$$S = S^0 + \varepsilon f(q, P) \qquad S^0 = qP$$

$$Q = \frac{\partial S}{\partial P} = q + \varepsilon \frac{\partial f}{\partial P} = q + \varepsilon \frac{\partial f}{\partial p}$$

$$p = \frac{\partial S}{\partial q} = P + \varepsilon \frac{\partial f}{\partial q}$$

$$P = p - \varepsilon \frac{\partial f}{\partial q}$$

$$\varepsilon \frac{\partial f}{\partial P} = \varepsilon \frac{\partial}{\partial P} f\left[q, P = p - \varepsilon \frac{\partial f}{\partial q}\right]$$

$$= \varepsilon \frac{\partial f}{\partial p} + O(\varepsilon^2)$$

$$f(q, P) = f\left(q, P = p - \varepsilon \frac{\partial f}{\partial q}\right) =$$

$$= f\left(q, p - \varepsilon \frac{\partial f}{\partial q}\right) = f(q, p) - \varepsilon \frac{\partial f}{\partial p} \cdot \frac{\partial f}{\partial q}$$

NC $\quad l(x-a) = l(x) - l' \cdot a$, $\quad l' = \frac{\partial l}{\partial x}$

$$G(p, q)$$

$$q = Q - \varepsilon \frac{\partial f}{\partial p}$$

$$p = P + \varepsilon \frac{\partial f}{\partial q}$$

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$$G(p, q) = G\left(P + \varepsilon \frac{\partial f}{\partial q}, Q - \varepsilon \frac{\partial f}{\partial p}\right) =$$

$$= G(P, Q) + \frac{\partial G}{\partial P} \cdot \varepsilon \frac{\partial f}{\partial q} - \frac{\partial G}{\partial Q} \varepsilon \frac{\partial f}{\partial p} =$$

$$= G(P, Q) + \left(\frac{\partial G}{\partial p} \frac{\partial f}{\partial q} - \frac{\partial G}{\partial q} \frac{\partial f}{\partial p}\right) \varepsilon$$

$$G(P, Q) = G(p, q) + \varepsilon [f, G]$$