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

Do manual calculations for two iterations.

$$\frac{df}{dx} = 4x^3 + 6x$$

$$\boxed{f'(x) = 4x^3 + 6x}$$

First iteration

let say $x = 1$

$\eta = \overset{0.1}{\cancel{0.01}}$ (learning rate)

$\frac{df}{dx}$ at $x_1 = 1$

$$\frac{df(1)}{dx} = 4(1)^3 + 6(1)$$

$$f'(1) = 10$$

The new x value will be

$$x = x - \eta f'(1)$$

$$x = 1 - 0.1(10)$$

$$= 1 - 1$$

$$= 0$$

Second iteration

$x = 0$

$$f(0) = 4(0)^3 + 6(0)$$

$$= 0$$

The new value doesnot change

$$x = 0 - 0.1(0)$$

$$x = 0$$

because, it is the global minimum point

The value of $f(x)$ at $x = 0$ is

$$f(0) = (0)^4 + 3(0)^2 + 10$$

$$= 10$$