

1. Complete the following definition. (*4 points*)

Let $f(\mathbf{x})$ be defined throughout some deleted neighborhood of \mathbf{x}_0 . Then $\lim_{\mathbf{x} \rightarrow \mathbf{x}_0} f(\mathbf{x}) = L$ if and only if

2. Evaluate the following limits (explain your reasoning). (*5 points each*)

(a) $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 - y^2}{x^2 + y^2}$

(b) $\lim_{(x,y) \rightarrow (0,0)} \frac{\cos x}{x^2 + y^2 + 1}$

3. Let $f(x, y) = 2x^2 - y^2$.

Find the value of the directional derivative of f at the point $(2, 1)$ in the direction of $3\mathbf{i} + 4\mathbf{j}$. (*6 points*)