To maximize a minimize, \( f(x, y) \) subject to constraint \( g(x, y) = c \), solve system:

\[
\begin{align*}
\nabla g(x, y) &= 0 \\
\n\Delta g(x, y) &= 0
\end{align*}
\]

(see for \( x, y \)...)
on surface $S$, $\mathbf{g} \cdot \mathbf{n} = c$

Space parametrization $(x,y,z)$ over all $S$.

A sketch of proof in 3-D case:

foot, $A$, after $C$ are solution pts.

not same as finding critical pts. In

Why does Mind work? Note, the is

pfs on constraint (technical assumption).

also assume $\Delta g \neq 0$ zero vector at all

that assume weak (and of min) constraint.

if true, by Divergence theorem $\text{mean } \langle f(x,y,z) \text{div } \mathbf{F} \rangle$

not applies to any # of variables.

\[\text{ }\]
\[ \frac{d}{d\theta} g(p) = \frac{d}{d\theta} \Delta g(p) = \Theta \Delta g(p) \]
Note: \( z \neq 0 \) for \( \text{Max} \) and \( \text{Min} \).

\[
\begin{align*}
\text{Max:} & \quad f(x, y, z) = 6x + 3y + 2z \\
\text{Min:} & \quad g(x, y, z) = 4x^2 + z^2 - 2yz = 62
\end{align*}
\]
\[ x^2 = 2 \times z \times z \]
\[ \therefore x = \sqrt{2} \times z \]

(1, 0)

\[ (2, y) \]
\[ 2x = \sqrt{16} \]
\[ \therefore x = \frac{2}{2} = 1 \]

(0, 3)

\[ x = \frac{y}{x} = z \]

\[ \implies 2 \times x = 2 \times 1 = 2 \]

\[ \begin{align*}
9 & = 6 \Delta x \Delta y \\
\Delta y & = 4 \Delta x
\end{align*} \]

(2015) Past Paper

Max 0 \leq \int (x, y) = (x^2 + \frac{y}{2}) \Delta x \Delta y

\[ \int (3, 3') = 6.3 + 3.3 + 2.2 > 0 \text{; } \therefore \text{ Max } + \text{ An } g = c \]

\[ \int (3', 3'') = 6.3 + 3.3 + 2.2 > 0 \text{; } \therefore \text{ Max } + \text{ An } g = c \]
... whatever aren't we? to get...

What if here, we use continuous...

\[ f(-1, 2, -1) = 2e^2 \]

\[ f(1, 2, 1) = 2e^2 \]

\[ f(x, y, z) = (x + 1, 2, y + 1) \]

\[ \frac{2}{2 \text{ pts.}} \]

\[ x = \frac{1}{2} \]

\[ 0 \leq (2x^2 + 3)(x^2 - 1) = 0 \]

\[ 0 \leq 2x^4 + x^2 - 3 = 0 \]

\[ 0 \leq x^2 + 4x + 6 = 6 \]
Cons: More equations
Pros: Simpler equations

\[ f(x,y) = \frac{1}{\sqrt{x^2 + y^2}} \]

Legend: 
- \( x \leq 0 \)
- \( v \leq x \)
- \( \text{arc (x,y)} \) in circle

Try to measure (mm/meter) this

\[ \int (x^2 + 16 - x^2 - y^2) \, dy \]

\[ \int (x^2 + 16 - x^2 - y^2) \, dy \]
\[ g(x, y) = c \]
\[ h(x, y) = c' \]
\[ g(x, y) \| \| h(x, y) = c'' \]

The system of type $\Sigma$:

\[ \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 1 \]

A family, we maintain, if there are
\[
\frac{\partial}{\partial x} \int f(x,y) \, dx = \frac{\partial f(x,y)}{\partial x}
\]

**Ans:** We can just as you expected.

So why can't we do partial integration?

\[
\frac{\partial}{\partial x}
\]

**Why can't we do partial integration?**

Given a function, have seen how to take double integrals.
\[ (x + e^x)(h_x + ch_x) = \int_2^1 (x + e^x + (x + e^x) \, dx) \, dh \]

\[ \int_2^1 \left( x + e^x + (x + e^x) \, dx \right) \, dh \]

\[ \int_2^1 \left( 2x + e^x \right) \, dx \]

\[ \int_2^1 \left( x + e^x + \frac{x}{x + e^x} \right) \, dx \]

\[ \frac{x}{x + e^x} - (x + e^x) \]

\[ \text{ant. limit of } \int_2^1 \left( x + e^x \right) \, dx \]
\[
\int \left( \frac{x}{h} + \frac{h}{x} - \frac{h^2}{x^2} \right) \, dx = \int \left( \frac{x}{h} + \frac{h}{x} + \frac{h^2}{x^2} \right) \, dx = \ln \left( x + \sqrt{x^2 + h^2} \right) + C
\]
\[
\frac{\sqrt{2}}{\sqrt{1}} - \frac{\sqrt{8}}{\sqrt{4}} = \left( \frac{8}{\sqrt{4}} - \frac{12}{\sqrt{6}} \right) = \\
\int_{1}^{3} h \left( \frac{2}{y^3} - \frac{2}{5y} \right) dy = \\
\int_{1}^{3} h \left( \frac{2}{y^3} - \frac{2}{5y} \right) dy = \\
\int_{h=x}^{h=y} \left( \frac{2}{y^3} - \frac{2}{5y} \right) dy = h \int_{a=0}^{y} \left( \frac{2}{y^3} - \frac{2}{5y} \right) dy
\]