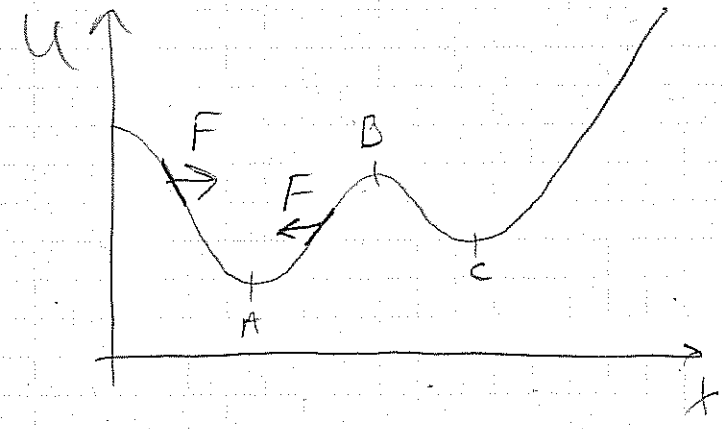
Graph of Potential Energy

1-D System

Example: Spring $U = \frac{1}{2}kx^2$

Grav. $U = -\frac{GM_1M_2}{r}$

Coul. $U = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r}$



$F_x = -\frac{dU}{dx}$ F_x is − slope of $U(x)$ graph.

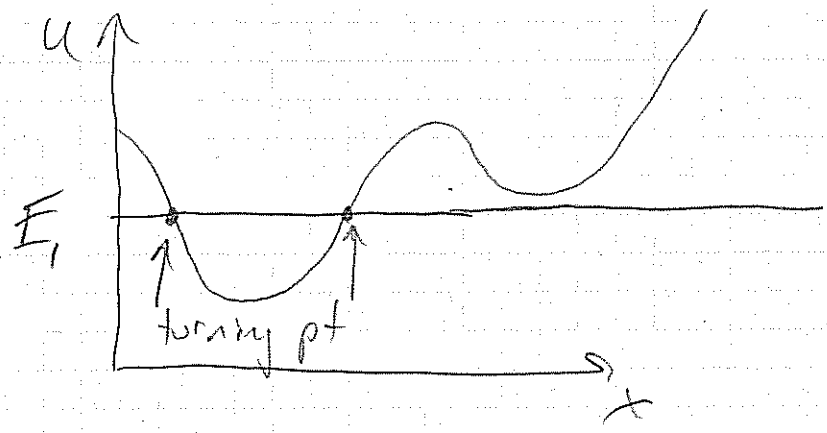
$F_x = 0$ equilibrium

if $\left.\frac{d^2U}{dx^2}\right|_{x_{equil}} > 0$, then x_{equil} is stable.

for a small displacement, F_x is toward equilibrium.

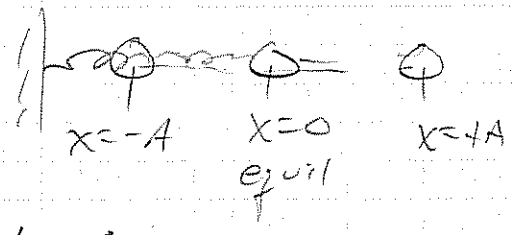
if $\left.\frac{d^2U}{dx^2}\right|_{x_{equil}} < 0$, then x_{equil} is unstable

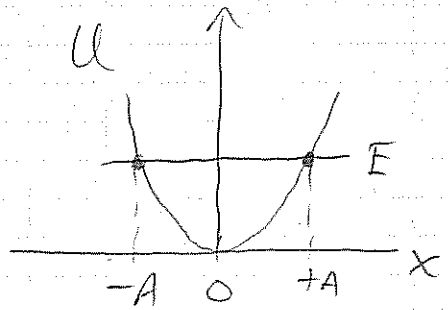
for a small displacement, F_x is away from equilibrium.



Where E and U intersect, K=0. This is a classical turning point. If there are two turning pts, then the particle is trapped between the turning pts. This is a "potential well". and v=0

Example





$U = \frac{1}{2}kx^2$

$E = \frac{1}{2}kA^2$ $\quad K = E - U = \frac{1}{2}kA^2 - \frac{1}{2}kx^2$