphically :

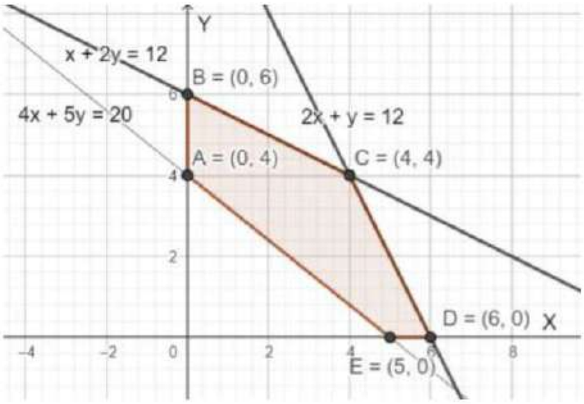
Maximise $z = 500x + 300y$,

subject to constraints

$$x + 2y \leq 12$$
$$2x + y \leq 12$$
$$4x + 5y \geq 20$$
$$x \geq 0, y \geq 0$$

Sol.

Max $z = 500x + 300y$



Corner Point	Z
A (0,4)	1200
B (0,6)	1800
C (4,4)	3200
D (6,0)	3000
E (5,0)	2500

Max $z = 3200$ at $x = 4, y = 4$

29.2024

Solve the following linear programming problem graphically :

Maximise $z = 5x + 4y$

subject to the constraints

$$x + 2y \geq 4$$

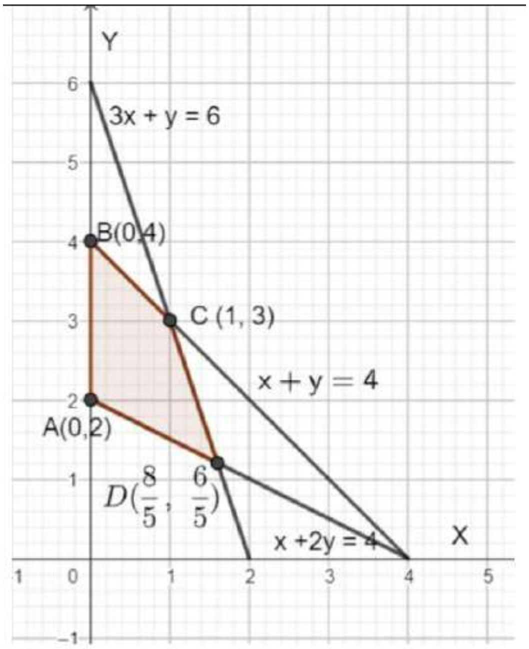
$$3x + y \leq 6$$

$$x + y \leq 4$$

$$x, y \geq 0$$

Sol.

Max $z = 5x + 4y$



Corner Point	Z = 5x + 4y
A (0,2)	8
B (0,4)	16
C (1,3)	17
D $(\frac{8}{5}, \frac{6}{5})$	$\frac{64}{5}$

Maximum $z = 17$ at $x = 1$, $y = 3$

30.2024.

Solve the following linear programming problem graphically :

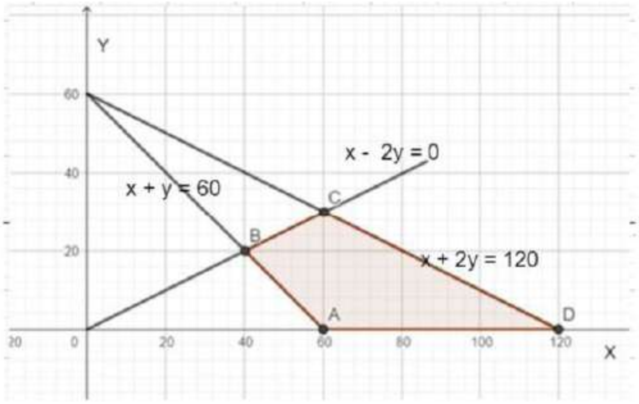
Minimise z = 5x – 2y

subject to the constraints

$$x + 2y \leq 120$$
$$x + y \geq 60$$
$$x - 2y \geq 0$$
$$x, y \geq 0$$

Sol.

Min z = 5 x -2 y



Corner Points	Z = 5x −2y
A(60, 0)	300
B(40, 20)	160
C(60, 30)	240
D(120, 0)	600

Min Z = 160 at x = 40, y = 20

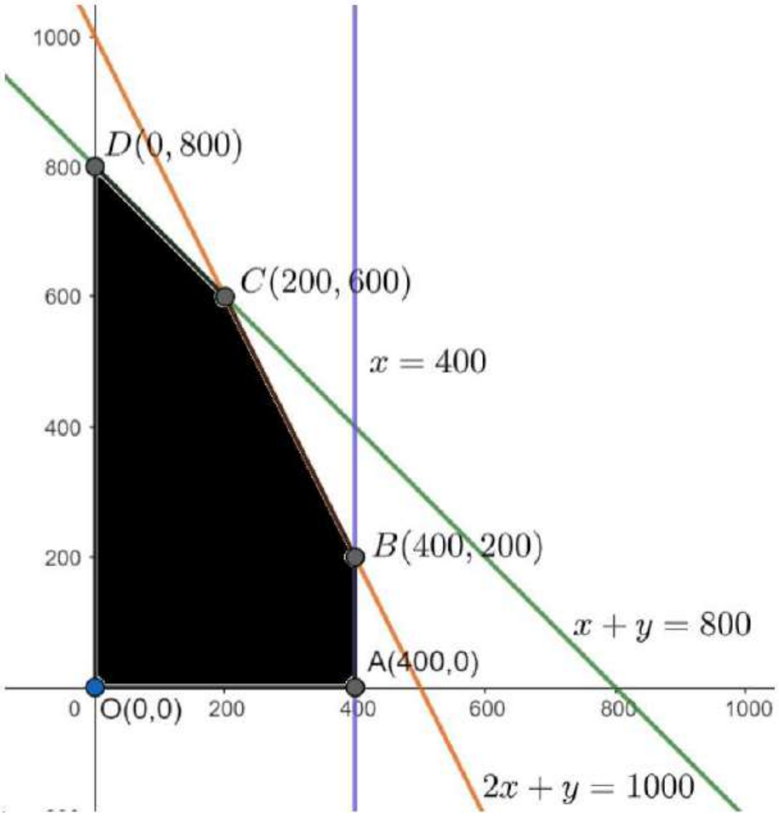
31. 2024

Solve the following linear programming problem graphically :

Maximise z = 4x + 3y,
subject to the constraints

$$x + y \leq 800$$
$$2x + y \leq 1000$$
$$x \leq 400$$
$$x, y \geq 0.$$

Sol.



Corner Point	Value of $z = 4x + 3y$
$O(0,0)$	0
$A(400,0)$	1600
$B(400,200)$	2200
$C(200,600)$	2600
$D(0,800)$	2400

$z_{\max} = 2600$ when $x = 200, y = 600$

32.2024

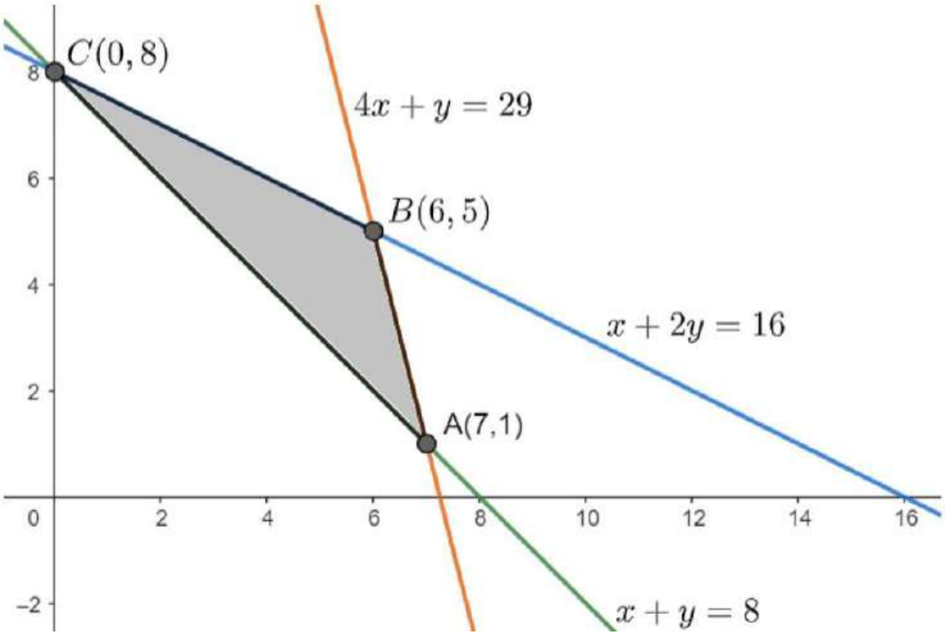
Solve the following linear programming problem graphically :

Minimize $z = 600x + 400y$,

subject to the constraints

$$x + y \geq 8$$
$$x + 2y \leq 16$$
$$4x + y \leq 29$$
$$x, y \geq 0.$$

Sol.



Corner Point	Value of $z=600x+400y$
$A(7,1)$	4600
$B(6,5)$	5600
$C(0,8)$	3200

$z_{\min}=3200$ when $x=0,\ y=8$

33.2024

Solve the following linear programming problem graphically :

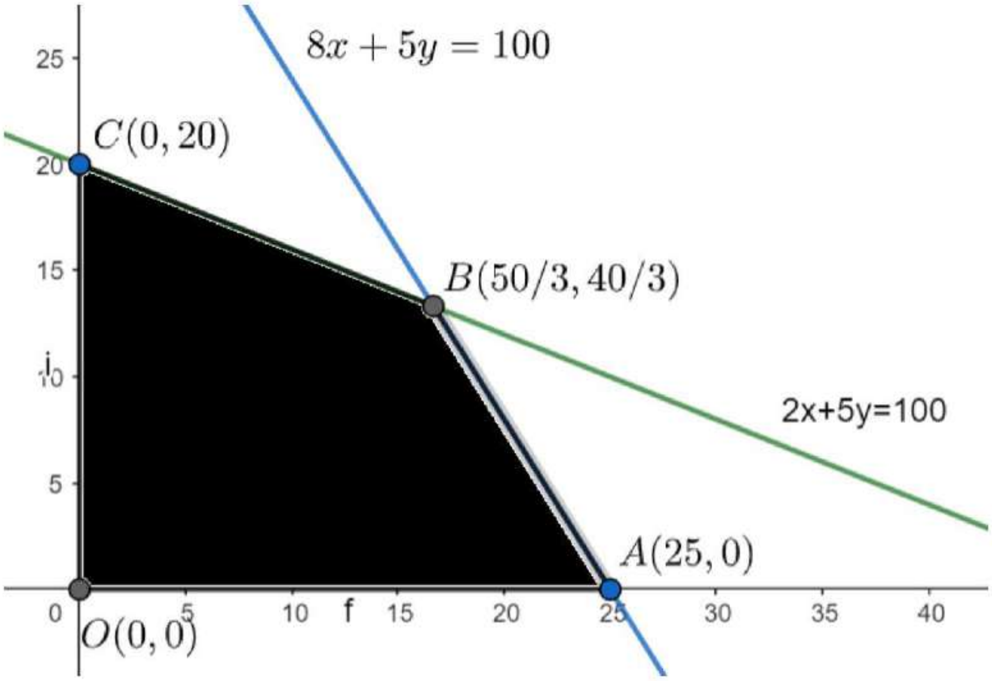
Maximize $z = x + y$

subject to constraints

$$2x + 5y \le 100$$

$$8x + 5y \le 200$$

$$x \ge 0,\ y \ge 0.$$



Corner Point	Value of $z = 4x + 3y$
$O(0,0)$	0
$A(25,0)$	25
$B\left(\frac{50}{3}, \frac{40}{3}\right)$	30
$C(0,20)$	20

$z_{\max} = 30$ when $x = \frac{50}{3}, y = \frac{40}{3}$

34.2024

Solve the following linear programming problem graphically :

Maximise Z = 2x + 3y

subject to the constraints :

$$x + y \leq 6$$

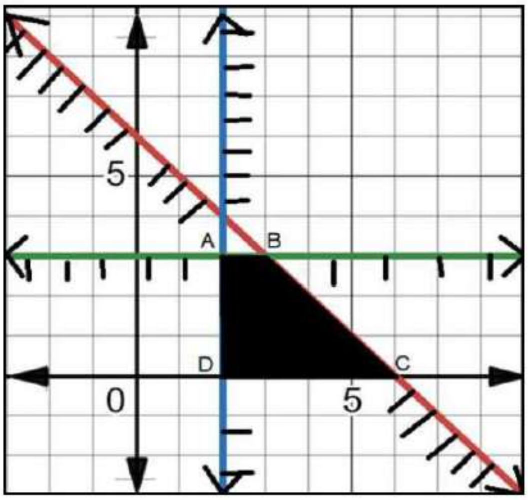
$$x \geq 2$$

$$y \leq 3$$

$$x, y \geq 0$$

Sol.

On plotting the graph of $x + y \leq 6, x \geq 2,\ y \leq 3, \& x \geq 0, y \geq 0$ we get the following graph and common shaded region is the region ABCD.



Now, Corner points of the common shaded region are $A(2,3), B(3,3), C(6,0)$ & $D(2,0)$.Thus,

Corner points	Value of $Z = 2x+3y$
$A(2,3)$	13
$B(3,3)$	15
$C(6,0)$	12
$D(2,0)$	4

So, Maximum Value of Z is 15 at $x = 3,\ y = 3$. prepared by : BALAJI KANCHI

35.2024

Solve the following L.P.P. graphically :

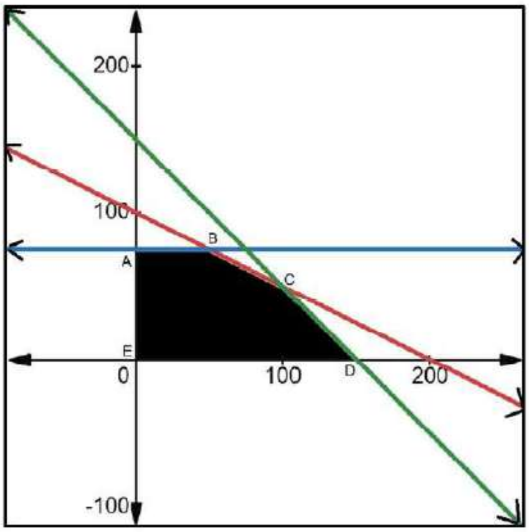
Maximise $Z = x + 3y$

subject to the constraints :

$$x + 2y \le 200$$
$$x + y \le 150$$
$$y \le 75$$
$$x, y \ge 0$$

Sol.

On plotting the graph of $x+2y \le 200, x+y \le 150,\ y \le 75, \& x \ge 0, y \ge 0$ we get the following graph and common shaded region is the region ABCDE.



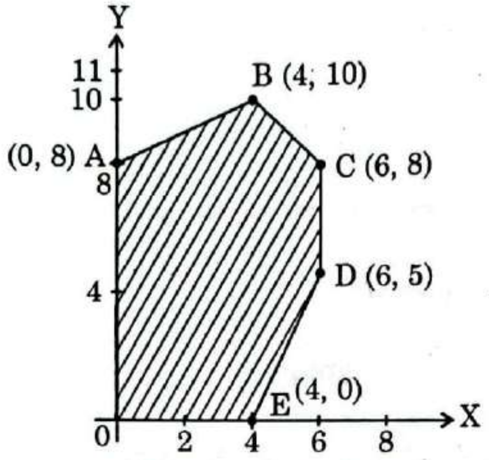
Now, Corner points of the common shaded region are $A(0,75), B(50,75), C(100,50), D(150,0)$ & $E(0,0)$.Thus,

Corner points	Value of $Z = x + 3y$
$A(0,75)$	225
$B(50,75)$	275
$C(100,50)$	250
$D(150,0)$	150
$E(0,0)$	0

So, Maximum Value of Z is 275 at $x = 50$ & $y = 75$.

36.2024.

The corner points of the feasible region determined by the system of linear constraints are as shown in the following figure :



(i) If Z = $3x - 4y$ be the objective function, then find the maximum value of Z.

(ii) If Z = $px + qy$ where p, q > 0 be the objective function. Find the condition on p and q so that maximum value of Z occurs at B(4, 10) and C(6, 8).

Sol.

(i)

corner points	$Z = 3x - 4y$
$A(0,8)$	-32
$B(4,10)$	-28
$C(6,8)$	-14
$D(6,5)$	-2
$E(4,0)$	12(Maximum)
$O(0,0)$	0

Maximum value of Z is 12 at E when $x = 4,\ y = 0$

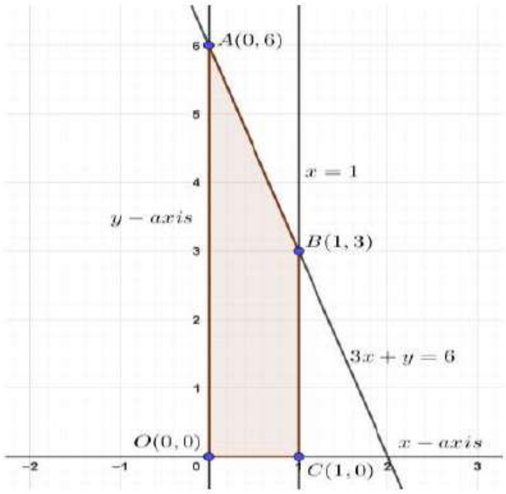
(ii) $Z_B = Z_C \Rightarrow 4p + 10q = 6p + 8q$ Thus, $p = q$

2025 March :

37.2025

In a Linear Programming Problem, the objective function $Z = 5x + 4y$ needs to be maximised under constraints $3x + y \leq 6$, $x \leq 1$, $x, y \geq 0$. Express the LPP on the graph and shade the feasible region and mark the corner points.

Sol.



38.2025

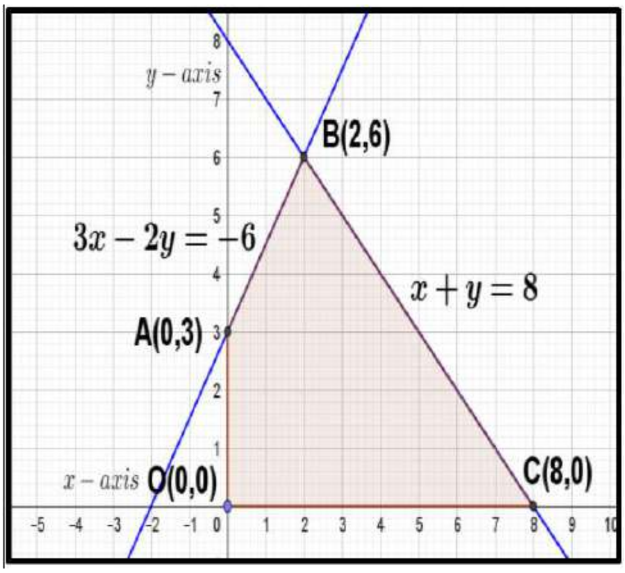
In a Linear Programming Program (LPP) for objective function $Z = 14x - 10y$

subject to constraints

$$x + y \le 8$$
$$3x - 2y \ge -6$$
$$x, y \ge 0$$

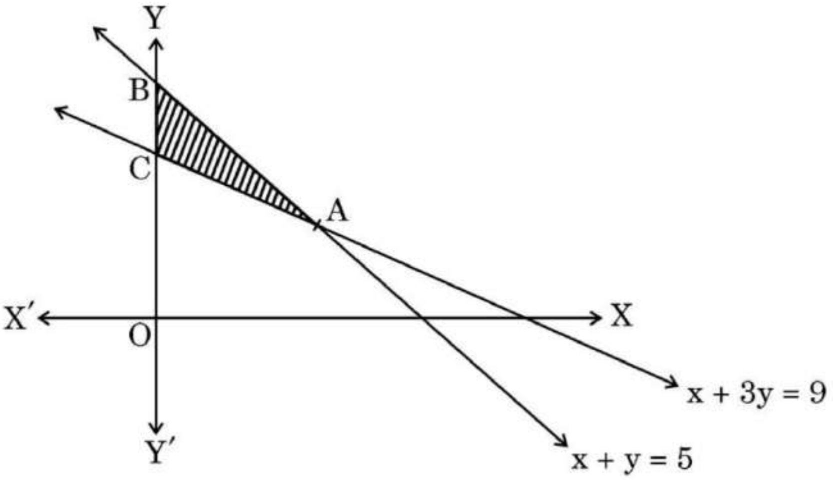
shade the feasible region and mark the corner points in a neatly drawn

Sol.



39.2025

For a Linear Programming Problem, find min Z = 5x + 3y (where Z is the objective function) for the feasible region shaded in the given figure.



(Note : The figure is not to scale)

Sol.

Corner Points	Value of $Z = 5x + 3y$
A (3,2)	21
B (0,5)	15
C (0,3)	9

Min (Z) = 9

40. 2025

Solve the following linear programming problem graphically :

Maximise $Z = x + 2y$

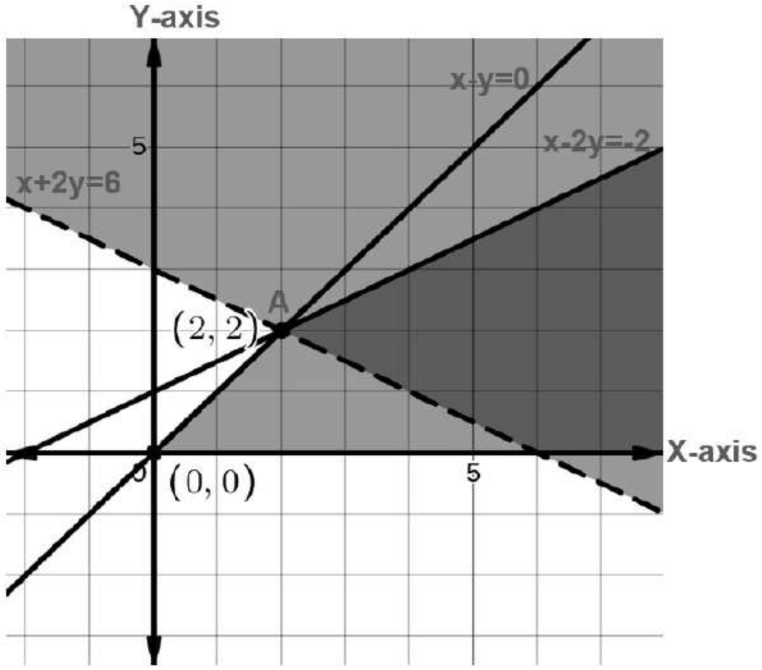
Subject to the constraints :

$x - y \geq 0$

$x - 2y \geq -2$

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

Sol.



Corner Point	Value of $Z = x + 2y$
$O(0,0)$	0
$A(2,2)$	6

Since feasible region is unbounded. Plot $x + 2y > 6$ which has common region with feasible region, thus Z has no maximum value. prepared by : BALAJI KANCHI

41. 2025

Solve the following linear programming problem graphically :

Maximise $Z = 20x + 30y$

Subject to the constraints :

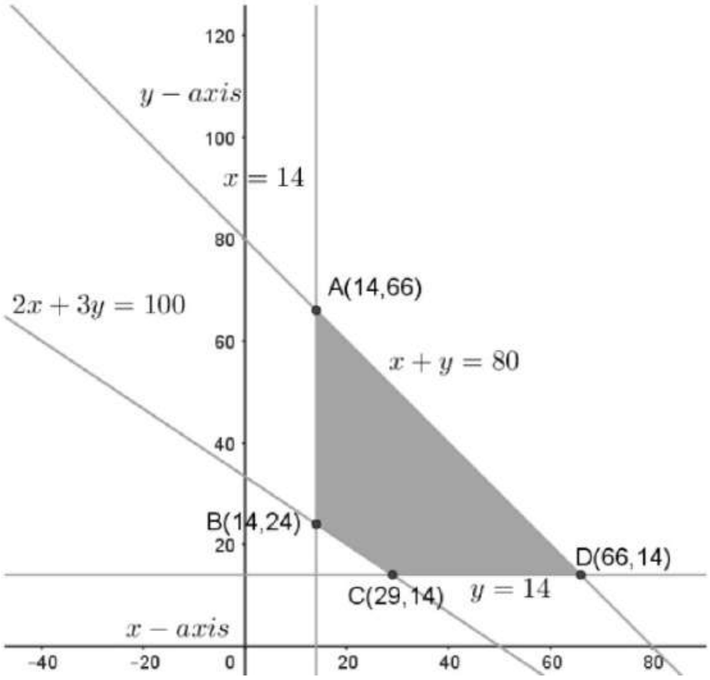
$x + y \leq 80$

$2x + 3y \geq 100$

$x \geq 14$

$y \geq 14$

Sol.



Corner Point	Value of $Z = 20x + 30y$
$A(14,66)$	2260
$B(14,24)$	1000
$C(66,14)$	1740
$D(29,14)$	1000

$\text{Max}(Z) = 2260$

42. 2025

Solve the following linear programming problem graphically :

Maximize $Z = 8x + 9y$

Subject to the constraints :

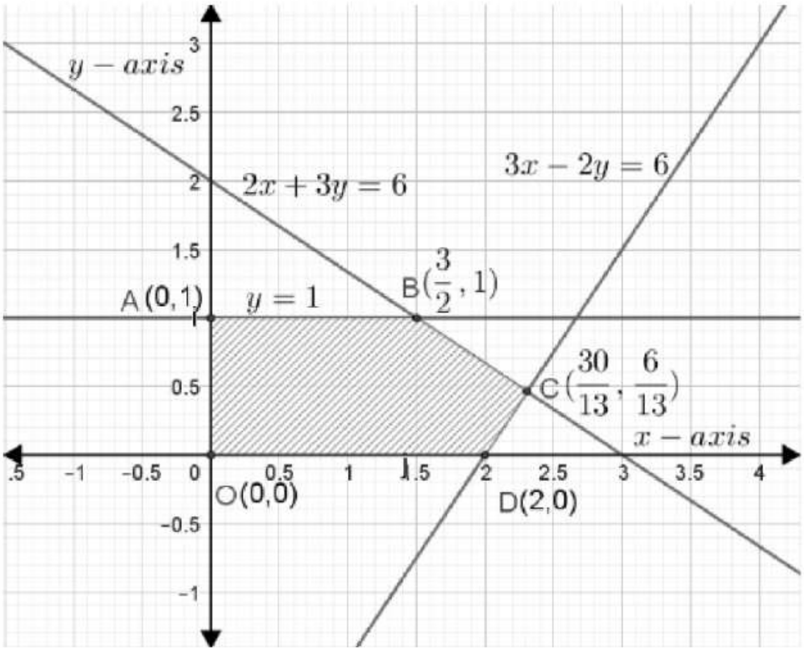
$2x + 3y \leq 6$

$3x - 2y \leq 6$

$y \leq 1$

$x \geq 0, y \geq 0$

Sol.



Corner Point	Value of $Z = 8x + 9y$
$A(0,1)$	9
$B\left(\frac{3}{2},1\right)$	21
$C\left(\frac{30}{13},\frac{6}{13}\right)$	$\frac{294}{13}$
$D(2,0)$	16
$O(0,0)$	0

$$\text{Max}(Z) = \frac{294}{13}$$

43. 2025

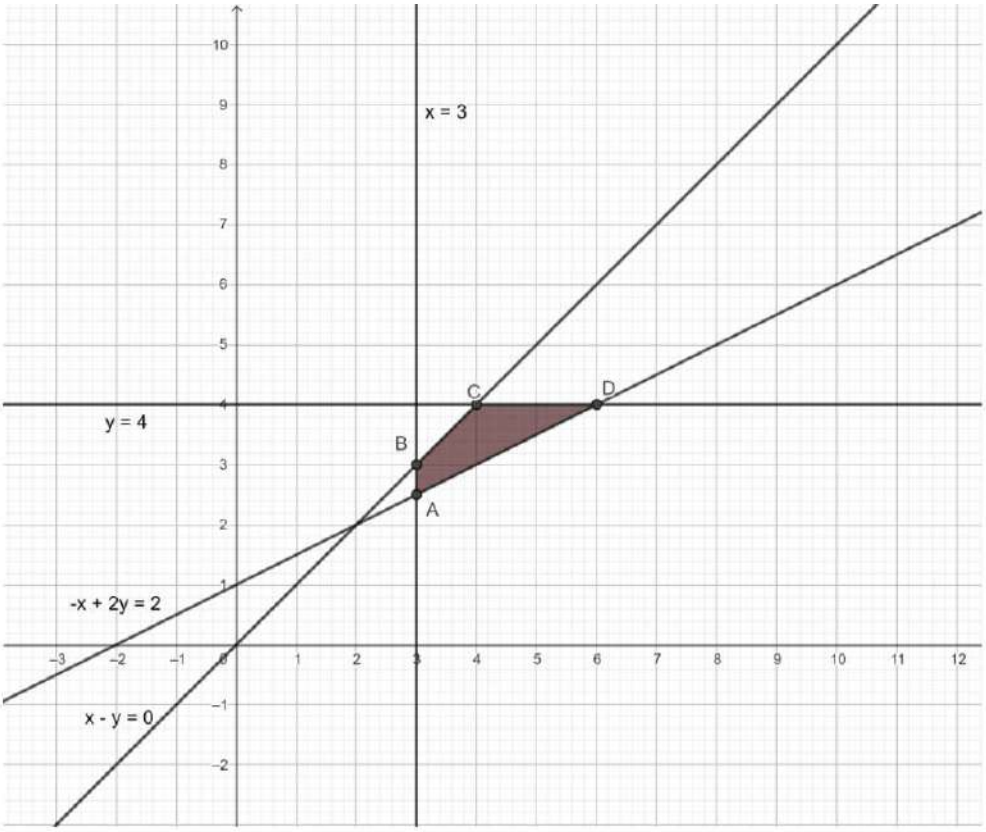
Solve the following linear programming problem graphically :

Minimise $Z = x - 5y$

subject to the constraints :

$$x - y \geq 0$$
$$-x + 2y \geq 2$$
$$x \geq 3,\ y \leq 4,\ y \geq 0$$

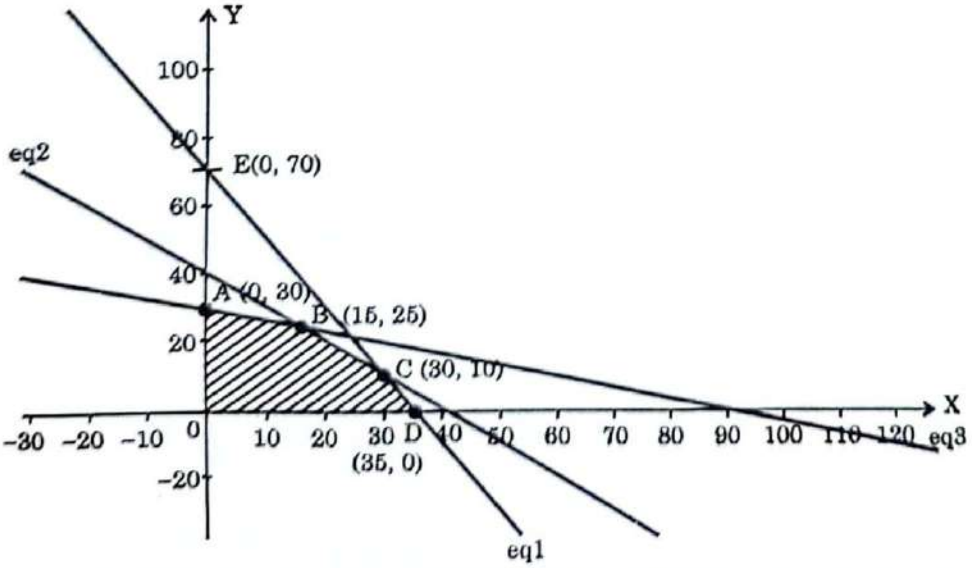
Sol.



Corner point	Value of $Z = x - 5y$
A (3, 2.5)	-9.5
B (3, 3)	-12
C (4, 4)	-16
D (6, 4)	-14

The minimum value of Z is -16, which is attained at x = 4, y = 4.

44. 2025



The feasible region along with corner points for a linear programming problem are shown in the graph. Write all the constraints for the given linear programing problem.

Sol.

The equation of the line AB is

$$y - 30 = \frac{25-30}{15-0}(x - 0)$$

$$\Rightarrow x + 3y = 90$$

The equation of the line BC is

$$y - 10 = \frac{10-25}{30-15}(x - 30)$$

$$\Rightarrow x + y = 40$$

The equation of the line CD is

$$y - 10 = \frac{70-10}{0-30}(x - 30)$$

$$\Rightarrow 2x + y = 70$$

Hence, the constraints are

$$x + 3y \leq 90, x + y \leq 40, 2x + y \leq 70$$

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

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45. 2025

Solve the following linear programming problem graphically :

Minimise $Z = 2x + y$

subject to the constraints :

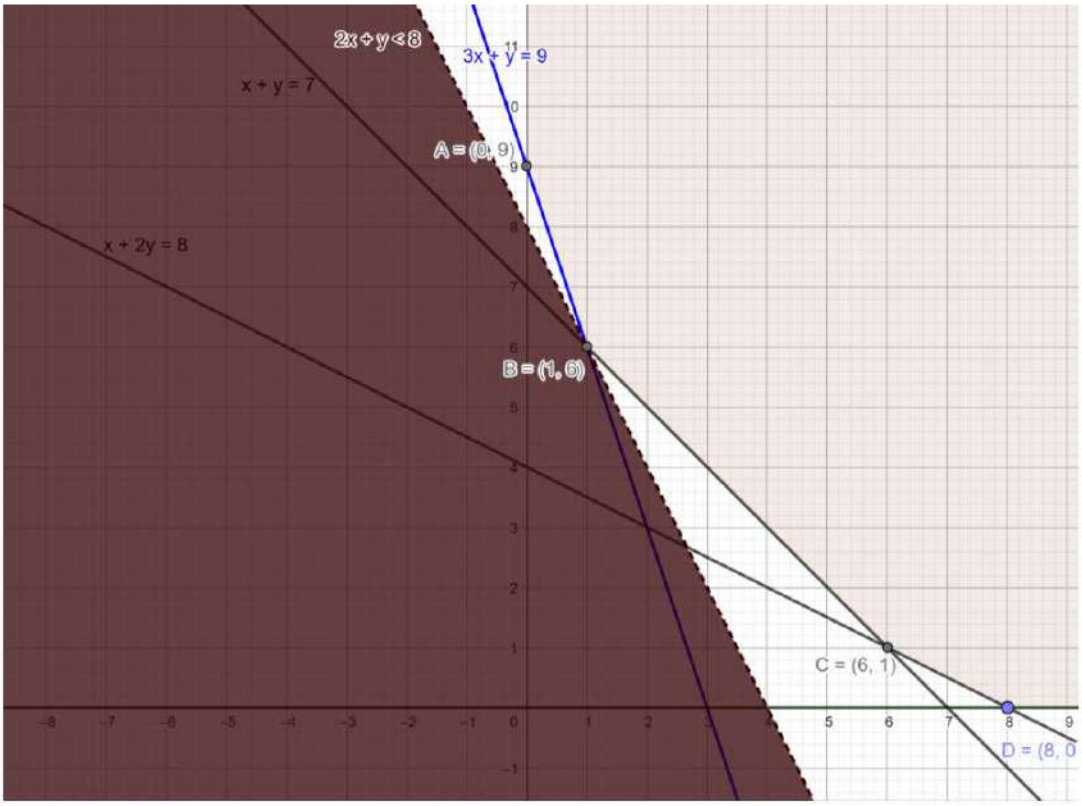
$3x + y \geq 9$

$x + y \geq 7$

$x + 2y \geq 8$

$x, y \geq 0$

Sol.



Corner point	Value of $Z = 2x + y$
A(0, 9)	9
B(1, 6)	8
C(6, 1)	13
D(8, 0)	16

In the half-plane $2x + y < 8$, there is no point in common with the feasible region. Hence, the minimum value of Z is 8, which is attained at $x = 1, y = 6$.

46. 2025

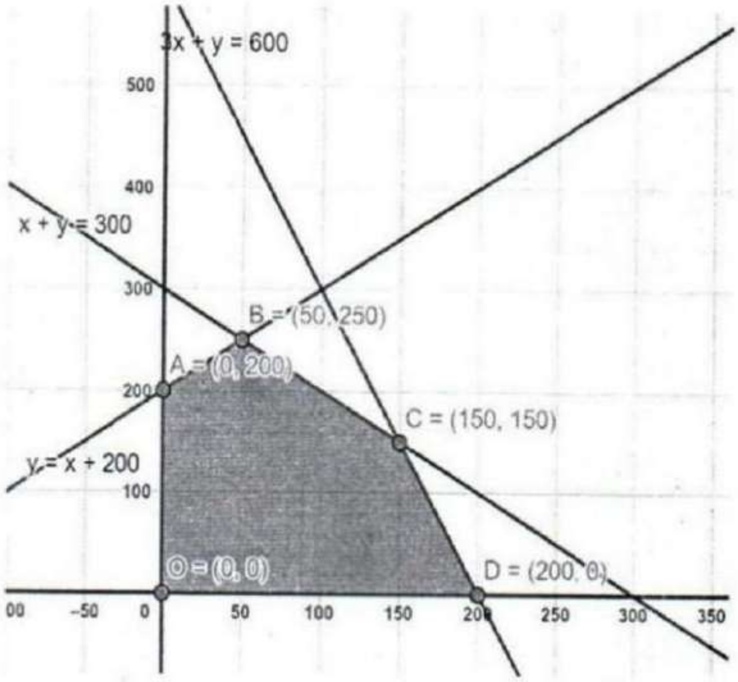
Solve the following Linear Programming Problem using graphical method :

Maximise Z = 100x + 50y

subject to the constraints

$$3x + y \leq 600$$
$$x + y \leq 300$$
$$y \leq x + 200$$
$$x \geq 0, y \geq 0$$

Sol.



Corner Point	Value of $Z = 100x + 50y$
$O(0,0)$	0
$A(0,200)$	10000
$B(50,250)$	17500
$C(150,150)$	22500
$D(2000,0)$	20000

$Z_{\max} = 22500$ when $x = 150, y = 150$ prepared by : BALAJI KANCHI

47. 2025

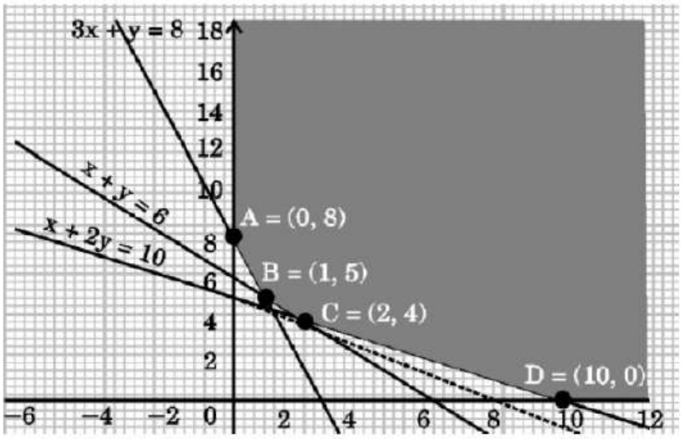
Solve the following Linear Programming Problem graphically :

Minimise Z = 3x + 5y

subject to the constraints

$$x + 2y \geq 10$$
$$x + y \geq 6$$
$$3x + y \geq 8$$
$$x, y \geq 0$$

Sol.

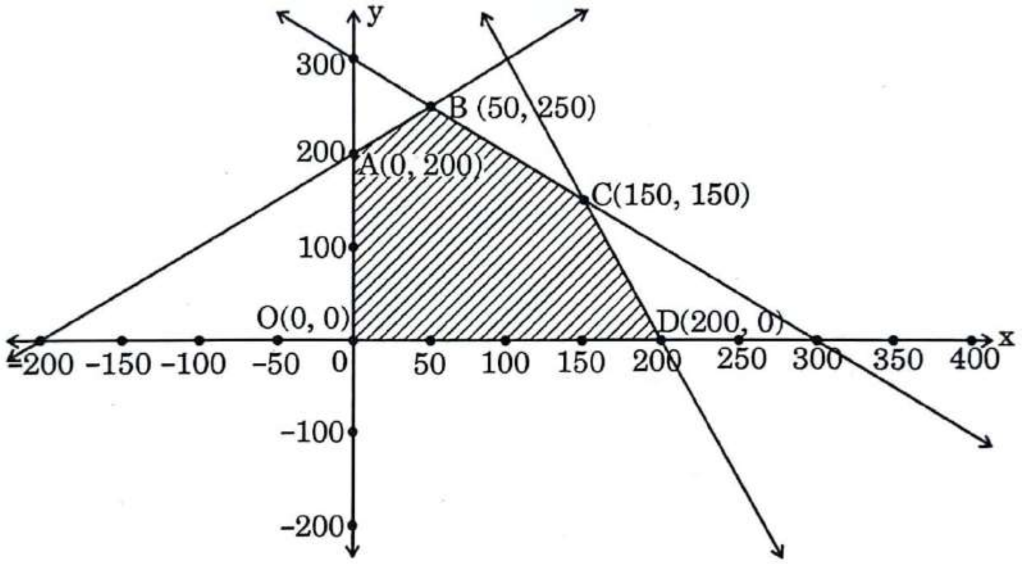


Corner Point	Value of $Z = 3x + 5y$
$A(0,8)$	40
$B(1,5)$	28
$C(2,4)$	26
$D(10,0)$	30

$3x + 5y < 26$ has no common region with the feasible region.

$\therefore Z_{\min} = 26$

48. 2025



For the given graph of a Linear Programming Problem, write all the constraints satisfying the given feasible region.

Sol.

Equation of AB :

$$y-200=\frac{250-200}{50-0}(x-0) \text{ i.e. } -x+y=200$$

Equation of BC :

$$y-250=\frac{150-250}{150-50}(x-50) \text{ i.e. } x+y=300$$

Equation of CD :

$$y-0=\frac{0-150}{200-150}(x-200) \text{ i.e. } 3x+y=600$$

Required constraints are :

$-x+y\leq 200$

$x+y\leq 300$

$3x+y\leq 600$

$x\geq 0, y\geq 0$

49. 2025

In the Linear Programming Problem (LPP), find the point/points giving maximum value for $Z = 5x + 10y$

subject to constraints

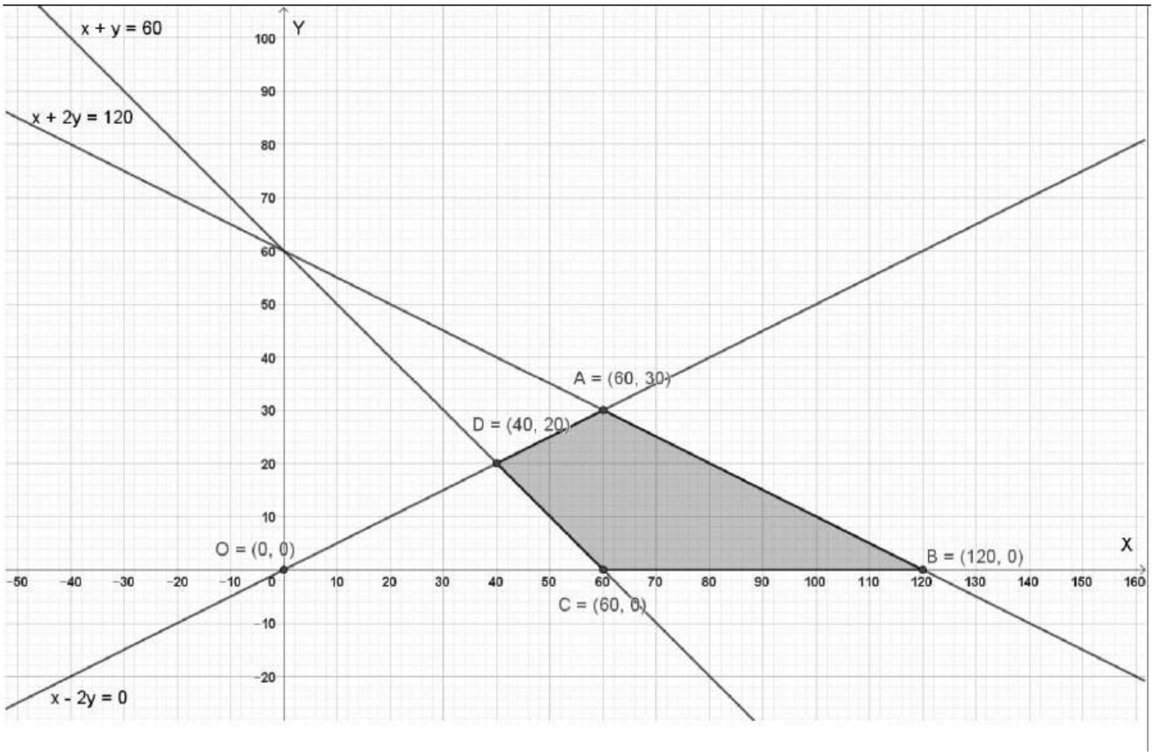
$$x + 2y \leq 120$$

$$x + y \geq 60$$

$$x - 2y \geq 0$$

$$x, y \geq 0$$

Sol.



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

Since Z is maximum on points A and B

Hence all points lying on segment AB give maximum Z.

50. 2025

Consider the Linear Programming Problem, where the objective function Z = (x + 4y) needs to be minimized subject to constraints

$$2x + y \geq 1000$$

$$x + 2y \geq 800$$

$$x, y \geq 0.$$

Draw a neat graph of the feasible region and find the minimum value of Z.

Sol.

Correct Graph and shading:

Corner points	Value of Z
(800, 0)	800
(400, 200)	1200
(0, 1000)	4000

x + 4y < 800 has no region common with feasible region, hence 800 is minimum

51. 2025

In the Linear Programming Problem for objective function Z = 18x + 10y subject to constraints

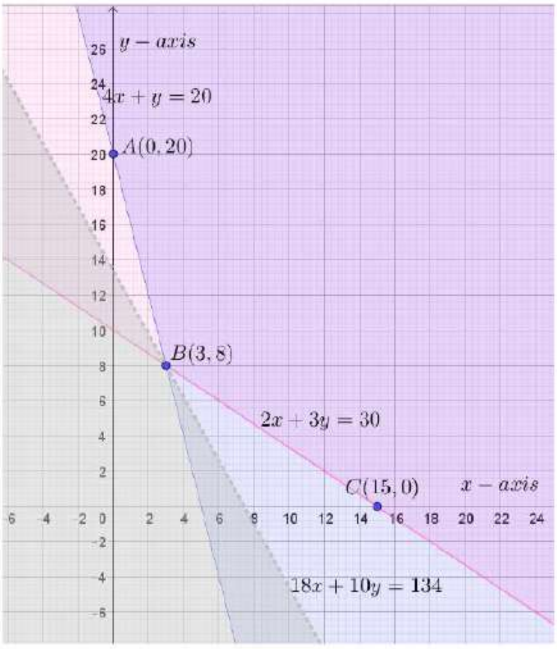
$$4x + y \geq 20$$

$$2x + 3y \geq 30$$

$$x, y \geq 0$$

find the minimum value of Z.

Sol.



Correct Fig.

Corner points	Value of Z = 18x + 10y
A (0, 20)	200
B (3, 8)	134
C (15, 0)	270

Also, $Z < 134$, does not have any common point with the feasible region,

$\therefore \text{Min}(Z) = 134$ at B (3, 8)

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52.

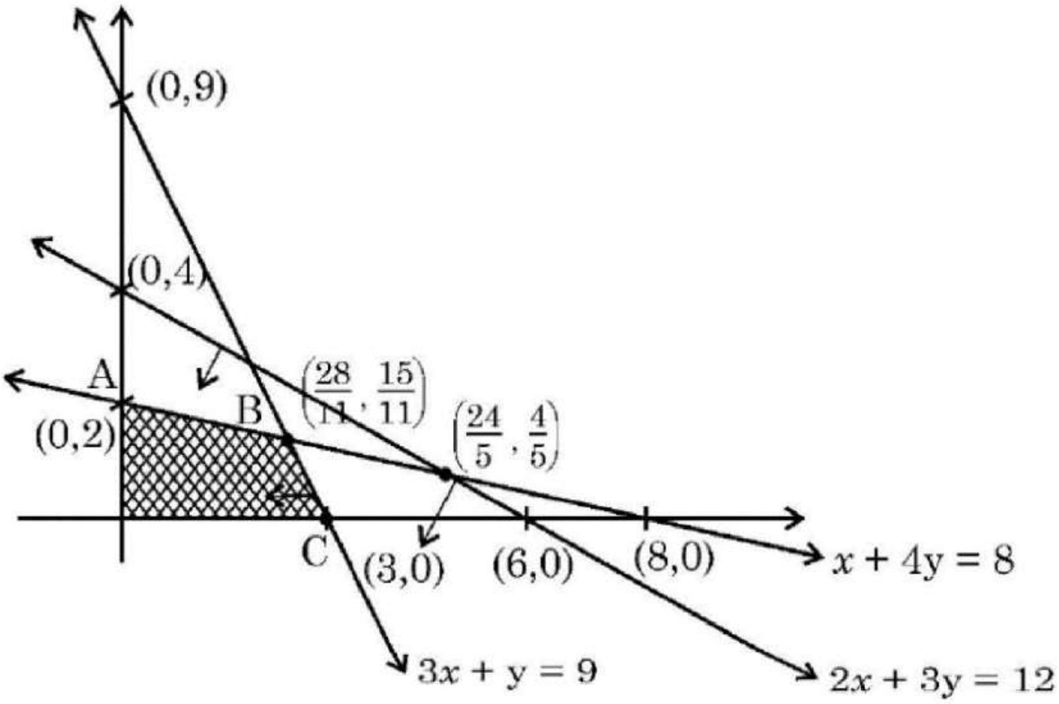
Solve the following LPP graphically :

Maximize Z = 2x + 3y

subject to the constraints $x + 4y \le 8$

$$2x + 3y \le 12$$
$$3x + y \le 9$$
$$x \ge 0, y \ge 0.$$

Sol.



Corner Point	Value of $Z = 2x + 3y$
$O(0,0)$	0
$A(0,2)$	6
$B\left(\frac{28}{11}, \frac{15}{11}\right)$	$\frac{101}{11}$ Maximum
$C(3,0)$	6

$Z_{\max} = \frac{101}{11}$ when $x = \frac{28}{11}, y = \frac{15}{11}$

5 Marks :

1.2024

Solve the following L.P.P. graphically :

Maximise $Z = 60x + 40y$

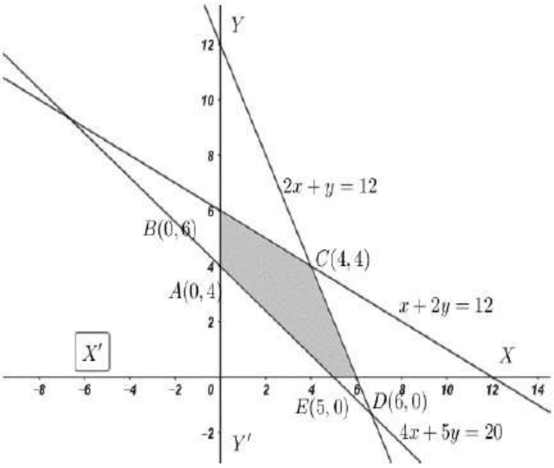
Subject to $x + 2y \leq 12$

$2x + y \leq 12$

$4x + 5y \geq 20$

$x, y \geq 0$

Sol.



Corner Points	Value of $Z = 60x + 40y$
$A(0,4)$	$Z = 160$
$B(0,6)$	$Z = 240$
$C(4,4)$	$Z = 400$
$D(6,0)$	$Z = 360$
$E(5,0)$	$Z = 300$

$\text{Max}(Z) = 400$ at $x = 4, y = 4$

2.2024

Solve the following Linear Programming problem graphically :

Maximise $Z = 300x + 600y$

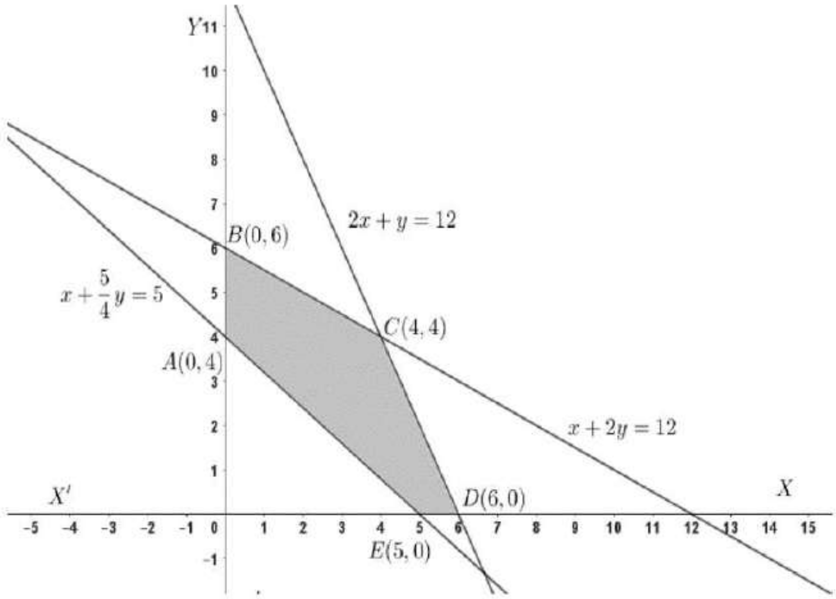
Subject to $x + 2y \leq 12$

$2x + y \leq 12$

$x + \frac{5}{4}y \geq 5$

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

Sol.



Corner Points	Value of $Z = 300x + 600y$
$A(0,4)$	$Z = 2400$
$B(0,6)$	$Z = 3600$
$C(4,4)$	$Z = 3600$
$D(6,0)$	$Z = 1800$
$E(5,0)$	$Z = 1500$

Max(Z) = 3600, at all points on the line segment BC

3.2024

Solve the following L.P.P. graphically :

Minimise $Z = 6x + 3y$

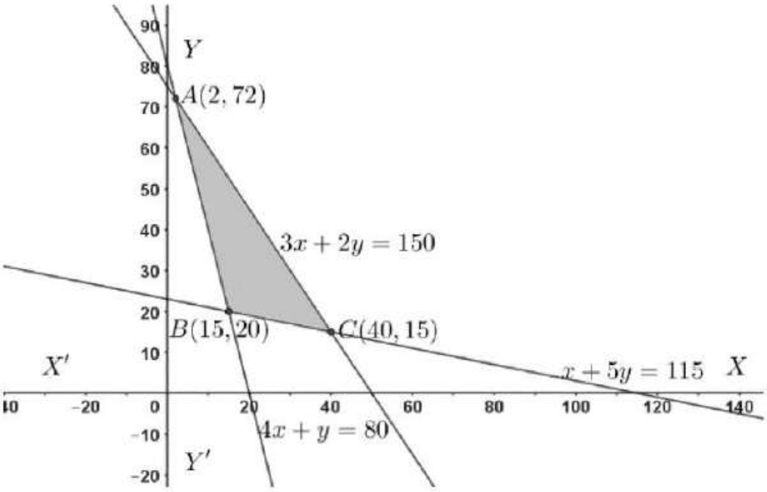
Subject to constraints

$$4x + y \geq 80;$$

$$x + 5y \geq 115;$$

$$3x + 2y \leq 150$$

$$x, y \geq 0$$



Corner Points	Value of $Z = 6x + 3y$
$A(2,72)$	$Z = 228$
$B(15,20)$	$Z = 150$
$C(40,15)$	$Z = 285$

$$\text{Min}(Z) = 150 \text{ at } x = 15, y = 20$$

4. 2024

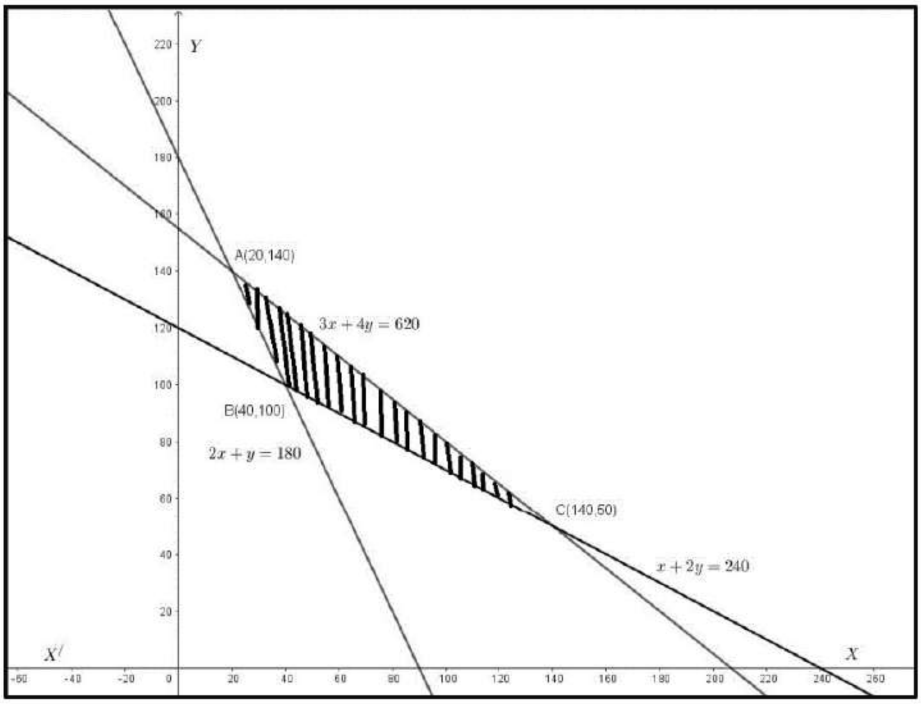
Solve the following linear programming problem graphically :

Minimise $Z = 6x + 7y$

subject to constraints

$$x + 2y \geq 240$$
$$3x + 4y \leq 620$$
$$2x + y \geq 180$$
$$x, y \geq 0.$$

Sol.



Corner Points	Value of $Z = 6x + 7y$
$A(20,140)$	$Z = 1100$
$B(40,100)$	$Z = 940$
$C(140,50)$	$Z = 1190$

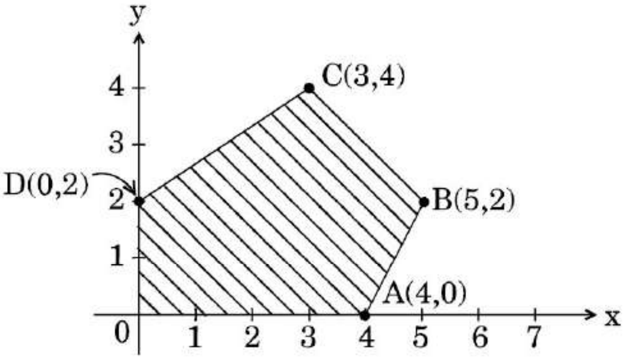
$$\text{Min}(Z) = 940 \text{ at } x = 40, y = 100$$

prepared by : BALAJI KANCHI

Case study :

1.

The corner points of the feasible region determined by the system of linear inequations are as shown below :



Answer each of the following :

(i) Let $z = 13x - 15y$ be the objective function. Find the maximum and minimum values of z and also the corresponding points at which the maximum and minimum values occur.

(ii) Let $z = kx + y$ be the objective function. Find k, if the value of z at A is same as the value of z at B.

Ans. $z(A) = 13(4) - 15(0) = 52$

$z(B) = 13(5) - 15(2) = 35$

$z(C) = 13(3) - 15(4) = -21$

$z(D) = 13(0) - 15(2) = -30$

$z(0) = 0$

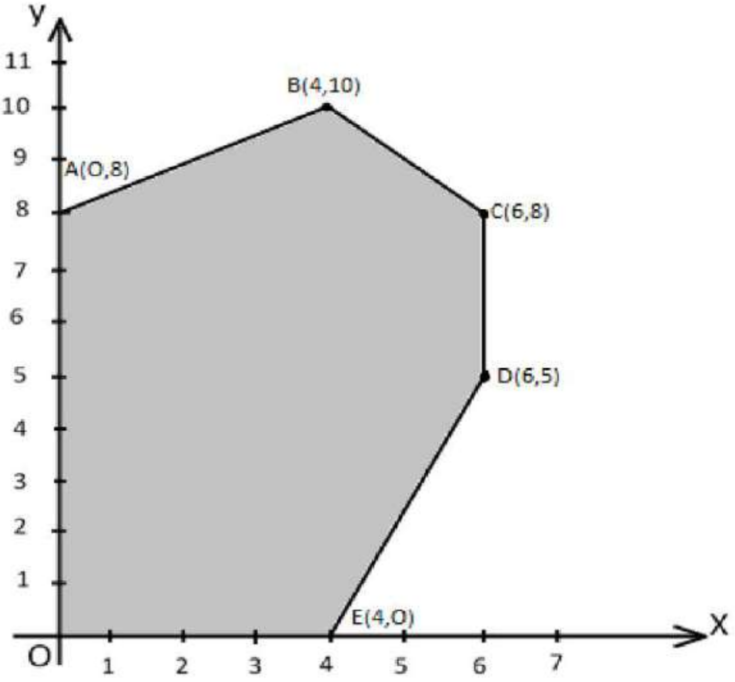
$\therefore$ Max(z) = 52 at A(4, 0), Min(z) = –30 at (0, 2)

(ii)

Ans. $z(A) = z(B) \Rightarrow 4k + 0 = 5k + 2 \Rightarrow k = -2$

2.

The corner points of the feasible region determined by the system of linear constraints are as shown below:



Answer each of the following:

(i) Let $Z = 3x - 4y$ be the objective function. Find the maximum and minimum value of Z and also the corresponding points at which the maximum and minimum value occurs.

(ii) Let $Z = px + qy$, where $p, q > o$ be the objective function. Find the condition on p and q so that the maximum value of Z occurs at $\mathrm{B}(4,10) and \mathrm{C}(6,8)$. Also mention the number of optimal solutions in this case.

3.

The month of September is celebrated as the Rashtriya Poshan Maah across the country. Following a healthy and well-balanced diet is crucial in order to supply the body with the proper nutrients it needs. A balanced diet also keeps us mentally fit and promotes improved level of energy.

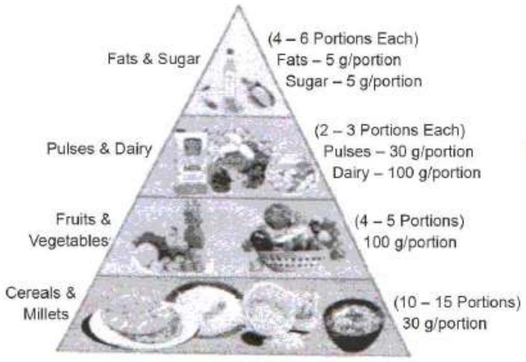


Figure-1

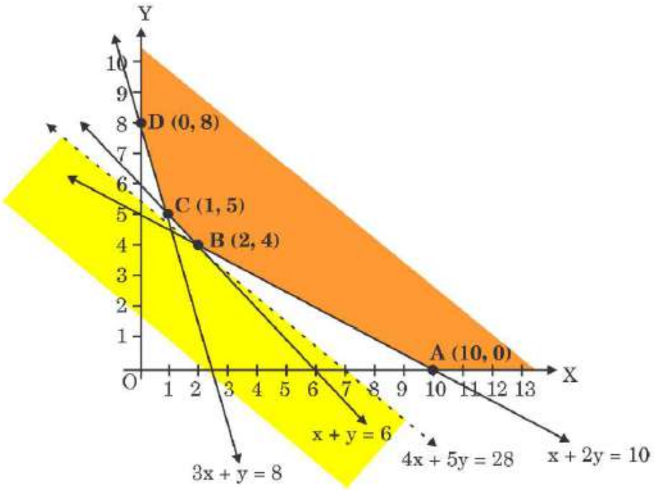


Figure-2

A dietician wishes to minimize the cost of a diet involving two types of foods, food X (x kg) and food Y (y kg) which are available at the rate of ₹ 16/kg and ₹ 20/kg respectively. The feasible region satisfying the constraints is shown in Figure-2.

On the basis of the above information, answer the following questions :

(i) Identify and write all the constraints which determine the given feasible region in Figure-2.

(ii) If the objective is to minimize cost Z = 16x + 20y, find the values of x and y at which cost is minimum. Also, find minimum cost assuming that minimum cost is possible for the given unbounded region.

Sol.

(i)Constraints are $x + 2y \geq 10$
$x + y \geq 6$
$3x + y \geq 8$
$x \geq 0$
$y \geq 0$

(ii)

Corner points	Value of Z = 16x + 20y
A (10, 0)	160
B (2, 4)	112
C (1, 5)	116
D (0, 8)	160

The minimum cost is ₹112

prepared by : BALAJI KANCHI