

**Non-Linear Programming.** If a monopolist produces  $q$  units, she can charge  $400 - 4q$  dollars per unit. The variable cost is \$60 per unit. How can the monopolist maximize her profit?

### Discussion.

This is an example of a non-linear programming model to maximize profit. The model is non-linear because the objective function is an algebraic equation of degree greater than 1, making the boundary of the feasible region non-linear. The rest of the mathematical model remains similar to that of a linear model. The constraints ensure that the decision variable (units produced) is an integer and that selling price remains positive. The decision is to decide how many units to produce to maximize the profit.

### Model.

#### Parameters:

$400 - 4q$  : Selling Price of  $q$  units

$C$  : Unit cost price

#### Decisions:

$q$  : Number of units to produce

#### Objective: Maximize Profit

$$\max C * q - (400 - 4q) * q = 4q^2 + (C - 400) * q$$

#### Constraints:

$$400 - 4q \geq 0$$

$$q \in \text{Integer}$$

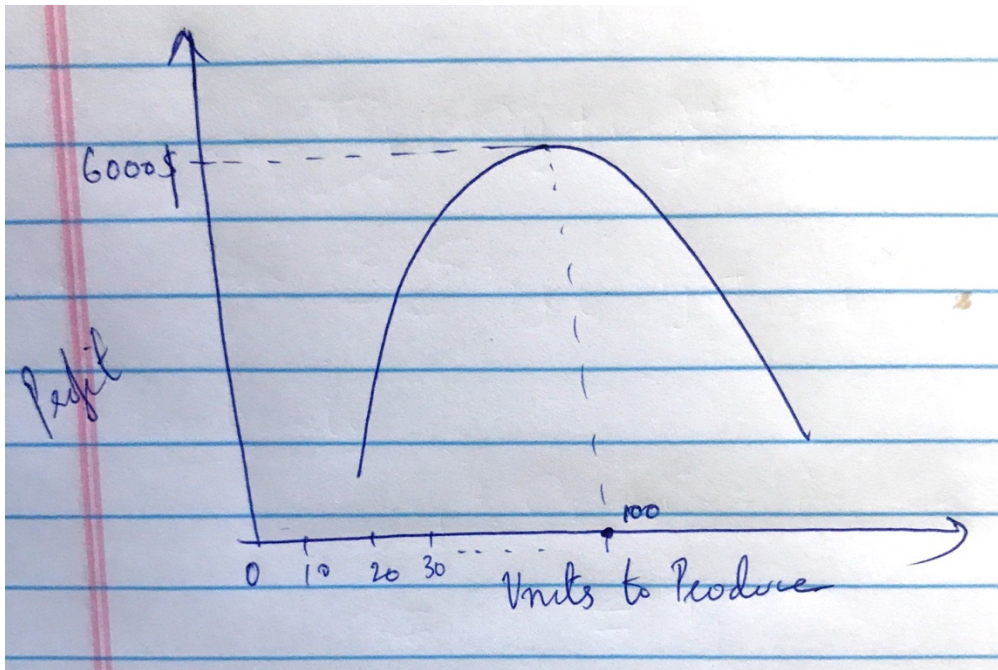
(1) Non – negative selling price

(2) Integer number of units produced

**Optimal Solution.** The following is the solution obtained from Excel Solver.



A maximum profit of 6000\$ can be attained by producing 100 units.



Number of units to produce	100
unit CP	0
CP	0
unit SP	60
SP	6000
Profit	6000