QB365 Question Bank Software

12th Maths CBSE Case Study Linear Programming Questions For - 2024

12th Standard

Maths

SECTION-A 2 x 4 = 8

1) Linear programming is a method for finding the optimal values (maximum or minimum) of quantities subject to the constraints when relationship is expressed as linear equations or inequations.

Based on the above information, answer the following questions.

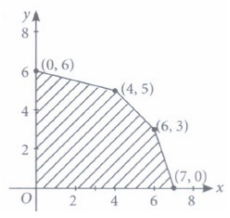
(i) The optimal value of the objective function is attained at the points

(a) on X-axis **(b) on Y-axis** **(c) which are corner points of the feasible region** **(d) none of these**

(ii) The graph of the inequality 3x + 4y < 12 is

(a) half plane that contains the origin **(b) half plane that neither contains the origin nor the points of the line 3x + 4y =12.** **(c) whole XOY-plane excluding the points on line 3x + 4y = 12** **(d) none of these**

(iii) 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) (7,0) **(b) (6,3)** **(c) (0,6)** **(d) (4,5)**

(iv) 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) p = q **(b) p = 2q** **(c) q=2p** **(d) q=3p**

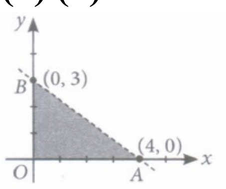
(v) The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 40), (20,40), (60,20), (60, 0). The objective function is Z = 4x + 3y. Compare the quantity in Column A and Column B

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 of the information supplied**

Answer : **(i) (c):** 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.

(ii) (d): 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.



(iii) (d): 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

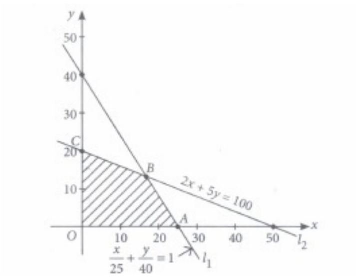
(iv) (d): Value of Z = px + qy at (15, 15) = 15p + 15q and that at (0, 20) = 20 q. According to given condition, we have 15p + 15q = 20q ⇒ 15p = 5q ⇒ q = 3p

(v) (b): Construct the following table of values of the objective function:

Corner Points	**Value of Z = 4x + 3y**
(0,0)	4 × 0 + 3 × 0 = 0
(0,40)	4 x 0 + 3 x 40 = 120
(20,40)	4 x 20 + 3 x 40 = 200
(60,20)	4 x 60 + 3 x 20 = 300 ← Maximum
(60,0)	4 x 60 + 3 x 0 = 240

2) Deepa rides her car at 25 km/hr, She has to spend Rs. 2 per km on diesel and if she rides it at a faster speed of 40 km/hr, the diesel cost increases to Rs. 5 per km. She has Rs. 100 to spend on diesel. Let she travels x kms with speed 25 km/hr and y kms with speed 40 km/hr. The feasible region for the LPP is shown below:

Based on the above information, answer the following questions



Based on the above information, answer the following questions.

(i) What is the point of intersection of line l_1 and l_2,

(a) $\left(\frac{40}{3}, \frac{50}{3}\right)$ (b) $\left(\frac{50}{3}, \frac{40}{3}\right)$ (c) $\left(\frac{-50}{3}, \frac{40}{3}\right)$ (d) $\left(\frac{-50}{3}, \frac{-40}{3}\right)$

(ii) The corner points of the feasible region shown in above graph are

(a) $(0,25), (20,0), \left(\frac{40}{3}, \frac{50}{3}\right)$ (b) $(0,0), (25,0), (0,20)$ (c) $(0,0), \left(\frac{40}{3}, \frac{50}{3}\right), (0,20)$ (d) $(0,0), (25,0), \left(\frac{50}{3}\right.$

(iii) If Z = x + y be the objective function and max Z = 30. The maximum value occurs at point

(a) $\left(\frac{50}{3}, \frac{40}{3}\right)$ **(b) (0, 0)** **(c) (25, 0)** **(d) (0, 20)**

(iv) If Z = 6x - 9y be the objective function, then maximum value of Z is

(a) -20 (b) 150 (c) 180 (d) 20

(v) If Z = 6x + 3y be the objective function, then what is the minimum value of Z?

(a) 120 (b) 130 (c) 0 (d) 150

Answer : **(i) (b):** Let B(x, y) be the point of intersection of the given lines

2x + 5y = 100 ....(i)

and $\frac{x}{25} + \frac{y}{40} = 1 \Rightarrow 8x + 5y = 20$...(ii)

Solving (i) and (ii), we get

$x = \frac{50}{3}, y = \frac{40}{3}$

∴ The point of intersection $B(x, y) = \left(\frac{50}{3}, \frac{40}{3}\right)$

(ii) (d): The corner points of the feasible region shown in the given graph are

$(0,0), A(25,0), B\left(\frac{50}{3}, \frac{40}{3}\right), C(0,20)$

(iii) (a): Here Z = x + y

Corner Points	**Value of Z = x + y**
(0,0)	0