

# 12 LINEAR PROGRAMMING

## MODEL QUESTIONS

### Question :

Consider the linear programming problem.

Maximize  $z = 11x + 7y$

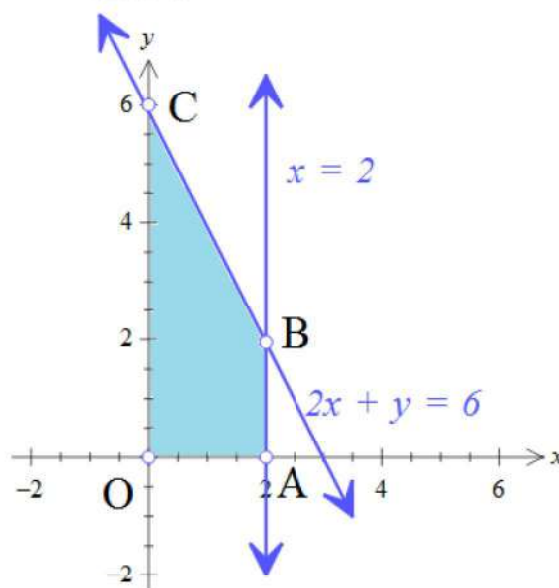
Subject to the constraints

$2x + y \leq 6$  ;  $x \leq 2$  ;  $x, y \geq 0$

- (a) Find the feasible region.
- (b) Find the corner points of the feasible region.
- (b) Determine the maximum value.

### Solution :

These inequalities are plotted as shown in figure.



The corner points of the feasible region are  $O(0,0)$ ,  $A(2,0)$ ,  $(2,2)$ ,  $(0,6)$ .

Corner points	Value of Z
O(0,0)	0
A(2,0)	22
B(2,2)	36
C(0,6)	<b>42 Maximum</b>

Maximum value of Z is = 42 at (0,6)

### Question :

Consider the linear programming problem.

Minimize  $z = 13x - 15y$

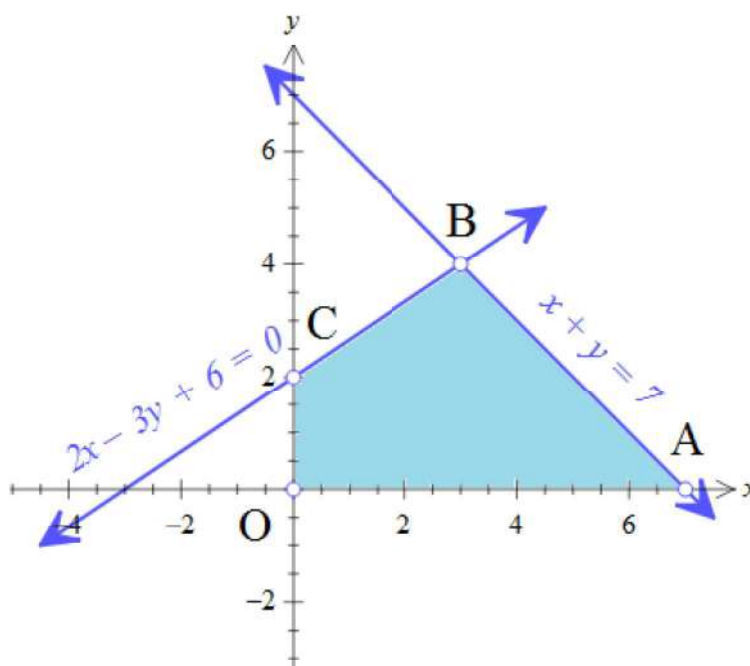
Subject to the constraints

$$x + y \leq 7 ; 2x - 3y + 6 \geq 0 ; x, y \geq 0$$

- Find the feasible region.
- Find the corner points of the feasible region.
- Determine the minimum value.

### Solution :

These inequalities are plotted as shown in figure.



The corner points of the feasible region are O(0,0), A(7,0), (3,4), (0,2).

Corner points	Value of Z
O(0,0)	0
A(7,0)	91
B(3,4)	-21
C(0,2)	<b>-30 Minimum</b>

Minimum value of Z is  $= -30$  at  $(0,6)$

### Question :

A manufacture produce two models bikes X and Y. Model X takes a 6 man hours available per unit, while Model Y takes a 10 man-hours available per unit. There is a total of 450 man-hours available per week. Handling and Marketing costs are 2000/- and 1000/- per unit for Models X and Y respectively. The total funds available for these purpose are 80000/- per week. Profits per unit for model X and Y are 1000/- and 500/- respectively. How many bikes of each model should the manufacturer produce so as to yield a maximum profit? Find the maximum profit.

### Solution :

Let the manufacture produce  $x$  number of Model X and  $y$  number Model Y bikes.

We have 450 man-hour available per week

$$\therefore 6x + 10y \leq 450$$

$$3x + 5y \leq 225$$

Handling and Marketing costs are 2000/- and 1000/- per unit for Models X and Y respectively, total funds available for these purpose are 80000/- per week.

$$\therefore 2000x + 1000y \leq 80000$$

$$2x + y \leq 80$$

Also  $x, y \geq 0$



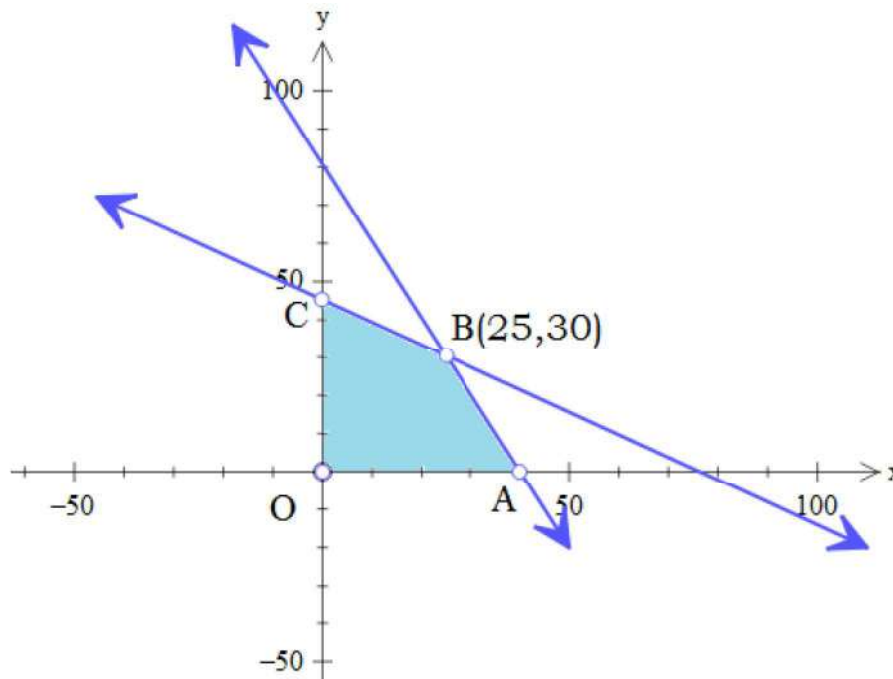
Profits per unit for model X and Y are 1000/- and 500/- respectively.

So, Maximize  $Z = 1000x + 500y$

Subject to

$$3x + 5y \leq 225 ; 2x + y \leq 80 ; x, y \geq 0$$

These inequalities are plotted as shown in figure.



The corner points of the feasible region are  $O(0,0)$ ,  $A(40,0)$ ,  $(25,30)$ ,  $(0,45)$ .

Corner points	Value of $Z$
$O(0,0)$	0
$A(40,0)$	40000 <b>Maximum</b>
$B(25,30)$	40000 <b>Maximum</b>
$C(0,45)$	22500

For Maximum profit manufacture must produce 25 number of model X and 30 number of model Y.

## HOME WORK QUESTIONS

Question : (Imp2017)

Consider the linear programming problem.

Maximize  $z = x + y$

Subject to the constraints

$$x - y \leq -1 ; -2x + y \geq 0 ; x, y \geq 0$$

- (a) Find the feasible region.
- (b) Find the corner points of the feasible region.
- (c) Find the maximum point.

Answer :

- (a) (b) corner points  $(0,1), (1,2)$  (c) No maximum point.

Question : (Imp2017)

Consider the linear programming problem.

Maximize  $z = 50x + 40y$

Subject to the constraints

$$x + 2y \geq 10 ; 3x + 4y \leq 24 ; x \geq 0, y \geq 0$$

- (a) Find the feasible region.
- (b) Find the corner points of the feasible region.
- (c) Find the maximum value of  $Z$ .

Answer :

- (a) Figure (b) corner points  $(0,5), (0,6), (4,3)$  (c) 320

Question : (Imp2016)

Consider the following L.P.P.

Maximize  $z = 3x + 9y$

Subject to the constraints

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

- (a) Draw its feasible region.
- (b) Find the corner points of the feasible region.

Answer :

(a)

(b) corner points  $(0,10), (0,20), (15,15), (5,5)$

Question : (March 2016)

Consider the following L.P.P.

Maximize  $z = 3x + 2y$

Subject to the constraints

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

(a) Draw its feasible region.

(b) Find the corner points of the feasible region.

(c) Find the maximum value of  $Z$ .

Answer :

(a)

(b) corner points  $(0,0), (5,0), (4,3), (0,5)$



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