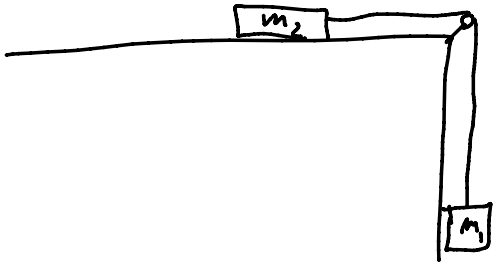
5.2

Saturday, November 5, 2022 7:42 PM



$$a m = g m_1$$

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

$$m_1 = m + \lambda y$$
$$m_2 = (L - y)\lambda$$
$$\Rightarrow a = \frac{g(m + \lambda y)}{m + \lambda y + L\lambda - \lambda y}$$

$$\Rightarrow \ddot{y} = g \frac{m + \lambda y}{m + L\lambda} \quad j$$

$$(m + L\lambda)\ddot{y} - g\lambda y = gm$$

RORJ

$$y = e^{at} \Rightarrow a^2(m + L\lambda) - g\lambda = 0$$

$$\Rightarrow a = \pm\sqrt{\frac{g\lambda}{m + L\lambda}} = \pm\sqrt{\frac{gM}{(m+M)L}}$$

$$= y_{RORJ} = C_1 e^{\sqrt{\frac{gM}{(m+M)L}}} + C_2 e^{\sqrt{\frac{gM}{(m+M)L}}}$$

RS RN:

$$(m+2\lambda)\ddot{y} - g\lambda y = gm$$

$$y = C_3 \Rightarrow -g\frac{M}{L}\cdot C_3 = gm$$

$$\Rightarrow C_3 = -L\frac{m}{M}$$

$\Rightarrow$ RORN:

$$y(t) = -L\frac{m}{M} + C_1 e^{\alpha t} + C_2 e^{-\alpha t}$$

$$y(t) = L\frac{m}{M}\left(\frac{C_1}{-L\frac{m}{M}} e^{\alpha t} + \frac{C_2}{-L\frac{m}{M}} e^{-\alpha t} - 1\right)$$

$$y(t) = L\frac{m}{M}\left(A_1 e^{\sqrt{\frac{gM}{(m+M)L}}\,t} + A_2 e^{-\sqrt{\frac{gM}{(m+M)L}}\,t} - 1\right)$$

$$y(t=0)=0 \Rightarrow A_1 + A_2 = 0 \Rightarrow A_1 = -A_2$$

$$\Rightarrow y(t) = L\frac{m}{M}\cdot\left(2A_1\cdot\frac{e^{\sqrt{\frac{gM}{(m+M)L}}\,t} - e^{-\sqrt{\frac{gM}{(m+M)L}}\,t}}{2} - 1\right)$$

$$y(t) = L\frac{m}{M}\left(B\cdot\cosh\left(\sqrt{\frac{gM}{(m+M)L}}\,t\right) - 1\right)$$

$t=0 \Rightarrow y=0$

$$\Rightarrow B\cosh(\cdots) = 1$$

$$\Rightarrow B = 1$$

$$\rightarrow y(t) = L\frac{m}{M}\left(\cosh\left(\sqrt{\frac{gM}{(m+M)L}}\,t\right) - 1\right)$$

$$\Rightarrow \quad y(t) = L\frac{m}{M}\left(\cosh\left(\sqrt{\frac{g/M}{(m+M)L}}\,t\right) - 1\right)$$