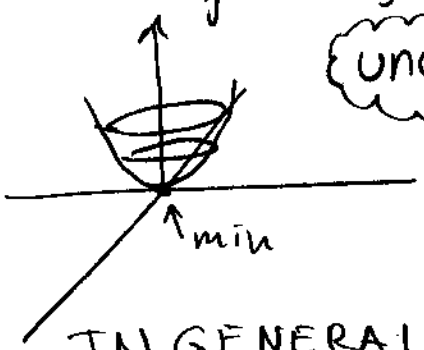
Lagrange's Method

$f(x,y) = x^2 + y^2 \to \min$

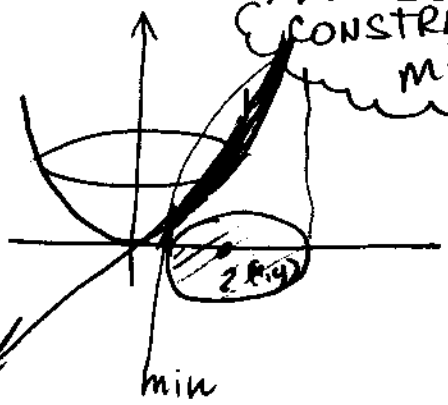
UNCONSTRAINED MIN



$f(x,y) = x^2 + y^2 \to \min$

$x^2 + (y-2)^2 = 1$

CONSTRAINED min



IN GENERAL

$$\begin{cases} f(x,y) \to \min \\ g(x,y) = 0 \end{cases}$$ constraint equation

How to solve a constrained minimization problems?

1) IF you CAN solve $g(x,y) = 0$ for x or $y \Rightarrow$ plug in $f(x,y)$ and reduce the problem to a regular min problem

2) IF you CAN NOT solve $g(x,y) = 0$??!

A: Penalty method: INstead of considering

$$\begin{cases} f(x,y) \to \min \\ g(x,y) = 0 \end{cases}$$

Consider $f(x,y) + g^2(x,y) \to \min$

(use regular means to find the extremums)

B: Lagrange's Method INSTEAD of considering

$$\begin{cases} f(x,y) \to \min \\ g(x,y) = 0 \end{cases}$$

Consider

$$F(x,y,\lambda) = f(x,y) + \lambda \cdot g(x,y) \to \min$$