3.19   The transformation of thermodynamic potentials

Why not just replace a coordinate by its adjacent force?
We will have a closer look at a 1D example of a function $y(x)$.
Let

$$z := dy/dx \qquad (3.34)$$

and

$$x = x(z) \qquad . \qquad (3.35)$$

We find

$$y = y(x(z)) = f(z) \qquad , \qquad (3.36)$$

consequently

$$y = f(dy/dx) \qquad , \qquad (3.37)$$

respectively

$$dy/dx = f^{-1}(y) \qquad . \qquad (3.38)$$

This differential equation has the solution $y(x)$; but there exist more solutions

$$y = y(x + const.) \qquad . \qquad (3.39)$$

Simply substituting a coordinate x by the adjacent force z leads to a **loss of information**, since the original function is known only up to a constant. For a function with several parameters this is even more critical since the "constant" may by a function of all the remaining parameters.