Consider the Lagrangian $L = \frac{1}{2} m \left( \dot{x}^2 + \dot{y}^2 + \dot{z}^2 \right) - V(y,z)$ of a particle with mass $m$ moving in 3D space under the influence of a scalar potential.

(a) Identify an infinitesimal symmetry transformation.

(b) Apply Noether’s theorem to determine the associated constant of the motion.

Solution: