22. A manufacturer produces two Models of bikes – Model X and Model Y. Model X takes 6 man-hours to make per unit, while Model Y takes 10 man-hours per unit. There is a total of 450 man-hour available per week. Handling and Marketing costs are Rs 2000 and Rs 1000 per unit for Models X and Y respectively. The total funds available for these purposes are Rs 80,000 per week. Profits per unit for Models X and Y are Rs 1000 and Rs 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's take x an y to be the number of models of bike produced by the manufacturer.
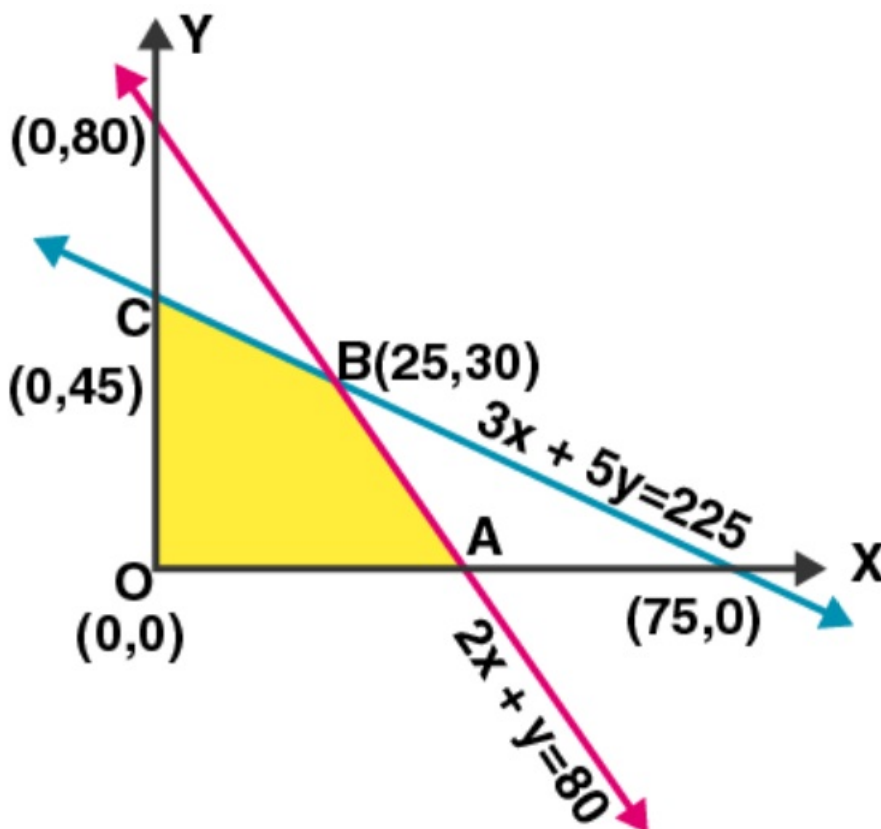
From the question we have,

Model x takes 6 man-hours to make per unit

Model y takes 10 man-hours to make per unit

Total man-hours available = 450

So, $6x + 10y \leq 450 \Rightarrow 3x + 5y \leq 225$ ..... (i)

The handling and marketing cost of model x and y are Rs 2000 and Rs 1000 respectively.

And, the total funds available is Rs 80,000 per week

So, $2000x + 1000y \leq 80000 \Rightarrow 2x + y \leq 80$ ... (ii)

And, $x \geq 0, y \geq 0$

Now, the total profit (Z) per unit of models x and y are Rs 1000 and Rs 500 repectively

⇒ Z = 1000x + 500y

Hence, the required LPP is

Maximize Z = 1000x + 500y subject to the constraints

$3x + 5y \le 225$, $2x + y \le 80$ and $x \ge 0$, $y \ge 0$

Now, let's construct a constrain table for the above:

Table for (i)

x	75	0
y	0	45

Table for (ii)

x	0	40
y	80	0

Next, on solving equation (i) and (ii) we get

x = 25 and y = 30

After plotting all the constraint equations, we observe that the feasible region is OABC, whose corner points are O(0, 0), A(40, 0), B(25, 30) and C(0, 45).

On evaluating the value of Z, we get

Corner points	Value of Z = 1000x + 500y
O(0, 0)	Z = 1000(0) + 500(0) = 0
A(40, 0)	Z = 1000(40) + 500(0) = 40,000
B(25, 30)	Z = 1000(25) + 500(30) = 40,000
C(0, 45)	Z = 1000(0) + 500(45) = 22,500

Therefore, from the above table it's seen that the maximum profit is Rs 40,000.

The maximum profit can be achieved by producing 25 bikes of model x and 30 bikes of model Y or by producing 40 bikes of model x.