[mex6] Periodic motion in 2D phase space

Let $S(E)$ be the area enclosed by the trajectory corresponding to a periodic motion with energy E in 2D phase space $(x, \dot{x})$.
(a) Show that the period of the motion along this trajectory is

$$T = m\frac{dS}{dE}.$$

(b) Use this relation to calculate the period T of a particle with mass m moving in the quadratic potential $V_2(x) = \frac{1}{2}m\omega_0^2 x^2$ and for a particle of mass m moving in the linear potential $V_1(x) = a|x|$.

Solution: