1. $f(x,y,z)=\sqrt{|xyz|}$ No existen las derivadas parciales en el origen

2. $f(x,y)=\begin{cases} \frac{x^4-y^4}{x^2+y^2} & si\ (x,y)\neq(0,0) \\ 0 & si\ (x,y)=(0,0) \end{cases}$

   $f_x(0,0)=\lim_{x\to}\frac{f(h,0)-f(0,0)}{h}=$

   $\lim_{h\to 0}\frac{\frac{h^4}{h^2}}{h}=$

   $\lim_{h\to 0}\frac{h^{\cancel{4}}}{\cancel{h^3}}=0$

   $f_y(0,0)=\lim_{h\to 0}\frac{f(0,h)-f(0,0)}{h}=$

   $\lim_{h\to 0}\frac{\frac{-h^4}{h^2}}{h}=$

   $\lim_{h\to 0}\frac{-h^{\cancel{4}}}{\cancel{h^3}}=0$

   $\lim_{(x,y)\to(0,0)}\frac{\frac{x^4-y^4}{x^2+y^2}}{\|x^2+y^2\|}\stackrel{?}{=}0$

   $\lim_{(x,y)\to(0,0)}\frac{\frac{x^4-y^4}{\|x^2+y^2\|^2}}{\|x^2+y^2\|}=$

   $\lim_{(x,y)\to(0,0)}\frac{x^4-y^4}{\|x^2+y^2\|^3}$

   $\lim_{(x,y)\to(0,0)}\frac{|x^4-y^4|}{\|x^2+y^2\|^3}\stackrel{DesTrian}{\leq}$

   $\lim_{(x,y)\to(0,0)}\frac{x^4+y^4}{\|x^2+y^2\|^3}\leq$

   $\lim_{(x,y)\to(0,0)}\frac{2\|x^2+y^2\|^{\cancel{4}}}{\cancel{\|x^2+y^2\|^3}}\leq$

   $2\lambda<\epsilon\Rightarrow\lambda\leq\frac{\epsilon}{2}$

   $\Pi: z=0$

3. $f(x,y)=\begin{cases} \frac{x^2}{x^2+y^2}\cdot\sin\left(\frac{1}{\sqrt{x^2+y^2}}\right) & si\ (x,y)\neq(0,0) \\ 0 & si\ (x,y)=(0,0) \end{cases}$

   $f_x(0,0)=\lim_{h\to 0}\frac{f(h,0)-f(0,0)}{h}=$

   $\lim_{h\to 0}\frac{\frac{\cancel{h^2}}{\cancel{h^2}}\cdot\sin\left(\frac{1}{\sqrt{h^2}}\right)}{h}=$

   $\lim_{h\to 0}\frac{\sin\left(\frac{1}{\sqrt{h^2}}\right)}{h}=$

   $\lim_{h\to 0}\frac{\sin\left(\frac{1}{\sqrt{h^2}}\right)}{h}=\nexists$

   $\Rightarrow$ No es diferenciable en el origen