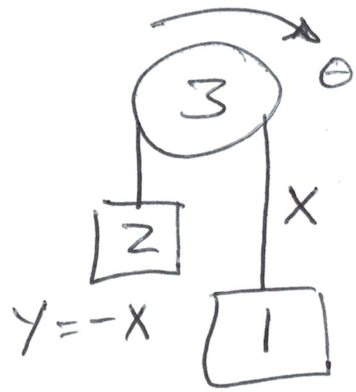
#1 13.31 $X = -Y$ $\theta = \frac{X}{r}$



$I_3 = \frac{1}{2} m_3 r^2$ $\omega = \dot{\theta} = \frac{\dot{X}}{r}$

$$T = \frac{1}{2} m_1 \dot{X}^2 + \frac{1}{2} m_2 \dot{X}^2 + \frac{1}{4} m_3 \dot{X}^2$$

$$T = \frac{\dot{X}^2}{2} \left[m_1 + m_2 + \frac{m_3}{2} \right] \equiv \frac{\dot{X}^2}{2} \underline{M}$$

effective Mass

$$V = -(m_1 - m_2) g X$$

$$H = T + V \qquad L = T - V$$

$$P = \frac{\partial L}{\partial \dot{X}} = \dot{X} \left[m_1 + m_2 + \frac{m_3}{2} \right] = \dot{X} \underline{M}$$

$$\therefore \quad T = \frac{P^2}{2 \underline{M}} \qquad V = -(m_1 - m_2) g X$$

$$H[X, P] = T + V$$

$$\dot{X} = \frac{\partial H}{\partial P} = \frac{P}{\underline{M}} \qquad \dot{P} = -\frac{\partial H}{\partial X} = +(m_1 - m_2) g$$

$$\ddot{X} = \frac{\dot{P}}{\underline{M}} = \frac{(m_1 - m_2) g}{\underline{M}}$$

$$\hookrightarrow \underline{M} = \left(m_1 + m_2 + \frac{m_3}{2} \right)$$

#2 13.41

$$T = \frac{\dot{x}^2}{2}\left[m_1 + m_2 + \frac{m_3}{2}\right] = \frac{\dot{x}^2}{2}\underline{M}$$

$$V = -(m_1 - m_2)\, g x$$

$$L = T - V \qquad p = \frac{\partial L}{\partial \dot{x}} = \dot{x}\,\underline{M}$$

$$p\dot{q} = p\dot{x} = \dot{x}^2\,\underline{M} \equiv \frac{p^2}{\underline{M}}$$

$$L = T - V = \frac{x^2\,\underline{M}}{2} - (m_1 - m_2)\, g x$$

$$L = \frac{p^2}{2\underline{M}} - V$$

$$H = p\dot{q} - L = \frac{p^2}{\underline{M}} - \frac{p^2}{2\underline{M}} + V$$

$$= \frac{p^2}{2\underline{M}} + V \equiv T + V$$

Q.E.D.