

# Optimization Assignment - 2

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**Problem Statement** - Find the maximum and minimum values of  $f(x) = (2x-1)^2 + 3$ .

## Solution

### Gradient descent

Let

$$f(x) = (2x - 1)^2 + 3 \quad (1)$$

$$\Rightarrow f(x) = 4x^2 - 4x + 4 \quad (2)$$

$$(2x - 1)^2 \geq 0 \quad (3)$$

$$f(x) \geq 3 \quad (4)$$

$$\boxed{\text{Maxima} = \infty} \quad (5)$$

$f(x)$  consists only minima,

Using gradient ascent method we can find its minima ,

$$x_{n+1} = x_n - \alpha \nabla f(x_n) \quad (6)$$

$$\Rightarrow x_{n+1} = x_n - \alpha (8x_n - 4) \quad (7)$$

Taking  $x_0 = 0.1, \alpha = 0.001$  and precision = 0.00000001, values obtained using python are:

$$\boxed{\text{Minima} = 3.00000} \quad (8)$$

$$\boxed{\text{Minima Point} = 0.50000} \quad (9)$$

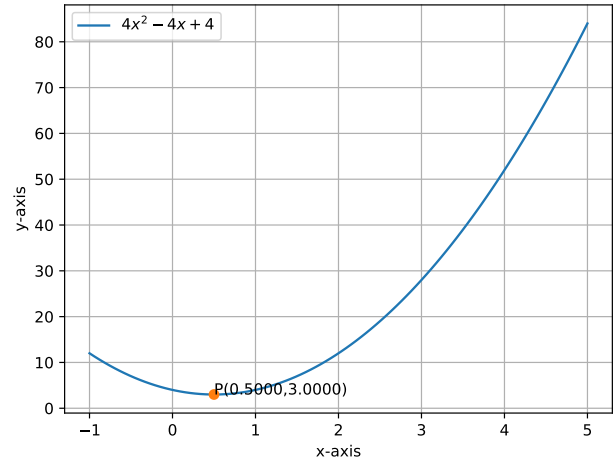


Figure 1: Graph of  $f(x)$  in (2)