# Notes for Vector Calculus

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# Chapter 1.

# *Directional and Partial Derivatives*

## §1.1 Basic Definitions

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**Definition 1.1.1.** Let $f : U \to \mathbb{R}^n$, where $U$ is an open set in $\mathbb{R}^m$, and let $x \in U$.

The *ith partial derived function of $f$* is a function $\frac{\partial f}{\partial x_i} : U \to \mathbb{R}^n$

$$\frac{\partial f}{\partial x_i}(x) := \begin{cases} \lim\limits_{\delta \to 0} \dfrac{f(x + \delta \hat{e}_i) - f(x)}{\delta} & \text{if the limit exists in } \mathbb{R}^n, \\ 0 & \text{otherwise.} \end{cases}$$