Assignment - 1 :-

Find the global minimum point and Value for the function

$$f(x) = x^4 + 3x^2 + 10 \quad \text{Do manual calculation for 2 iterations.}$$

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

Step1 : intialize Variable

$$x = 2$$
$$\eta = 0.01$$
$$epochs = 2$$
$$iter = 1$$

Step2.

$$\left.\frac{\partial f}{\partial x}\right|_{x=2} = 4x^3 + 6x = 4(2)^3 + 6(2)$$
$$= 32 + 12 = 44$$

Step3

$$Dx = -\eta \frac{\partial f}{\partial x}$$
$$= -(0.01)(44) = -0.44$$

Step4   Update Variable x

$$x = x + Dx$$
$$= 2 - 0.44 = 1.56$$

$$\boxed{x = 1.56}$$

Step5   Increment iteration

$$iter = iter + 1$$
$$iter = 1 + 1 = 2$$

Step6   if (iter $\geq$ epochs) goto step 7

else
        goto step 2

if (2 > 2)
    false goto step 2

step 2 : first order derivative at x

$$\frac{\partial f}{\partial x}\Big|_{x=1.56} = 4x^3 + 6x = 4(1.56)^3 + 6(1.56)$$

$$= 24.545$$

step 3 : $\Delta x = -\eta \frac{\partial f}{\partial x}$

$$= -(0.01)(24.545) = -0.245$$

step 4 : Update Variable x

$$x = x + \Delta x$$

$$= 1.56 - 0.245$$

$$\boxed{x = 1.315}$$

step 5 : Increment iteration

$$iter = iter + 1$$

$$iter = 2 + 1 = 3$$

step 6 : if (iter $\geq$ epochs) goto step 7

else

goto step 7

$$3 > 2 \quad goto \ step \ 7$$

Step 7 : Print x, f(x) values

$$\boxed{x = 1.315}$$

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

$$= (1.315)^4 + 3(1.315)^2 + 10$$

$$\boxed{f(x) = 13.287}$$