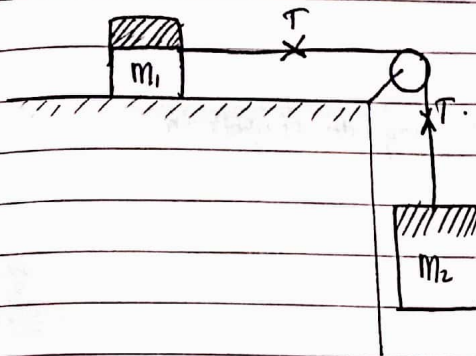


Sistem Sederhana. Penyelesaian dengan Newtonian dan Lagrangian

→ Newtonian.



Bidang licin. dan massa katrol diabaikan.

Tinjau benda 1.

$$\sum F = m \cdot a$$

$$T_1 = m_1 \cdot a$$

Tinjau Benda 2.

$$\sum F = m \cdot a$$

$$W_2 - T_2 = m_2 \cdot a$$

$$T_2 = W_2 - m_2 \cdot a$$

Nilai dari gaya tegang tali adalah sama, sehingga.

$$T_1 = T_2$$

$$m_1 \cdot a = W_2 - m_2 \cdot a$$

$$m_1 \cdot a + m_2 \cdot a = W_2$$

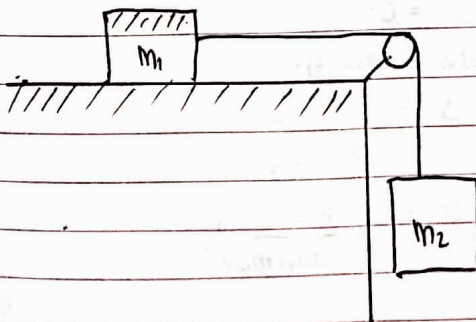
$$a(m_1 + m_2) = W_2$$

$$a = \frac{W_2}{m_1 + m_2}$$

$$m_1 + m_2$$

$$a = \frac{m_2 \cdot g}{m_1 + m_2}$$

→ Lagrangian.



Panjang tali katrol = l .

Energi Kinetik. Sistem

$$T = \frac{1}{2} m_1 \dot{x}^2 + \frac{1}{2} m_2 \dot{y}^2$$

Energi Potensial Sistem

$$V = m_2 g y_2$$

$$\dot{x} = \frac{dx}{dt}$$

$$x_1 = s$$

$$y_2 = -(l - s).$$

kecepatan sistem adalah sama sehingga $\dot{x}_1 = \dot{y}_2$ yang kita simbolkan sebagai $\dot{s}$.

Sehingga

$$\begin{aligned} \text{Energi Kinetik. } T &= \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 \\ &= \frac{1}{2} (m_1 + m_2) \dot{s}^2. \end{aligned}$$

$$\text{Energi Potensial } V = m_2 g (s - l).$$

Persamaan Lagrangian:

$$\begin{aligned} L &= T - V \\ &= \frac{1}{2} (m_1 + m_2) \dot{s}^2 - m_2 g (s - l). \end{aligned}$$

$$\frac{\partial L}{\partial s} - \frac{d}{dt} \frac{\partial L}{\partial \dot{s}} = 0.$$

$$\Rightarrow \frac{\partial L}{\partial s} = -m_2 g.$$

$$\Rightarrow \frac{\partial L}{\partial \dot{s}} = (m_1 + m_2) \dot{s}$$

$$\Rightarrow \frac{d}{dt} \frac{\partial L}{\partial \dot{s}} = (m_1 + m_2) \ddot{s}$$

$$\text{Sehingga } \frac{\partial L}{\partial s} - \frac{d}{dt} \frac{\partial L}{\partial \dot{s}} = 0 \Rightarrow -m_2 g - (m_1 + m_2) \ddot{s} = 0.$$

$$\ddot{s} = -\frac{m_2 \cdot g}{m_1 + m_2}$$

$$\ddot{s} = -\left(\frac{m_2 \cdot g}{m_1 + m_2}\right).$$