$\delta S = 0$ if initial coordinates and time and final coordinates and time are fixed

now let final time, t, not fixed

then $\delta S = -H\,\delta t$ (for variations with constant energy)

$H = E$

$\Rightarrow \delta S_0 = 0$

To use this variational principle we have to express p_i in terms of q_i and dq_i

$$p_i = \frac{\partial}{\partial \dot q_i} L(q, \dot q) \qquad E(q_i, \dot q_i) = E, \quad \dot q_i = \frac{dq_i}{dt}$$

use this to express dt in terms of q_i and dq_i — Maupertuis principle

<u>Example</u> $L = \frac{1}{2} \sum a_{ik} \dot q_i \dot q_k - U$

$$p_i = \frac{\partial L}{\partial \dot q_i} = a_{ik} \dot q_k$$

$$E = H = \frac{1}{2} \sum a_{ik} \dot q_i \dot q_k + U$$

$$\Rightarrow dt = \sqrt{\frac{\sum a_{ik}\, dq_i\, dq_k}{2(E-U)}}$$

$$\Rightarrow \sum p_i\, dq_i = \sum a_{ik} \frac{dq_k}{dt} dq_i = \frac{\sum a_{ik}\, dq_k\, dq_i}{\left(\frac{\sum a_{ik}\, dq_i\, dq_k}{2(E-U)}\right)^{\frac{1}{2}}}$$