

# Optimization-Basic Assignment

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**Problem Statement** - Find the maximum and minima of the function of  $x(x-1)^2, 0 \leq x \leq 2$  also determine the area bounded by the curve  $y = x(x-1)^2$  the y axis and the line  $y=2$

## Solution

1. For Maxima :

Using gradient ascent method,

$$x_n = x_{n-1} + \mu \frac{df(x)}{dx} \quad (1)$$

$$\frac{df(x)}{dx} = 3x^2 - 4x + 1 \quad (2)$$

After substituting 7 in 6 we get:

$$x_n = x_{n-1} + \mu(3x^2 - 4x + 1_{n-1}) \quad (3)$$

Taking  $x_0 = 1, \mu = 0.001$  and  $precision = 0.00000001$ , values obtained using python are:

$$\boxed{\text{Minima} = 1} \quad (4)$$

$$\boxed{\text{Minima Point} = 2.483346} \quad (5)$$

For Minima :

Using gradient ascent method,

$$x_n = x_{n-1} - \mu \frac{df(x)}{dx} \quad (6)$$

$$\frac{df(x)}{dx} = 3x^2 - 4x + 1 \quad (7)$$

After substituting 7 in 6 we get:

$$x_n = x_{n-1} + \mu(3x^2 - 4x + 1_{n-1}) \quad (8)$$

Taking  $x_0 = 1, \mu = 0.001$  and  $precision = 0.00000001$ , values obtained using python are:

$$\boxed{\text{Maxima} = 0.3} \quad (9)$$

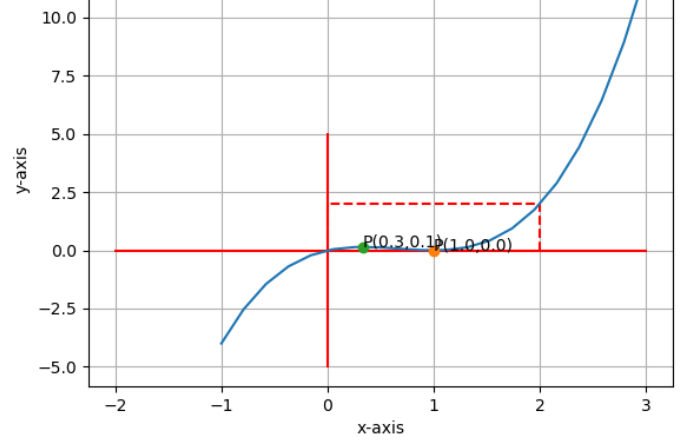
$$\boxed{\text{Maxima Point} = 0.148148148} \quad (10)$$

Area of square OABC

$S = 4$

$$\Rightarrow A_1 = \int_0^2 x(x-1)^2 dx \quad (11)$$

$$\text{Totalarea} = S - A_1 = \frac{10}{3} \text{squnits} \quad (12)$$



Graph of  $f(x) = x^3 - 2x^2 + x$