$f(x, y) = \cos(y)e^{2x}$

- $f_x(x, y) = 2\cos(y)e^{2x}$

- $f_y(x, y) = -\sin(y)e^{2x}$

- $f_xx(x, y) = 4\cos(y)e^{2x}$

- $f_xy(x, y) = -2\sin(y)e^{2x}$

- $f_yy(x, y) = -\cos(y)e^{2x}$

- $f(0, 0) = 1$

- $f_x(0, 0) = 2$

- $f_y(0, 0) = 0$

- $f_xx(0, 0) = 4$

- $f_xy(0, 0) = 0$

- $f_yy(0, 0) = -1$

$P_2(x, y) = 1 + 2x + 2x^2 - \frac{y^2}{2} + R_2(x, y)$

$\Rightarrow \cos(y)e^{2x} - (1 + 2x + 2x^2 - \frac{y^2}{2}) \equiv$

$\cancel{1 + 2x + 2x^2 - \frac{y^2}{2}} + R_2(x, y) - \cancel{(1 + 2x + 2x^2 - \frac{y^2}{2})} =$

$R_2(x, y) \Rightarrow$

$\lim_{(x,y)\to(0,0)} \frac{\cos(y)e^{2x} - (1 + 2x + 2x^2 - \frac{y^2}{2})}{x^2 + y^2} = \lim_{(x,y)\to(0,0)} \frac{R_2(x,y)}{x^2 + y^2} = 0$