PE - II Assignment - 1 18K41A05H9

step 1: Given

$$y = x^4 + 3x^2 + 10.$$

calculate derivative of y wrt x.

$$\Rightarrow \frac{\partial y}{\partial x} = \frac{\partial}{\partial x}(y) = \frac{\partial}{\partial x}(x^4 + 3x^2 + 10)$$

$$\Rightarrow \frac{\partial y}{\partial x} = 4x^3 + 6x$$

step 2: Initialising x value, number of maximum iterations and learning rate η.

$\Rightarrow x = 1$

$\eta = 0.1$

no-of-iters = 1

max-iters = 2

step 3: Calculate $\frac{\partial y}{\partial x}$ when $x = 1$.

$$\therefore \left.\frac{\partial y}{\partial x}\right|_{x=1} = \left. 4x^3 + 6x\right|_{x=1}$$

$$= 4(1)^3 + 6(1) = 4 + 6 = 10$$

step 4: calculate change in x i.e Δx.

Δx can be calculated using formula,

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

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

$$= -\frac{1}{\cancel{10}} \times \cancel{10} = -1$$

$$\therefore \Delta x = -1$$

Step 5: ~~Subtract~~ add change in x ~~from~~ to x i.e

Perform $x + \Delta x$

$\Rightarrow \quad x + \Delta x = 1 - 1 = 0.$

no.of_iters = no_of_iters + 1.

Step 6: If no_of_iters > max_iters

stop calculations else repeat step 3 with

updated x value i.e $x = 0$.

$\therefore \; 2 > 2 \Rightarrow$ False.

$\therefore$ repeat step 3 with $x = 0$.

Step 7: $\left.\frac{\delta y}{\delta x}\right|_{x=0} = 4x^3 + 6x \big|_{x=0}$

$= 4(0) + 6(0) = 0.$

Step 8: calculate change in x (Δx) when

$x = 0$.

$\therefore \; \Delta x = -\eta \frac{\delta y}{\delta x}$

$= -(0.1)(0)$

$= 0$

Step 9: calculate/update x as ~~subtracting~~ adding Δx

~~from~~ to x

$\Rightarrow \quad x + \Delta x \Rightarrow 0 + 0 = 0$

Step 10: increment no_of iterations.

no_of_iters = no_of_iters + 1.

step 11: If no-of-iters > max-iters,

stop process else repeat step 3.

Here $3 > 2$.

Hence stop the process.

step 12: $\therefore$ slope $= 0$.

Point at which slope $= 0 \Rightarrow y(0)$

$$= x^4 + 3x^2 + 10 \big|_{x=0}$$

$$= 0 + 3(0) + 10$$

$$= 0 + 10$$

Point at slope $\to 0$ $\Rightarrow 10 \Rightarrow$ GLOBAL MINIMUM

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