

## Summary: Constrained Optimization

### Theorem

If a function  $f(x, y)$  of two variables is differentiable on a closed bounded region  $R$ , then  $f(x, y)$  attains its absolute maximum (or minimum) on  $R$ . Furthermore, either

- the absolute maximum (or minimum) occurs at a critical point, or
- the absolute maximum (or minimum) occurs on the boundary of  $R$ .

### Mechanics

In order to solve an optimization problem, the first step is to describe the constraint as a closed and bounded region. Next we need to find an equation for the boundary.

In the next lecture, we will apply multivariable calculus techniques to find a more algorithmic procedure to finding maxima along a boundary.

**Warning!** Constrained optimization is really hard! In the examples of this lecture, we were able to reduce to a single variable calculus problem.

### Ask Yourself

**If a function has no critical points, can it have a maximum on a bounded region?**

**Can the maximum (or minimum) of a function happen at a critical point that is outside of the bounded region?**