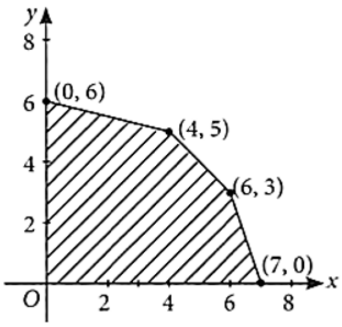
CBSE 2025-26
Class 12 - Mathematics
Linear Programming
Important Question

Question No. 1 to 5 are based on the given text. Read the text carefully and answer the questions:
Linear programming is a method for finding the optimal values (maximum or minimum) of quantities subject to the constraints when a relationship is expressed as linear equations or inequations.

1. The optimal value of the objective function is attained at the points
   a. which are corner points of the feasible region
   b. on X-axis
   c. none of these
   d. on Y-axis
2. The graph of the inequality $3x + 4y < 12$ is
   a. half plane that neither contains the origin nor the points of the line $3x + 4y = 12$
   b. whole XOY-plane excluding the points on line $3x + 4y = 12$
   c. none of these
   d. half plane that contains the origin
3. The feasible region for an LPP is shown in the figure. Let $Z = 2x + 5y$ be the objective function. Maximum of Z occurs at



   a. (4, 5)
   b. (7, 0)
   c. (0, 6)
   d. (6, 3)
4. The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5), (15, 15), (0, 20). Let $Z = px + qy$, where $p, q > 0$. Condition on p and q so that the maximum of Z occurs at both the points (15, 15) and (0, 20) is:
   a. $q = 2p$
   b. $p = q$
   c. $p = 2q$
   d. $q = 3p$
5. The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 40), (20, 40), (60, 20), (60, 0). The objective function is $Z = 4x + 3y$. Compare the quantity in

Column A	Column B
Maximum of Z	325

a. The quantity in column A is greater
b. The quantity in column B is greater
c. The two quantities are equal
d. The relationship cannot be determined on the basis of the information supplied

6. Maximize Z = – x + 2y, subject to the constraints: $x \geq 3$, $x + y \geq 5$, $x + 2y \geq 6$, $y \geq 0$.
   a. Z has no maximum value
   b. Maximum Z = 14 at (2, 6)
   c. Maximum Z = 12 at (2, 6)
   d. Maximum Z = 10 at (2, 6)
7. In Corner point method for solving a linear programming problem one finds the feasible region of the linear programming problem ,determines its corner points and evaluates the objective function Z = ax + by at each corner point. If M and m respectively be the largest and smallest values at corner points then
   a. None of these
   b. If the feasible region is bounded, M and m respectively are the maximum and minimum values of the objective function
   c. If the feasible region is unbounded, M and m respectively are the maximum and minimum values of the objective function
   d. If the feasible region is bounded, M and m respectively are the minimum and maximum values of the objective function
8. In linear programming infeasible solutions
   a. fall inside the a regular polygon
   b. fall inside the feasible region
   c. fall outside the feasible region
   d. fall on the x = 0 plane

9. Which of the following types of problems cannot be solved by linear programming methods
   a. Transportation problems
   b. Manufacturing problems
   c. Traffic signal control
   d. Diet problems
10. The value of objective function is maximum under linear constraints
   a. at (0, 0)
   b. at any vertex of feasible region
   c. the vertex which is maximum distance from (0, 0)
   d. at the centre of feasible region
11. State True or False:
   i. A corner point of a feasible region is a point in the region which is the intersection of two boundary lines.
      a. True
      b. False
   ii. The common region determined by all the constraints including non-negative constraints $x \geq 0$, $y \geq 0$ of an LPP is called the feasible region for the problem.
      a. True
      b. False
12. Fill in the blanks:
   a. Any point in the feasible region that gives the optimal value of the objective function is called an _________ solution.
   b. A feasible region of a system of linear inequalities is said to be _________ if it can be enclosed within a circle.

13. Maximize Z = 4x + 9y subject to the constraints $x \geq 0, y \geq 0, x + 5y \leq 200, 2x + 3y \leq 134$
14. Determine graphically the minimum value of the objective function Z = - 50x + 20y Subject to constraints:

    $2x - y \geq -5$

    $3x + y \geq 3$

    $2x - 3y \leq 12$

    $x \geq 0, y \geq 0$
15. Find the maximum value of Z = 7x + 7y subject to the constraints $x \geq 0, y \geq 0, x + y \geq 2$ and $2x + 3y \leq 6$
16. Solve the linear programming problem graphically:

    Maximise Z = 4x + y subject to the constraints:

    $x + y \leq 50$

    $3x + y \leq 90$

    $x \geq 0, y \geq 0$

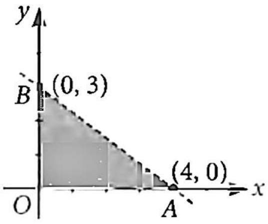
Solution

1. (a) which are corner points of the feasible region

   Explanation: When we solve an L.P.P. graphically, the optimal (or optimum) value of the objective function is attained at corner points of the feasible region.

2. (c) none of these

   Explanation: From the graph of 3x + 4y < 12 it is clear that it contains the origin but not the points on the line 3x + 4y = 12.



3. (a) (4, 5)

   Explanation: Maximum of objective function occurs at corner points.

Corner Points	**Value of Z = 2x + 5y**
(0, 0)	0
(7, 0)	14
(6, 3)	27
(4, 5)	33 ⟵ Maximum
(0, 6)	30

4. (d) q = 3p

   Explanation: Value of Z = px + qy at (15, 15) = 15p + 15q and that at (0, 20) = 20 q. According to given condition, we have

   15p + 15q = 20 q ⇒ 15p = 5q ⇒ q = 3p

5. (b) The quantity in column B is greater

   Explanation: Construct the following table of values of the objective function:

Corner Points	**Value of Z = 2x + 5y**
(0, 0)	4 × 0 + 3 × 0 = 0
(0, 40)	4 × 20 + 3 × 40 = 0
(20, 40)	4 × 20 + 3 × 40 = 200
(60, 20)	4 × 60 + 3 × 20 = 300 ⟵ Maximum
(60, 0)	4 × 60 + 3 × 20 = 240

6. (a) Z has no maximum value

   Explanation: Objective function is Z = - x + 2 y ……………………(1).

The given constraints are : x ≥ 3, x + y ≥ 5, x + 2y ≥ 6, y ≥ 0.

Corner points	**Z = - x + 2y**
D(6,0)	-6
A(4,1)	-2
B(3,2)	1

Here, the open half plane has points in common with the feasible region.

Therefore, Z has no maximum value.

7. (b) If the feasible region is bounded, M and m respectively are the maximum and minimum values of the objective function

   Explanation: In Corner point method for solving a linear programming problem one finds the feasible region of the linear programming problem ,determines its corner points and evaluates the objective function Z = ax + by at each corner point. If Mand m respectively be the largest and smallest values at corner points then If the feasible region is bounded, M and m respectively are the maximum and minimum values of the objective function .
8. (c) fall outside the feasible region

   Explanation: In linear programming infeasible solutions fall outside the feasible region. In other words, it the region other than the feasible region is called the infeasible region.
9. (c) Traffic signal control

   Explanation: Traffic signal control types of problems cannot be solved by linear programming methods, because there is no need for optimization in such problems.
10. (b) at any vertex of feasible region

    Explanation: In linear programming problem we substitute the coordinates of vertices of feasible region in the objective function and then we obtain the maximum or minimum value. Therefore, the value of objective function is maximum under linear constraints at any vertex of feasible region.

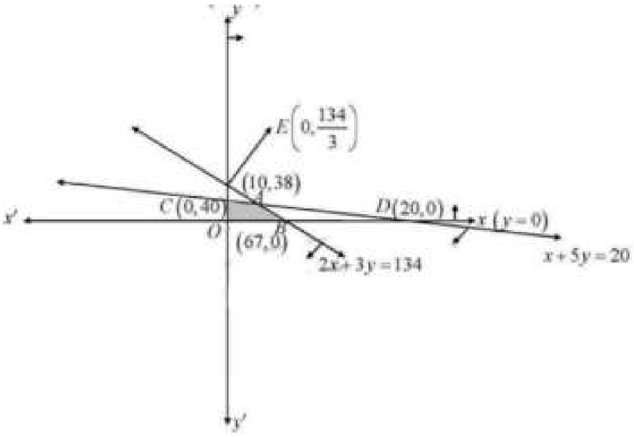
11. State True or False:
    i. (a) True
    ii. (a) True
12. Fill in the blanks:
    a. optimal
    b. Bounded
13. Here,it is given Z = 4x + 9 y subject to the constraints

    $x + 5y \leq 200$

    and $x \geq 0, \quad y \geq 0$

    and $x \geq 0, \quad y \geq 0$

    Now draw the line x + 5y = 200 and 2x + 3 y = 134



and shaded regions satisfied by the above inequalities.

Here, the feasible region is bounded

The corner points are given as O (0,0) A (10, 38), B(67, 0) and C(0, 40)

Therefore,the maximum value of z is 382, which occurs at (10, 38)

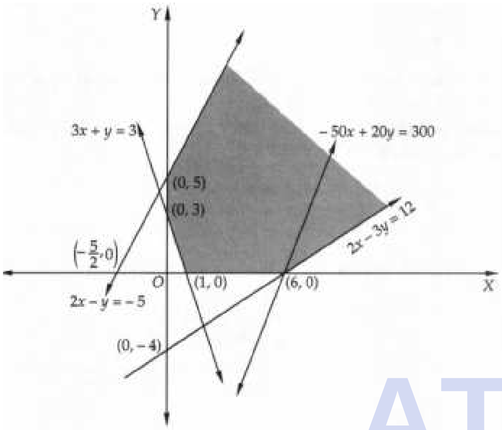
14. $2x - y \geq -5$

$3x + y \geq 3$

$2x - 3y \leq 12$

$x \geq 0, y \geq 0$

The feasible region of the system of inequations given in constraints is shown in a figure. We observe that the feasible region is unbounded.



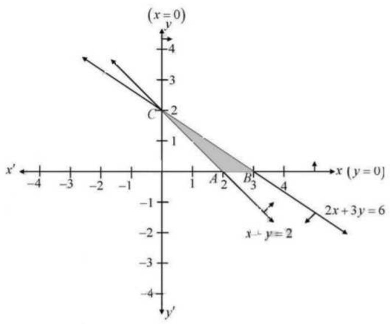
The values of the objective function Z at the corner points are given in the following table:

Corner point (x, y)	Value of the objective function Z = -50x + 20y
(0,5)	$Z = -50 \times 0 + 20 \times 5 = 100$
(0,3)	$Z = -50 \times 0 + 20 \times 3 = 60$
(1,0)	$Z = -50 \times 1 + 20 \times 0 = -50$
(6,0)	$Z = -50 \times 6 + 20 \times 0 = -300$

Clearly, - 300 is the smallest value of Z at the corner point (6, 0). Since the feasible region is unbounded, therefore, to check whether - 300 is the minimum value of Z, we draw the line $-300 = -50x + 20y$ and check whether the open half plane $-50x + 20y < -300$ has points in common with the feasible region or not. From Fig., we find that the open half plane represented by $-50x + 20y < -300$ has points in common with the feasible region. Therefore, $Z = -50x + 20y$ has no minimum value subject to the given constraints.

15. Given $Z = 7x + 7y$ subject to the constraints $x \geq 0, y \geq 0, x + y \geq 2$ and $2x + 3y \leq 6$

Now, draw the line $x + y = 2$ and $2x + 3y = 6$



And shaded region satisfied by above inequalities here the feasible region is bounded.

The value of Z at A(3, 0), Z = 7 × 2 + 7 × 0 = 14 at B(3, 0), Z = 7 × 3 + 7 × 0 = 21 and at C(0, 2), Z = 7 × 0 + 7 × 2 = 14

Therefore,the maximum value of Z is 21, this is the required solution which occurs at B(3.0)

16. To Maximize Z = 4x + y ......(i)

subject to the constraints:

$x + y \leq 50$ .....(ii)

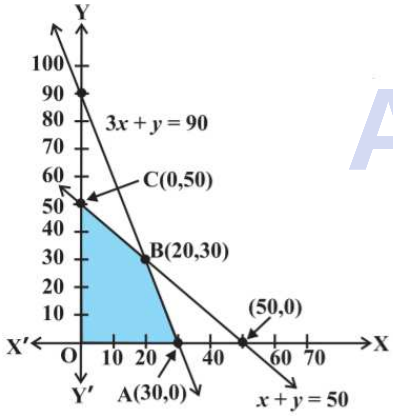
$3x + y \leq 90$ ......(iii)

$x \geq 0, y \geq 0$ .....(iv)

The shaded region in a figure is the feasible region determined by the system of constraints (ii) to (iv). We observe that the feasible region OABC is bounded. So, we now use Corner Point Method to determine the maximum value of Z.

The coordinates of the corner points O, A, B and C are (0, 0), (30, 0), (20, 30) and (0, 50) respectively. Now we evaluate Z at each corner point.

Corner Point	Corresponding value of Z
(0, 0)	0
(30, 0)	120
(20, 30)	110
(0, 50)	50



Hence, maximum value of Z is 120 at the point (30, 0).