Optimization Assignment

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Problem Statement **-Find both the maximum value and the minimum value of**

$$f(x) \quad = 3x^4 - 8x^3 + 12x^2 - 48x + 25 = 0 \quad x \in (0, 3)$$

Figure:

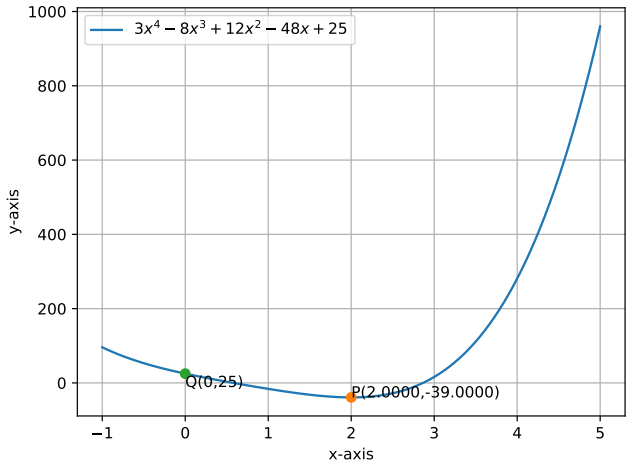

Figure 1: Graph of f(x)

Solution:

Given:

$$f(x) \quad = 3x^4 - 8x^3 + 12x^2 - 48x + 25 = 0 \quad x \in (0, 3)$$

$$\frac{df(x)}{dx} \quad = 12x^3 - 24x^2 + 24x - 48 \tag{1}$$

For minima :
By using Gradient descent method :

$$x_{n+1} \quad = x_n - \alpha \frac{df(x)}{dx} \tag{2}$$

$$x_{n+1} \quad = x_n - \alpha(12x_n^3 - 24x_n^2 + 24x_n - 48) \tag{3}$$

where

1. $\alpha = 0.001$
2. x_{n+1} is current value
3. x_n is previous value
4. precession = 0.00000001
5. maximum iterations = 100000000

The minimum values obtained from the python code

The given function has minimum value at

$$\boxed{\text{Minima} = -39} \tag{4}$$

$$\boxed{\text{Minima Point} = 2} \tag{5}$$

For maxima :
Critical point is given by

$$\frac{df(x)}{dx} = 0 \tag{6}$$

$$\implies x = 2 \tag{7}$$

and,end points are $x = 0$ and $x = 3$ .Using table1

x	f(x)
0	25
2	-39
3	16

Table 1: Value of f(x)

$$\boxed{\text{Maxima} = 25} \tag{8}$$

$$\boxed{\text{Maxima Point} = 0} \tag{9}$$