13.4 #5

$f(x,y) = \tan^{-1}\left(\frac{x}{y}\right)$; $P(1,1)$

$f(1,1) = \tan^{-1} 1 = \frac{\pi}{4}$

$f_x(x,y) = \frac{1}{1+\frac{x^2}{y^2}} \cdot \frac{1}{y} \Rightarrow f_x(1,1) = \frac{1}{1+1} \cdot \frac{1}{1} = \frac{1}{2}$

$f_y(x,y) = \frac{1}{1+\frac{x^2}{y^2}} \cdot \frac{-x}{y^2} \Rightarrow f_y(1,1) = \frac{1}{1+1} \cdot \frac{-1}{1} = \frac{-1}{2}$

Now at $(1,1)$

$$L(x,y) = f(1,1) + f_x(1,1)(x-1) + f_y(1,1)(y-1)$$

So $L(x,y) = \frac{\pi}{4} + \frac{1}{2}(x-1) - \frac{1}{2}(y-1)$

$$= \frac{\pi}{4} + \frac{1}{2}x - \frac{1}{2} - \frac{1}{2}y + \frac{1}{2}$$

$$= \frac{\pi}{4} + \frac{1}{2}x - \frac{1}{2}y$$