# Assigment - I

- 18K41A0562

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

L> Manual calculations for 2 iterations.

Calculations :-

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

step 1:- Variable's Initialization.

$x = 2$

$\eta = 0.01$

epoches = 2

iter = 1 (initial)

step 2:

1st order derivative for $f(x)$ at $x = 2$

$$\left(\frac{df}{dx}\right)_{\substack{at \\ x=2}} = (4x^3 + 6x)_{at\ 2} = 4(2)^3 + 6(2)$$

$$= 44$$

step 3: calculating change in $x$

$$\Delta x = -\eta \frac{df}{dx}$$

$$= -(0.01).(44)$$

$$\boxed{\Delta x = -0.44}$$

step 4:

update the value of $x$.

$$x = x + \Delta x$$
$$= 2 + (-0.44)$$
$$\boxed{x = 1.56}$$

step 5:

Increment the Iter value

iter = iter + 1

i.e, iter = 2 (now)

step 6:

if (iter > epoches)

then go to step 7

else

go to step 2.

- Here, iter = 2 & epoches = 2

if (2 > 2) → false

else → True

So, go to step 2.

step 2:- 1st order derivative for $f(x)$ at $x = 1.56$

$$\left(\frac{df}{dx}\right)_{1.56}^{at} = (4x^3 + 6x)_{x=1.56}^{at} = 24.54$$

step 3:- calculating change in $x$

$$\Delta x = -\eta \frac{df}{dx}$$

$$= -(0.01) \cdot (24.54)$$

$$\boxed{\Delta x = -0.2454}$$

step 4 update the value of $x$

$$x = x + \Delta x$$

$$= 1.56 + (-0.2454)$$

$$\boxed{x = 1.31}$$

step 5: Increment the Iter value

iter = iter + 1

i.e., iter = 3 (now)

step 6: if (iter > epoches) then

go to step 7

else

go to step 2

- Here, iter = 3 & epoches = 2

if (3 > 2) → True

so, go to step 7

step 7

print $x$ value, $x = 1.31$

Minimum value of function $f(x)$ at $x = 1.31$

is $= f(1.31) = 18.1$ (app)

- Here, we taken only 2 iterations, by increasing iterations we can reduce the $x$ value to minimum which is $x = 0$.