

Correction:

See Class notes on "Examples on Lagrange's equations". In obtaining the Lagrange's equations we have calculated the Kinetic energy in terms of generalized coordinates.

$$T = \dot{x}^2 + \dot{y}^2, \quad x = l \sin \theta, \quad y = l - l \cos \theta$$

Here  $\dot{x} = l \cos \theta \dot{\theta}$  and  $\dot{y} = l \sin \theta \dot{\theta}$

$$\begin{aligned} \dot{x}^2 + \dot{y}^2 &= (l \cos \theta \dot{\theta})^2 + (l \sin \theta \dot{\theta})^2 \\ &= l^2 \dot{\theta}^2 (\cos^2 \theta + \sin^2 \theta) = l^2 \dot{\theta}^2 \end{aligned}$$

$$\underline{\dot{x}^2 + \dot{y}^2 = l^2 \dot{\theta}^2}$$

In earlier note we do not need any approximation. This is exact.