

## Critical Points

A point  $P$  is a **critical point** of  $f$  if  $\text{grad } f(P) = O$ . Equivalently, all the partial derivatives  $D_i f$  are 0 at  $P$ .

**Example.** Find the critical points of  $f(x, y) = e^{-(x^2+y^2)}$ . We take partial derivatives and set them to 0 to find the critical points.

As in the single variable case, we can have a variety of behaviors at a critical point; we do not necessarily have a local minimum or local maximum.

Let  $f$  be defined on an open set  $U$ . A point  $P$  is called a **local maximum** of  $f$  if, in some neighborhood  $N$  of  $P$ , we have

$$f(X) \leq f(P)$$

for all  $X \in N$ .