

## 10.6: Time Development is a Canonical Transformation Generated by the Action

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The transformation from the variables  $[Math Processing Error]$  has to be canonical, since the system obeys Hamilton's (canonical!) equations at all times.

In fact, the variation of the action along the true path from  $[Math Processing Error]$  with respect to final *and* initial coordinates and times was found earlier to be

$[Math Processing Error]$

and, comparing that expression with the differential form of a canonical transformation corresponding to  $[Math Processing Error]$  in the discussion above, which was

$[Math Processing Error]$

we see that *the action itself is the generating function* for the canonical transformation from the variables  $[Math Processing Error]$  time  $[Math Processing Error]$  actually  $-S$  generates the forward motion in time, the equivalent variables in the two equations above being

$[Math Processing Error]$

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