# Lagrange Multipliers

Lecture 28

February 7, 2007

# Example

## Example

Find the extreme values of $f(x, y) = x^2 + 2y^2$ on the set

$$D = \{(x, y) \ : \ x^2 + y^2 \leq 1\}.$$

# Method of Lagrange Multipliers

## Fact

*To find the maximum and minimum values of $f(x, y, z)$ subject to constraint $g(x, y, z) = k$:*

1. *Find all values of $x, y, z$, and $\lambda$ such that*

$$\nabla f(x, y, z) = \lambda \nabla g(x, y, z)$$

*and*

$$g(x, y, z) = k$$

2. *Evaluate $f$ at all the points $(x, y, z)$ that result from step 1. The largest of these values is the maximum value of $f$; the smallest is the minimum value of $f$.*

# Example (cont'd)

**Example**

- Let's use the Lagrange multiplier method to find the extreme values of $f(x, y) = x^2 + 2y^2$ on the unit circle.
- Find the points on the sphere $x^2 + y^2 + z^2 = 4$ that are closed to and farthest from the point $(3, 1, -1)$.

Thank you and good luck!

The End!