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SRI VIDYA ARADHANA ACADEMY
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PCMB PHYSICS CHEMISTRY MATHEMATICS BIOLOGY
NEET/JEE

Topic: Linear Programming

Mathematics **Assignment-01 • Board & MHT-CET Practice** Chetan Sir

"Neat working is not decoration — it is how you catch your own mistakes before the examiner does."

SECTION A : FEASIBLE REGION AND CORNER POINTS

CONCEPT

- **Graph of** $ax + by \leq c$ **(or** $\geq c$**):** draw the line $ax + by = c$ (solid for $\leq, \geq$; dotted for $<, >$). Put $(0,0)$ in the inequality: true $\Rightarrow$ shade the origin side, false $\Rightarrow$ the other side.
- **Feasible region** = common region of *all* the constraints; $x \geq 0$, $y \geq 0$ keep it in the first quadrant.
- **Corner points** = vertices of the feasible region: solve two boundary lines at a time and keep the points that satisfy every constraint.
- A region that can be enclosed in a circle is *bounded*; otherwise *unbounded*.

CLASS QUESTIONS

1. The region represented by $30x + 20y \geq 120$, $10x + 30y \geq 110$, $x \geq 0$, $y \geq 0$ is [Class Q]

(A) bounded, on the origin side
(B) unbounded, on the non-origin side
(C) bounded, on the non-origin side
(D) unbounded, on the origin side

2. The common region determined by all the constraints of a linear programming problem is called [CBSE 2024]

(A) an optimal region
(B) a bounded region
(C) a feasible region
(D) an infeasible region

3. The number of corner points of the feasible region determined by $x \geq 0$, $y \geq 0$, $x + y \geq 4$ is [CBSE 2024]

(A) 0 (B) 1 (C) 2 (D) 3

PRACTICE QUESTIONS

4. Which of the terms is not used in a linear programming problem? [MHT CET 2007]

(A) Optimal solution
(B) Feasible solution
(C) Concave region
(D) Objective function

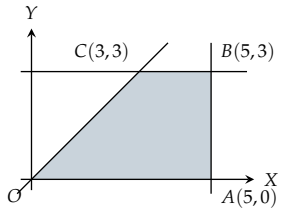
5. If L. P. P. has optimum solutions at two consecutive corner points of feasible region, then L. P. P. has [MHT CET 2020]

(A) infinite solutions
(B) no solution
(C) two solutions
(D) unique solution

6. In L.P.P., the corner points of the feasible region for the constraints $3x - y \geq 6, x \leq 3, y \leq 2, y \geq 0, x \geq 0$ are ..... [MHT CET 2026]

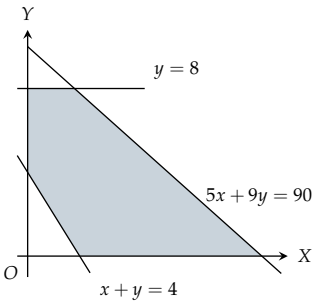
(A) $(3,2), (3,0), (2,0)$
(B) $\left(\frac{8}{3}, 2\right), (3,2), (3,0), (2,0)$
(C) $(0,0), (2,0), \left(\frac{8}{3}, 2\right), (0,2)$
(D) $(3,2), (0,3), (0,2)$

7. The shaded part of the given figure indicates the feasible region. Then the constraints are [MHT CET 2021]



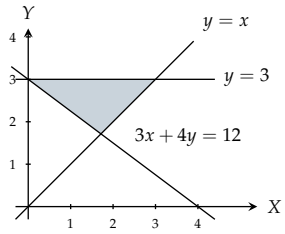
(A) $x, y \geq 0; x - y \geq 0; x \leq 5; y \leq 3$
(B) $x, y \geq 0; x - y \geq 0; x \leq 5; y \geq 3$
(C) $x, y \geq 0; x + y \geq 0; x \geq 5; y \leq 3$
(D) $x, y \geq 0; x - y \geq 0; x \geq 5; y \leq 3$

8. For the following shaded region the linear constraints are [MHT CET 2020]



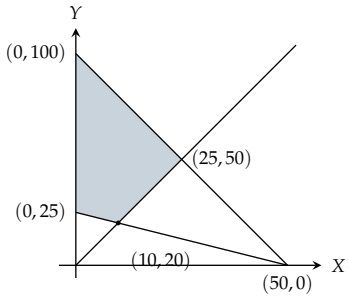
(A) $5x + 9y \leq 90, x + y \geq 4, \quad y \geq 8, \quad x, y \geq 0$
(B) $5x + 9y \geq 90, x + y \leq 4, \quad y \leq 8, \quad x, y \geq 0$
(C) $5x + 9y \geq 90, x + y \geq 4, \quad y \geq 8, \quad x, y \geq 0$
(D) $5x + 9y \leq 90, x + y \geq 4, \quad y \leq 8, \quad x, y \geq 0$

9. If feasible region is as shown in the figure, then the related inequalities are [MHT CET 2023]



(A) $3x+4y \geq 12, y-x \geq 0, y \leq 3, x, y \geq 0$
(B) $3x+4y \leq 12, y-x \leq 0, y \geq 3, x, y \geq 0$
(C) $3x+4y \leq 12, y-x \geq 0, y \leq 3, x, y \geq 0$
(D) $3x+4y \geq 12, y-x \leq 0, y \geq 3, x, y \geq 0$

10. The shaded region in the following figure is the solution set of the inequations [MHT CET 2024]



(A) $x+2y \geq 50, 2x+y \leq 100, 2x-y \leq 0, x, y \geq 0$
(B) $x+2y \leq 50, 2x+y \leq 100, 2x-y \leq 0, x, y \geq 0$
(C) $x+2y \geq 50, 2x+y \geq 100, 2x-y \leq 0, x, y \geq 0$
(D) $x+2y \leq 50, 2x+y \geq 100, 2x-y \leq 0, x, y \geq 0$

SECTION B : CORNER POINT METHOD (BOUNDED REGION)

CONCEPT

- **Objective function** $Z = ax + by$ (to maximise or minimise); **constraints** = linear inequalities with $x, y \geq 0$; **optimal solution** = feasible point giving the max/min Z.
- **Corner point method:** (1) graph the constraints and shade the feasible region; (2) find every corner point; (3) put each in Z — greatest = maximum, smallest = minimum.
- A *bounded* region always has both a maximum and a minimum, at corner points.

CLASS QUESTIONS

11. The maximum value of $Z = 4x + y$ subject to $x + y \leq 50,\ 3x + y \leq 90,\ x \geq 0,\ y \geq 0$ is [Class Q]

(A) 50 (B) 110 (C) 120 (D) 150

12. The minimum and the maximum values of $Z = 3x + 9y$ subject to $x + 3y \leq 60,\ x + y \geq 10,\ x \leq y,\ x, y \geq 0$ are [Class Q]

(A) 60 and 180 (B) 90 and 180
(C) 60 and 90 (D) 45 and 180

13. The maximum value of $Z = 500x + 300y$ subject to $x + 2y \leq 12,\ 2x + y \leq 12,\ 4x + 5y \geq 20,\ x, y \geq 0$ is [CBSE 2024]

(A) 3000 (B) 3200 (C) 2500 (D) 1800

PRACTICE QUESTIONS

14. The maximum value of $z = 9x + 13y$ subject to $2x + 3y \leq 18, 2x + y \leq 10, x \geq 0, y \geq 0$ is [MHT CET 2009]

(A) 130 (B) 81 (C) 79 (D) 99

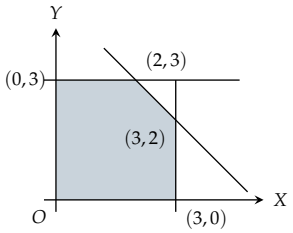
15. The maximum value of the objective function z = $4x + 6y$ subject to $3x + 2y \leq 12, x + y \geq 4, x, y \geq 0$ is [MHT CET 2024]

(A) 24 (B) 46 (C) 56 (D) 36

16. The maximum value of $z = 4x + y$ subject to the constraints $x + y \leq 5, 2x + y \leq 7, 3x + 2y \leq 11, x \geq 0, y \geq 0$ is ... [MHT CET 2026]

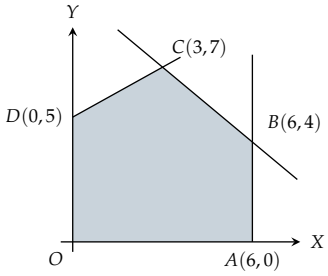
(A) 13 (B) 8 (C) 11 (D) 14

17. The shaded area in the given figure is a solution set for some system of inequations. The maximum value of the function $z = 10x + 25y$ subject to the linear constraints given by the system is [MHT CET 2023]



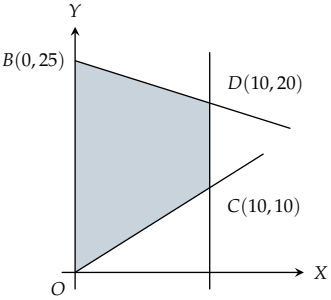
(A) 80 (B) 100 (C) 95 (D) 105

18. The shaded area in the given figure is a solution set for some system of inequalities. The maximum value of the function $z = 4x + 3y$ subject to linear constraints given by the system is [MHT CET 2024]



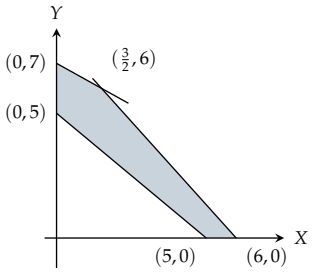
(A) 38 (B) 36 (C) 33 (D) 34

19. For a feasible region $OCDBO$ given below, the maximum value of the objective function $z = 3x + 4y$ is [MHT CET 2023]



(A) 70 (B) 100 (C) 110 (D) 130

20. The function to be maximized is $Z = 2x + y$ over the shaded feasible region. The maximum value of Z and the point where it occurs are [MHT CET 2022]



(A) $10, (5,0)$ (B) $12, (6,0)$
(C) $9, (1.5,6)$ (D) $21, (0.5,0)$

SECTION C : UNBOUNDED REGION AND MORE THAN ONE OPTIMAL POINT

CONCEPT
- **Unbounded region:** let m be the least and M the greatest corner value. *Minimum:* draw $Z < m$; if it has no point in common with the region, m is the minimum, otherwise there is **no minimum**. *Maximum:* same test with $Z > M$.
- **Same optimum at two corner points** $\Rightarrow$ the same value at every point of the segment joining them (infinitely many optimal solutions). To find an unknown in Z, equate its values at those two corners.
- Empty feasible region $\Rightarrow$ no solution.

CLASS QUESTIONS

21. The minimum value of $Z = 5x + 7y$ subject to $2x + y \geq 8,\ x + 2y \geq 10,\ x, y \geq 0$ is [Class Q (2020)]

(A) 38 (B) 50 (C) 56 (D) 40

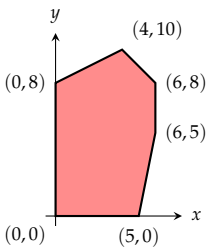
22. The minimum value of $Z = -50x + 20y$ subject to $2x - y \geq -5,\ 3x + y \geq 3,\ 2x - 3y \leq 12,\ x, y \geq 0$ is [Class Q]

(A) -300 (B) -50
(C) 60 (D) does not exist

23. The corner points of the feasible region are $(0,0), (4,0), (2,4)$ and $(0,5)$. If the maximum value of $z = ax + by\ (a, b > 0)$ occurs at both $(2,4)$ and $(4,0)$, then [Class Q (2020)]

(A) $a = b$ (B) $a = 2b$ (C) $2a = b$ (D) $a = 4b$

24. For the feasible region shown, the minimum of $z = 3x - 4y$ occurs at [NCERT Exemplar]



(A) $(0,0)$ (B) $(0,8)$ (C) $(5,0)$ (D) $(4,10)$

PRACTICE QUESTIONS

25. The minimum value of $Z = 3x + y$, subject to the constraints $2x + 3y \leq 6, x + y \geq 1, x \geq 0, y \geq 0$ is.... [MHT CET 2026]

(A) 5 (B) 2 (C) 1 (D) 9

26. If $Z = 7x + y$ subject to $5x + y \geq 5, x + y \geq 3, x \geq 0, y \geq 0$, then minimum value of Z is [MHT CET 2020]

(A) 2 (B) 5 (C) 6 (D) 3

27. The minimum value of the objective function $z = 4x + 6y$ subject to $x + 2y \geq 80, 3x + y \geq 75, x, y \geq 0$ is [MHT CET 2021]

(A) 324 (B) 250 (C) 320 (D) 254

28. If $Z = 10x + 25y$ subject to $0 \leq x \leq 3, 0 \leq y \leq 3, x + y \leq 5, x \geq 0, y \geq 0$ then z is maximum at the point [MHT CET 2020]

(A) $(2,4)$ (B) $(1,6)$ (C) $(2,3)$ (D) $(4,3)$

29. The point, at which the maximum value of $10x + 6y$ subject to the constraints $x + y \leq 12, 2x + y \leq 20, x \geq 0, y \geq 0$ occurs, is [MHT CET 2024]

(A) $(10,0)$ (B) $(8,4)$ (C) $(0,12)$ (D) $(12,0)$

30. The point at which the maximum value of $x + y$ subject to constraints $x + 2y \leq 70$ and $2x + y \leq 95, x \geq 0, y \geq 0$ is. [MHT CET 2026]

(A) $(47.5,0)$ (B) $(0,95)$
(C) $(0,35)$ (D) $(40,15)$

31. The L. P. P. to maximize $Z = x + y$, subject to $x + y \leq 1, 2x + 2y \geq 6, x \geq 0, y \geq 0$ has [MHT CET 2020]

(A) no solution. (B) infinite solutions.
(C) one solution. (D) two solutions.

32. The L.P.P. , minimize $z = 30x + 20y,\ x + y \leqslant 8,\ x + 2y \geqslant 4,\ 6x + 4y \geqslant 12,\ x \geqslant 0, y \geqslant 0$ has [MHT CET 2025]

(A) a unique solution (B) infinitely many solutions
(C) minimum value at $(4,0)$ (D) minimum value at $(8,0)$

33. For the linear programming problem, $x + 2y \leq 10,\ 3x + y \leq 12,\ x, y \geq 0$, the maximum value of $z = 5x + 10y$ occurs at every point on the line segment joining the points.. [MHT CET 2026]

(A) $(0,0)$ and $(4,0)$
(B) $(0,0)$ and $(0,5)$
(C) $(4,0)$ and $\left(\frac{14}{5}, \frac{18}{5}\right)$
(D) $(0,5)$ and $\left(\frac{14}{5}, \frac{18}{5}\right)$

34. The difference between the maximum value and the minimum value of the objective function $z = 3x + y$ subject to the constraints $2x + 3y \leq 6, x + y \geq 1, x \geq 0, y \geq 0$ is.... [MHT CET 2026]

(A) 7 (B) 3 (C) 8 (D) 1

35. If the difference between the maximum and minimum values of the objective function $z = 7x - 8y$ subject to the constraints $x + y \leqslant 20$, $y \geqslant 5, x, y \geqslant 0$ is $5k + 200$, then the value of k is [MHT CET 2025]

(A) 3 (B) 4 (C) 5 (D) 6

36. The corner points of the feasible region determined by a system of linear constraints are $(0,3), (1,1)$ and $(3,0)$. If the objective function is $z = px + qy$, where $p, q > 0$, then the condition on p and q such that the minimum of z occurs at both $(3,0)$ and $(1,1)$ is _____ [MHT CET 2026]

(A) $p = 3q$ (B) $3p = q$

(C) $p = \frac{q}{2}$ (D) $p = 2q$

SECTION D : WORD PROBLEMS (FORMULATION)

CONCEPT

- Let x, y be the two quantities asked for. Write Z from the cost or profit (minimise cost, maximise profit).
- One constraint per resource or requirement: "at least" $\Rightarrow \geq$, "at most" $\Rightarrow \leq$. Add $x, y \geq 0$, then use the corner points.
- Limits of LPP: objective and constraints must be linear, data accurate, and items like machines or packets are whole numbers.

CLASS QUESTIONS

37. A dietician mixes foods P and Q. One packet of P has 12 units calcium, 4 iron, 6 cholesterol, 6 vitamin A; one packet of Q has 3 calcium, 20 iron, 4 cholesterol, 3 vitamin A. The diet needs at least 240 calcium, at least 460 iron, at most 300 cholesterol. The minimum amount of vitamin A in the diet is [Class Q]

(A) 150 units (B) 228 units

(C) 285 units (D) 120 units

38. A diet must meet the constraints $x + 2y \geq 10$, $x + y \geq 6$, $3x + y \geq 8$, $x, y \geq 0$ (x kg of food X, y kg of food Y). If the cost is $Z = 16x + 20y$ (in Rs), the minimum cost is [CBSE 2024]

(A) Rs. 112 (B) Rs. 116 (C) Rs. 160 (D) Rs. 120

39. A factory runs machines I, II (at most 12 hours each) and III (at least 5 hours). One unit of M needs 1, 2, 1 hour on I, II, III; one unit of N needs 2, 1, 1.25 hours. Profit is Rs. 600 per unit of M and Rs. 400 per unit of N. The maximum profit is [Class Q]

(A) Rs. 3000 (B) Rs. 3600

(C) Rs. 4000 (D) Rs. 2400

PRACTICE QUESTIONS

40. A manufacturing company produces two items, A and B. Each toy should be processed by two machines, I and II. Machine I can be operated for maximum 10 hours 40 minutes. It takes 20 minutes for an item A and 15 minutes for B. Machine II can be operated for a total time at 8 hours 20 minutes. It takes 5 minutes for an item A and 8 minutes for B. The profit per item of A is Rs. 25 and per item of B is Rs. 18. The formulation of an L.P.P. to maximize the profit (where x is number of items A and y is the number of item B) is _____ [MHT CET 2025]

(A) Max $z = 25x + 18y$: $20x + 15y \leq 640$, $5x + 8y \geq 500$

(B) Max $z = 25x + 18y$: $20x + 15y \leq 640$, $5x + 8y \leq 500$

(C) Max $z = 25x + 18y$: $20x + 5y \leq 8$, $5x + 8y \leq 10$

(D) Max $z = 25x + 18y$: $4x + 3y \leq 128$, $5x + 8y \geq 500$

41. An airplane can carry a maximum of 250 passengers. A profit of Rs. 1500 is made on each executive class ticket and a profit of Rs. 900 is made on each economy class ticket. The airline reserves at least 30 seats for executive class. However at least 4 times as many passengers prefer to travel by economy class than by executive class. Let x_1 be the number of passengers of executive class and x_2 be the number of passengers of economy class. Formulate the LPP in order to maximize the profit for the airline... [MHT CET 2026]

(A) Max $1500x_1 + 900x_2$: $x_1 + x_2 \leq 250$, $x_1 \leq 30$, $x_2 \leq 4x_1$

(B) Min $150x_1 + 90x_2$: $x_1 + x_2 \leq 250$, $x_1 \geq 30$, $x_2 \geq 4x_1$

(C) Min $1500x_1 + 900x_2$: $x_1 + x_2 \leq 250$, $x_1 \geq 30$, $x_2 \geq 4x_1$

(D) Max $1500x_1 + 900x_2$: $x_1 + x_2 \leq 250$, $x_1 \geq 30$, $x_2 \geq 4x_1$

ANSWER KEY

1. (B)	**2.** (C)	**3.** (C)	**4.** (C)	**5.** (A)	**6.** (B)
7. (A)	**8.** (D)	**9.** (A)	**10.** (A)	**11.** (C)	**12.** (A)
13. (B)	**14.** (C)	**15.** (D)	**16.** (D)	**17.** (C)	**18.** (B)
19. (C)	**20.** (B)	**21.** (A)	**22.** (D)	**23.** (B)	**24.** (B)
25. (C)	**26.** (B)	**27.** (D)	**28.** (C)	**29.** (B)	**30.** (D)
31. (A)	**32.** (B)	**33.** (D)	**34.** (C)	**35.** (C)	**36.** (C)
37. (A)	**38.** (A)	**39.** (C)	**40.** (B)	**41.** (D)	