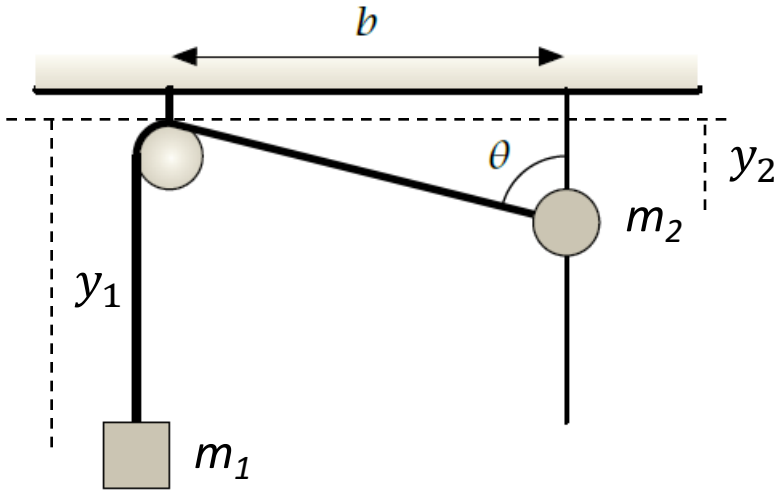

l = length of the rope

$$\frac{b}{l + y_1} = \sin\theta \Rightarrow y_1 = \frac{b}{\sin\theta} - l$$

$$\frac{b}{y_2} = -\tan\theta \Rightarrow y_2 = -b\frac{\cos\theta}{\sin\theta}$$

$$F_1 = m_1 g \quad F_2 = m_2 g$$

Generalized force $Q_\theta = F_1 \frac{\partial y_1}{\partial \theta} + F_2 \frac{\partial y_2}{\partial \theta}$

Virtual work $\delta W = Q_\theta \delta\theta = \underbrace{\left(F_1 \frac{\partial y_1}{\partial \theta} + F_2 \frac{\partial y_2}{\partial \theta}\right)}_{0 \text{ b/c } \delta\theta \neq 0} \delta\theta = 0$ In equilibrium

$$\frac{\partial y_1}{\partial \theta} = \frac{-b\cos\theta}{\sin^2\theta} \qquad \frac{\partial y_2}{\partial \theta} = \frac{b}{\sin^2\theta}$$

$$\frac{m_1 g b \cos\theta}{\sin^2\theta} = \frac{m_2 g b}{\sin^2\theta} \Leftrightarrow \theta = \cos^{-1}\frac{m_2}{m_1}$$

$m_2 > m_1$: no equilibrium, m_2 keeps sliding down, never stops

$m_2 = m_1$: m_2 keeps sliding down until $\theta = 0$

$m_2 < m_1$: equilibrium for $\frac{\pi}{2} > \theta > 0$