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Assignment - 1.

1) Find the global minimum point and value for the function

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

sol:

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

Step-1 : Initialize the variables

$x = 2$

$\eta_0 = 0.01$

epoches = 2

Step-2 : first order derivative of $f(x)$ at $x = 2$

$$\left(\frac{df}{dx}\right)_{x=2} = (4x^3 + 6x)_2$$

$$= 4(2)^3 + 6(2)$$

$$= 44$$

Step-3 : Calculate change in x

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

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

$$\Delta x = -0.44$$

step-4 : Update variable x

$$x = x + \Delta x$$

$$= 2 + (-0.44)$$

$$x = 1.56$$

step-5 : Increment iterations

$itr = itr + 1$

step-6 : If (iteration > epoches) then goto step-7

else goto step-2

here, $itr = 2$ epoches $= 2$

$2 > 2 \rightarrow$ false

goto step-2

step-2 : Calculate first order derivative of $f(x)$ at $x = 1.56$

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

$$= 4(1.56)^3 + 6(1.56)$$

$$= 15.18 + 9.36$$

$$= 24.54$$

step-3 : Calculate the change in x.

$$\Delta x = -\eta \left(\frac{df}{dx}\right)$$

$$= -0.01 (24.54)$$

$$= -0.2454$$

step-4 : Update variable x.

$$x = x + \Delta x$$

$$= 1.56 + (-0.2454)$$

$$x = 1.31$$

Step-5: Increment iterations

itr = itr + 1

Step-6: If (iteration > epoches) then goto step-7

else goto step-2

here, itr = 3, epoches = 2

3 > 2 → True

goto step-7

Step-7: Print variable x

=) x = 1.31

At x = 1.31,

$$f(1.31) = x^4 + 3x^2 + 10$$

$$= (1.31)^4 + 3(1.31)^2 + 10$$

$$= 18.092$$