CHAPTER 12 LINEAR PROGRAMMING

SUBJECT: MATHEMATICS **MAX. MARKS : 40**
CLASS : XII **DURATION : 1½ hrs**

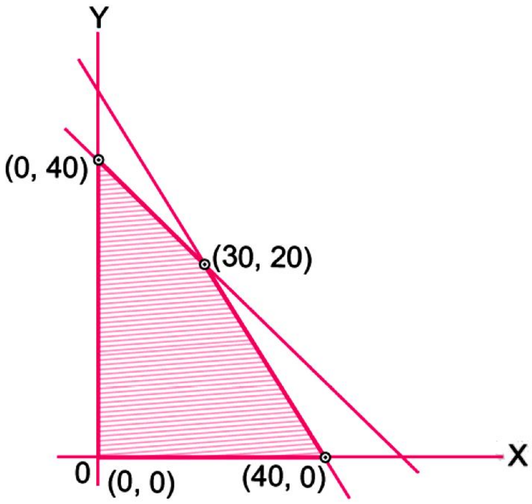
General Instructions:
(i). **All** questions are compulsory.
(ii). This question paper contains 2**0** questions divided into five Sections A, B, C, D and E.
(iii). **Section A** comprises of **10 MCQs** of **1 mark** each. **Section B** comprises of 4 questions of **2 marks** each. **Section C** comprises of 3 questions of **3 marks** each. **Section D** comprises of 1 question of **5 marks** each and **Section E** comprises of 2 Case Study Based Questions of **4 marks** each.
(iv). There is no overall choice.
(v). Use of Calculators is not permitted

SECTION – A

Questions 1 to 10 carry 1 mark each.

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

2. Feasible region (shaded) for a LPP is shown in the given figure.
The maximum value of the Z = 0.4x + y is

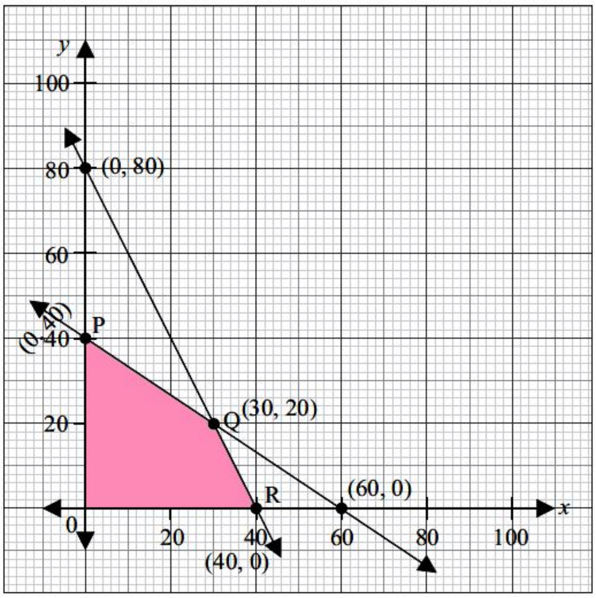


(a) 45 (b) 40 (c) 50 (d) 41

3. A set of values of decision variables that satisfies the linear constraints and non-negativity conditions of an L.P.P. is called its:
(a) Unbounded solution (b) Optimum solution
(c) Feasible solution (d) None of these

4. The corner points of the feasible region determined by the following system of linear inequalities: $2x + y \le 10$, $x + 3y \le 15$, $x, y \ge 0$ are (0,0), (5,0), (3,4), (0,5). Let Z= px + qy, where p,q > 0. Condition on p and q so that the maximum of Z occurs at both (3,4) and (0,5) is
(a) p = q (b) p = 2q (c) p = 3q (d) q = 3p

5. For an L.P.P. the objective function is Z = 4x + 3y, and the feasible region determined by a set of constraints (linear inequations) is shown in the graph.



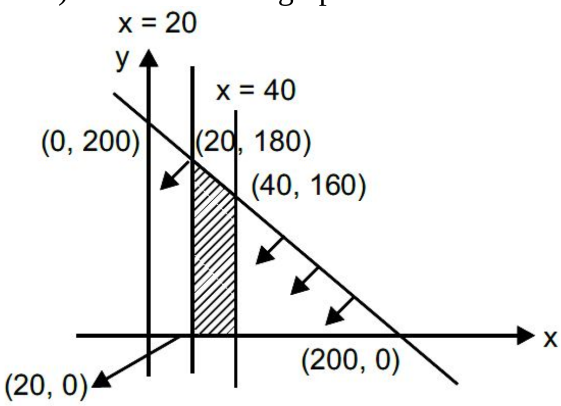
Which one of the following statements is true?

(a) Maximum value of Z is at R.
(b) Maximum value of Z is at Q.
(c) Value of Z at R is less than the value at P.
(d) Value of Z at Q is less than the value at R.

6. Corner points of the feasible region for an LPP are (0, 3), (1,1) and (3,0). Let Z = px + qy, where p, q > 0, be the objective function. The condition on p and q so that the minimum of Z occurs at (3,0) and (1,1) is

(a) p = q (b) $p = \frac{q}{2}$ (c) p = 3q (d) p=q

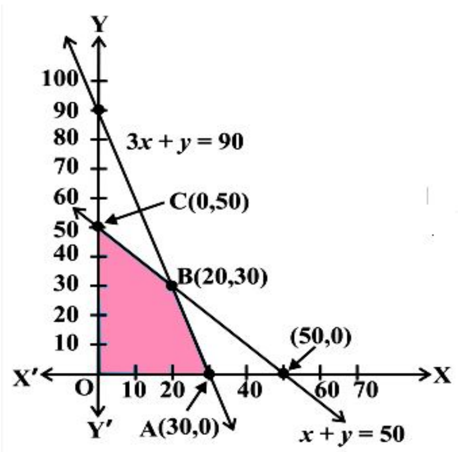
7. For an L.P.P. the objective function is Z = 400x + 300y, and the feasible region determined by a set of constraints (linear inequations) is shown in the graph.



Find the coordinates at which the objective function is maximum.

(a) (20, 0) (b) (40, 0) (c) (40, 160) (d) (20, 180)

8. The corner points of the shaded bounded feasible region of an LPP are (0,0),(30,0),(20,30) and (0,50) as shown in the figure .



The maximum value of the objective function Z = 4x+y is

(a) 120 (b) 130 (c) 140 (d) 150

In the following questions 9 and 10, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both Assertion (A) and Reason (R) are true and Reason(R) is the correct explanation of assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason(R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

9. **Assertion (A):** The maximum value of $Z = 5x + 3y$, satisfying the conditions $x \geq 20$, $y \geq 0$ and $5x + 2y \leq 10$, is 15.

Reason (R): A feasible region may be bounded or unbounded.

10. **Assertion (A):** The maximum value of $Z = x + 3y$. Such that $2x + y \leq 20$, $x + 2y \leq 20$, $x, y \geq 0$ is 30.

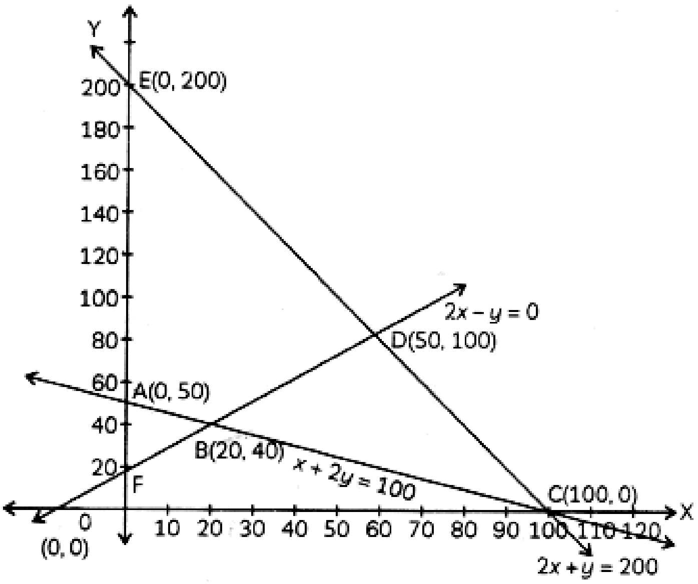
Reason (R): The variables that enter into the problem are called decision variables.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. In a linear programming problem, objective function, $z = x + 2y$. The subjective the constraints $x + 2y \geq 100$, $2x - y \leq 0$, $2x + y \leq 200$, $x \geq 0$, $y \geq 0$

The graph of the following equations is shown below.



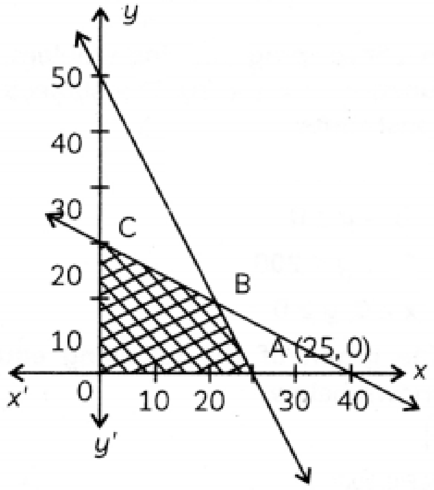
Name the feasible region, and find the corner point at which the objective function is minimum.

12. A manufacturer makes two types of furniture, chairs and tables. Both the products are processed on three machines A_1, A_2 and A_3. Machine A_1 requires 3 hours for a chair and 3 hours for a table, machine A_2 requires 5 hours for a chair and 2 hours for a table and machine A_3 requires 2 hours for a chair and 6 hours for a table. Maximum time available on machine A_1, A_2 and A_3 is 36 hours, 50 hours and 60 hours respectively. Profits are ₹ 20 per chair and ₹30 per table. Formulate the above as a linear programming problem to maximise the profit.

OR

Two tailors A and B earn ₹150 and ₹200 per day respectively. A can stich 6 shirts and 4 pants per day while B can stich 10 shirts and 4 pants per day. Form a linear programming problem to minimise the labour cost to produce at least 60 shirts and 52 pants.

13. The feasible region of a ∠PR is given as follows:



(i) Write the constraints with respect to the above in terms of x and y.
(ii) Find the coordinate of B and C and maximize, z = x + y.

14. Solve the following LPP graphically: Maximise Z = 3x + 4y and
Subject to $x + y \leq 4$, $x \geq 0$ and $y \geq 0$.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Solve the following Linear Programming Problem graphically:
Maximise z = 8x + 9y subject to the constraints: $2x + 3y \leq 6$, $3x - 2y \leq 6$, $y \leq 1$; $x, y \geq 0$

16. Solve the following Linear Programming Problem graphically:
Minimise Z = 13x – 15y subject to the constraints $x + y \leq 7$, $2x - 3y + 6 \geq 0$, $x \geq 0$ and $y \geq 0$.

17. Solve the following Linear Programming Problem graphically:
Maximize Z = 400x + 300y subject to $x + y \leq 200$, $x \leq 40$, $x \geq 20$, $y \geq 0$

SECTION – D

Questions 18 carry 5 marks.

18. Maximise Z = 8x + 9y subject to the constraints given below :
$2x + 3y \leq 6$; $3x - 2y \leq 6$; $y \leq 1$; $x, y \geq 0$

OR

Minimize and maximize Z = 5x + 2y subject to the following constraints:
$x - 2y \leq 2$, $3x + 2y \leq 12$, $-3x + 2y \leq 3$, $x \geq 0$, $y \geq 0$

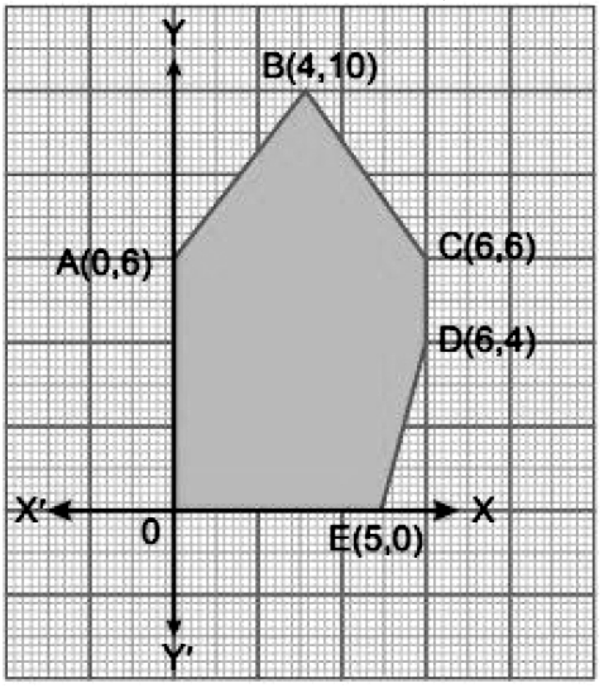
SECTION – E (Case Study Based Questions)

Questions 19 to 20 carry 4 marks each.

19. Case-Study 1: Read the following passage and answer the questions given below.
Linear Programming Problem is a method of or finding the optimal values (maximum or minimum) of quantities subject to the constraints when relationship is expressed as a linear equations or linear inequations.
The corner points of a feasible region determined by the system of linear constraints are as shown below.
(i) Is this feasible region is bounded?
(i) Write the number of corner points in the feasible region.
(iii) (a) If Z = ax + by has maximum value at C (6, 6) and B (4, 10). Find the relationship between a & b.

OR

(iii) (b) If Z = 2x – 5y then find the minimum value of this objective function.



20. Case-Study 2: Read the following passage and answer the questions given below.

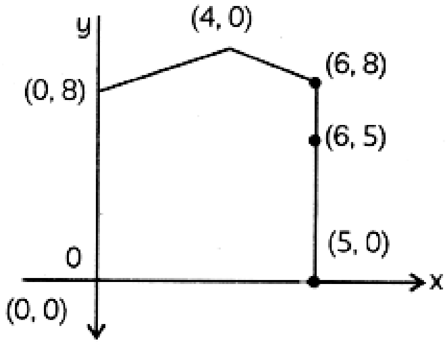
Let R be the feasible region of a linear programming problem and let Z = ax + by be the objective function. When Z has an optimal value (max. or min.), when the variable x and y are subject to constraints described by linear inequalities, this optimal value occurs at the corner point (vertex) of the feasible region.

Based on the above information, answer the following questions:

(i) What is an objective function of LPP? [1]

(ii) In solving an LPP "minimize f = 6x + 10y subject to constraints $x \geq 6$, $y \geq 2$, $2x + y \geq 10$, $x \geq 0$, $y \geq 0$" which among is redundant constraint? [1]

(iii) The feasible region for an LPP is shown in the figure. Let Z = 3x – 4y, be the objective function. Then, at which point minimum of Z occurs? [2]



OR

The feasible region for an LPP is shown shaded in the figure. Let F = 3x – 4y be the objective function. Then, what is the maximum value of F. [2]