# Extrema Multivariable function

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## Extrema Multivariable function

### Definition

The extrema of a multivariable function are the maximum and minimum values of the function over a given domain. In other words, they are the points at which the function takes on its highest and lowest values.

In order to find the extrema of a multivariable function, we need to first find the critical points of the function, which are the points at which the partial derivatives of the function are zero or undefined. We can then evaluate the function at each of these critical points to find the maximum and minimum values.

For example, consider the function $f(x, y) = x^2 + y^2$. The partial derivatives of this function are:

$$\frac{\partial f}{\partial x} = 2x$$

$$\frac{\partial f}{\partial y} = 2y$$

The critical points of the function are the points where the partial derivatives are zero, which are the points $(0, 0)$ and $(0, 0)$. Evaluating the function at these points gives us $f(0, 0) = 0$ and $f(0, 0) = 0$, so the maximum and minimum values of the function are $0$.

In general, finding the extrema of a multivariable function can be more complex than in the one-dimensional case, as the function may have multiple critical points and the extrema may not be unique. However, the tools of multivariable calculus can be used to analyze the behavior of the function near these critical points and to determine the maximum and minimum values.

### Links

- Partial Derivative
- Critical Points