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

↳ Manual calculations for 2 iterations

Calculations:

$$f(u) = u^2 + y^2 + 10 \quad (given)$$

step1:- variable's Initialization.

$$u = -1$$
$$y = +1$$
$$\eta = 0.1$$
epoches = 2
iter = 1

step2: 1st order derivative for $f(u)$ at $u = -1, y = 1$

$$\left(\frac{df}{du}\right)_{at \; u=-1} = 2x = -2$$

$$\left(\frac{df}{dy}\right)_{at \; y=1} = 2y = 2.$$

step 3: change in u & y

$$\Delta u = -\eta \left(\frac{df}{du}\right) = -2(0.1)$$
$$= 0.2$$

$$\Delta y = -\eta \left(\frac{df}{dy}\right) = -(0.1)(2)$$
$$= -0.2$$

step 4:-

update the value of u, & y

$$u = x + \Delta x$$
$$= -1 + 0.2$$
$$= -0.8$$

$$y = y + \Delta y$$
$$= 1 - 0.2$$
$$= 0.8$$

step 5:-

iter += 1

↳ iter = 2

step 6: if (iter > epoches)

goto step 7

else

goto step 2

step 2''

$$\left(\frac{df}{dx}\right)_{at \atop x = -0.8} = 2x = 2(-0.8) = -1.6$$

$$\left(\frac{df}{dy}\right)_{at \atop y = 0.8} = 2y = 2(0.8) = 1.6$$

step 3'

$$\Delta u = -n \frac{df}{dx}$$
$$= -(0.1)(-1.6) = 0.16$$

$$\Delta y = -n \frac{df}{dy}$$
$$= -(0.1)(1.6) = -0.16$$

step 4:

$x = x + \Delta x = -0.8 + 0.16$

$\Rightarrow -0.64$

$y = y + \Delta y$

$\Rightarrow 0.8 - 0.16 \Rightarrow 0.64$

step 5: iter + = 1

iter = 3

step 6' if (iter > epoches)

goto step 7

else

goto step2

step 7: $x = -0.64$

$y = 0.64$

$f(x, y) = x^2 + y^2 + 10$

$= (-0.64)^2 + (0.64)^2 + 10$

$= 0.4 + 0.4 + 10$

$= 10.8$