

# ASSIGNMENT-14

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Download all python codes from

<https://github.com/Gayathri1729/SRFP/tree/main/Assignment14>

and latex-tikz codes from

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is the point where the profit function will be maximum. And the maximum profit will be  $p(-2)$

$$p(-2) = 41 - 72(-2) - 18(-2)^2 = 113 \quad (2.0.9)$$

$$\boxed{\text{Maxima} = 113} \quad (2.0.10)$$

$$\boxed{\text{Maxima Point} = -2} \quad (2.0.11)$$

It is clear from the Fig.2.1

## 1 OPTIMIZATION 2.2

Find the maximum profit that a company can make, if the profit function is given by  $p(x) = 41 - 72x - 18x^2$

## 2 SOLUTION

**Lemma 2.1.** A function  $f(x)$  is said to be convex if following inequality is true for  $\lambda \in [0, 1]$  :

$$\lambda f(x_1) + (1 - \lambda)f(x_2) \geq f(\lambda x_1 + (1 - \lambda)x_2) \quad (2.0.1)$$

Given the profit function of the company is

$$p(x) = 41 - 72x - 18x^2 \quad (2.0.2)$$

Checking convexity of  $p(x)$  :

$$\begin{aligned} & \lambda(41 - 72x_1 - 18x_1^2) + (1 - \lambda)(41 - 72x_2 - 18x_2^2) \\ & \geq (41 - 72(\lambda x_1 + (1 - \lambda)x_2) - 18(\lambda x_1 + (1 - \lambda)x_2)^2) \end{aligned} \quad (2.0.3)$$

resulting in

$$18\lambda(\lambda - 1)(x_1 - x_2)^2 \geq 0 \quad (2.0.4)$$

$$\implies \lambda(\lambda - 1) \geq 0 \quad (2.0.5)$$

is not true .

$\implies$  The function is not convex.

Consider the derivative of  $p(x)$ ,

$$\frac{dp(x)}{dx} = -36x - 72 \quad (2.0.6)$$

Critical point is given by

$$\frac{dp(x)}{dx} = 0 \quad (2.0.7)$$

$$\implies x = -2 \quad (2.0.8)$$

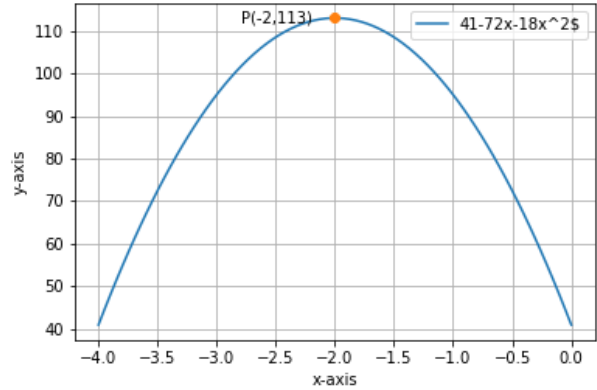


Fig. 2.1:  $p(x) = 41 - 72x - 18x^2$