

NNDL Assignment-1

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Q) Find the global minimum point and value for the function $f(x) = x^4 + 3x^2 + 10$.

* manual calculations for 2 iterations.

Sol) $f(x) = x^4 + 3x^2 + 10$.

Step-1: initialization of variables

$$x = 1$$

$$\text{epochs} = 2$$

$$\eta = 0.1$$

$$\text{itr} = 1$$

Step-2: 1st order derivative for $f(x)$ at $x=1$.

$$\left(\frac{\partial f}{\partial x}\right)_{\text{at } x=1} = 4x^3 + 6x = 4(1) + 6(1) = \underline{\underline{10}}$$

Step-3: change in x .

$$\Delta x = -\eta \frac{\partial f}{\partial x}$$

$$= -(0.1)(10)$$

$$\Delta x = -1$$

Step-4: Update 'x' value

$$x = x + \Delta x$$

$$x = 1 + (-1)$$

$$\underline{\underline{x = 0}}$$

Step-5: Increment iter value:

$$\text{iter} = \text{iter} + 1$$

$$\Rightarrow \underline{\underline{\text{iter} = 2}}$$

Step-6:

if ($\text{iter} > \text{epochs}$) go to step-7.

else go to step-2.

Here, $\text{iter} = 2$, $\text{epochs} = 2$

if ($2 > 2$) is false

else go to step 2.

Step-2: 1st order derivative for $f(x)$ at $x=0$

$$\left(\frac{\partial f}{\partial x}\right)_{\text{at } x=0} = 4x^3 + 6x = 0 + 0 = \underline{\underline{0}}$$

Step-3: change in x

$$\Delta x = -\eta \frac{\partial f}{\partial x} = -(0.1)(0) = \underline{\underline{0}}$$

Step-4: Update 'x' value

$$x = x + \Delta x = 0 + 0 = \underline{\underline{0}}$$

Step-5: increment iter value:

$$\text{iter} = \text{iter} + 1 \Rightarrow \underline{\underline{\text{iter} = 3}}$$

Step-6:

if ($\overset{\text{iter epochs}}{3 > 2}$) go to step-7

Step-7: print x value : $x=0$

Minimum value of function is at $x=0$.

$$\therefore \text{Minimum value, } f(x) = f(0) = 0 + 0 + 10 = \underline{\underline{10}}$$