3(a)

$f(x, y) = 3x^2 + 5e^{-y} + 10$

let $\eta = 0.01$, $x = 2$, $y = 5$, epochs $= 100$, iter $= 1$

Iteration - 1

$$\frac{\partial f}{\partial x}\Big|_{x=2} = 6x = 12$$

$$\frac{\partial f}{\partial y}\Big|_{y=5} = -5(e)^{-5} = -0.034$$

$$\Delta x = -\eta \frac{\partial f}{\partial x}\Big|_{x=2} = -(0.01)(12)$$
$$= -0.12$$

$$\Delta y = -\eta \frac{\partial f}{\partial y}\Big|_{y=5}$$
$$= -(0.01)(-0.034)$$

$$x = x + \Delta x = 2 - 0.12$$
$$= 1.88$$

$$y = y + \Delta y$$
$$= 5 + 0.00034$$
$$= 5.00034$$

Iteration-2

$$\left.\frac{\partial f}{\partial x}\right|_{x=1.88} = 6(1.88)$$

$$= 11.28$$

$$\left.\frac{\partial f}{\partial y}\right|_{y=5.00034} = -5(e)^{-5.00034}$$

$$= -0.034$$

$$\Delta x = -\eta \left.\frac{\partial f}{\partial x}\right|_{x=2}$$

$$= -(0.01)(11.28)$$

$$= -0.1128$$

$$\Delta y = -\eta \left.\frac{\partial f}{\partial y}\right|_{y=5}$$

$$= -(0.01)(-0.034)$$

$$= 0.00034$$

$$x = x + \Delta x$$

$$= 1.88 - 0.1128$$

$$= 1.76$$

$$y = y + \Delta y$$

$$= 5.00034 + 0.00034$$

$$= 5.00068$$