

PROBLEM 1.

"Find the ratio of the times in the same path for particles having different masses"

We have the same path and potential but different mass. The kinetic energy scales as $T \sim \frac{m l^2}{t^2}$ relative to the potential. We impose

$$\mathcal{L}' = \lambda \mathcal{L} \Rightarrow T' - U = \lambda(T - U) \text{ forces}$$

$$T' = T \text{ hence } \frac{m' l^2}{t'^2} = \frac{m l^2}{t^2} \Rightarrow \frac{t'}{t} = \sqrt{\frac{m'}{m}}$$

What is the point, you may ask? The point is to predict how motion changes without solving the EOM.