1) $f(x,y) = \dfrac{x}{x+y}$ $(2,1)$ $\qquad g(x,y) = \sqrt{x+e^{4y}} = (x+e^{4y})^{\frac{1}{2}}$ $(3,0)$

a) $\dfrac{\partial f}{\partial x} = \dfrac{1(x+y) - x(1)}{(x+y)^2} = \dfrac{x+y-x}{(x+y)^2} = \dfrac{y}{(x+y)^2}$ $\qquad \dfrac{\partial f}{\partial y} = \dfrac{0(x+y) - x(1)}{(x+y)^2} = \dfrac{-x}{(x+y)^2}$

$\dfrac{\partial g}{\partial x} = \dfrac{1}{2\sqrt{x+e^{4y}}} \cdot (1+0) = \dfrac{1}{2\sqrt{x+e^{4y}}}$ $\qquad \dfrac{\partial g}{\partial y} = \dfrac{1}{2\sqrt{x+e^{4y}}} \cdot (0+e^{4y} \cdot 4) = \dfrac{2e^{4y}}{\sqrt{x+e^{4y}}}$

b) $z - z_0 = f_x(x_0,y_0)(x-x_0) + f_y(x_0,y_0)(y-y_0)$, sendo $z = f(x,y)$

$z_f = \dfrac{2}{2+1} = \dfrac{2}{3}$ $\qquad f_x(2,1) = \dfrac{1}{(2+1)^2} = \dfrac{1}{3^2} = \dfrac{1}{9}$ $\qquad f_y(2,1) = \dfrac{-2}{(2+1)^2} = \dfrac{-2}{3^2} = \dfrac{-2}{9}$

$z - \dfrac{2}{3} = \dfrac{1}{9} \cdot (x-2) - \dfrac{2}{9} \cdot (y-1) \Rightarrow z = \dfrac{x-2}{9} - \dfrac{2(y-1)}{9} + \dfrac{2}{3} \Rightarrow$

$z = \dfrac{(x-2) - 2(y-1) + 6}{9}$

$z - z_0 = g_x(x_0,y_0)(x-x_0) + g_y(x_0,y_0)(y-y_0)$, sendo $z = g(x,y)$

$z_g = \sqrt{3+e^{4 \cdot 0}} = \sqrt{4} = 2$ $\qquad f_x(3,0) = \dfrac{1}{2\sqrt{3+e^{4 \cdot 0}}} = \dfrac{1}{2\sqrt{4}} = \dfrac{1}{4}$ $\qquad f_y(3,0) = \dfrac{2 \cdot e^{4 \cdot 0}}{\sqrt{3+e^{4 \cdot 0}}} = \dfrac{2 \cdot 1}{\sqrt{4}} = \dfrac{2}{2} = 1$

$z - 2 = \dfrac{1}{4}(x-3) + 1(y-0) \Rightarrow z - 2 = \dfrac{(x-3)}{4} + y \Rightarrow$

$z = \dfrac{x-3}{4} + y + 2$

c) $L(x,y) = f(x_0,y_0) + f_x(x_0,y_0)(x-x_0) + f_y(x_0,y_0)(y-y_0)$, usando os resultados do item "b", temos:

$L_f(x,y) = \dfrac{2}{3} + \dfrac{1}{9}(x-2) - \dfrac{2}{9}(y-1) = \dfrac{(x-2) - 2(y-1) + 6}{9}$

$L_g(x,y) = 2 + \dfrac{1}{4}(x-3) + 1(y-0) = \dfrac{x-3}{4} + y + 2$