

$$00. \quad f(x, y) = \begin{cases} \frac{\sin(x^3 + y^4)}{x^2 + y^2} & (x, y) \neq (0, 0) \\ 0 & (x, y) = (0, 0) \end{cases}$$

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

$$= \lim_{h \rightarrow 0} \frac{\sin(h^3) - 0}{h^2}$$

$$= \lim_{h \rightarrow 0} \frac{\sin(h^3)}{h^3} = 1$$

$$\frac{\partial f}{\partial y} = \lim_{h \rightarrow 0} \frac{f(0, h) - f(0, 0)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\sin(h^4)}{h^3}$$

$$= \lim_{h \rightarrow 0} h \cdot \frac{\sin(h^4)}{h^4}$$

$$= 0$$