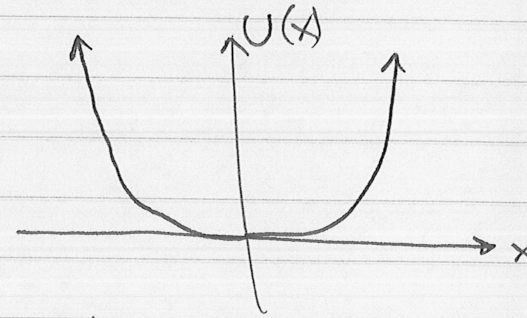
13.26 Mass m on x-axis with $F_x = -kx^3$, $k>0$.

Note that $F_x = -\frac{dU}{dx}$ with $U(x) = \frac{k}{4}x^4$.



$$T = \frac{1}{2}m\dot{x}^2$$

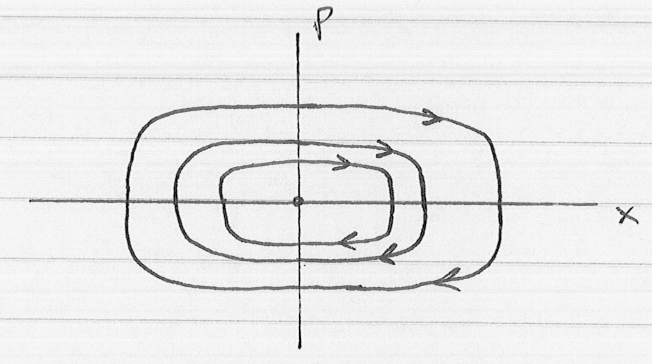
$$U = \frac{k}{4}x^4$$

$$\rightarrow H = T + U \quad \text{(coords. are "natural")}$$

$$= \frac{1}{2}m\dot{x}^2 + \frac{1}{4}kx^4$$

$$= \frac{p^2}{2m} + \frac{1}{4}kx^4 \qquad \left(p = m\dot{x} = \frac{\partial L}{\partial \dot{x}}\right)$$

Since $H(x,p)$ is not explicitly time-dependent, $H = \text{const.}$ for any motion.



Phase space orbits are roughly elliptical (but flatter at sides and top)... motion is periodic, corresponding to oscillation about equilibrium at $x=0$.