

10.4: Generating Functions in Different Variables

This *[Math Processing Error]* is only one example of a generating function—in discussing Liouville's theorem later, we'll find it convenient to have a generating function expressed in the q 's and P 's. We get that generating function, often labeled *[Math Processing Error]* by a *Legendre transformation*:

[Math Processing Error]

Then, for this new generating function

[Math Processing Error]

Evidently, we can similarly use the Legendre transform to find generating functions depending on the other possible mixes of old and new variables: p, Q , and p, P .

What's the Point of These Canonical Transformations?

It will become evident with a few examples: it is often possible to transform to a set of variables where the equations of motion are a lot simpler, and, for some variables, trivial. The canonical approach also gives a neat proof of Liouville's theorem, which we'll look at shortly.

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