$\frac{1}{2}\ q^3 \cdot p = -1$

$$\boxed{P = -\frac{p q^3}{2}}$$

Ejemplo propuesto

$H = \frac{p^2}{2} + \frac{q^2}{2}$ T.C. $\rightarrow$ $K = P$

Q ¿?

$H \neq H(t)$ y $K \neq K(t) \rightarrow K - H = 0$, $K = H$

$\dot{q} = p$ $\quad$ $\dot{Q} = P$ $\quad$ $Q(q,p)$, $\dot{Q} = \frac{\partial Q}{\partial q}\dot{q} + \frac{\partial Q}{\partial p}\dot{p}$

$\dot{p} = -q$ $\quad$ $\dot{P} = 0$ $\quad$ $P(q,p)$, $\dot{P} = \frac{\partial P}{\partial q}\dot{q} + \frac{\partial P}{\partial p}\dot{p}$

$\frac{p^2}{2} + \frac{q^2}{2} = P$, $\quad p = \sqrt{2P - q^2}$

$\left.\begin{array}{l} \frac{\partial F_2}{\partial q} = \overset{p}{\text{algo } 1} \\ \frac{\partial F}{\partial P} = Q \end{array}\right\}$

$\frac{\partial F_2}{\partial q} = p$, $\frac{\partial F_2}{\partial q} = \sqrt{2P - q^2}$

$F_2(q\,P,t) = \int \sqrt{2P - q^2}\, dq$

$\frac{\partial F_2}{\partial P} = \int \frac{1}{\cancel{2}}\left(2P - q^2\right)^{-1/2} \cancel{2}\, dq = Q$

$Q = \int \frac{1\, dq}{\sqrt{2P - q^2}} = \text{arcsen}\ \frac{q}{\sqrt{2P}}$

$Q = \text{arcsen}\ \frac{q}{\sqrt{p^2 + q^2}}$