1, a) $+\downarrow$ 

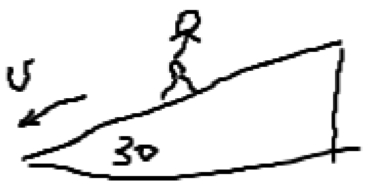
$\downarrow mg$

change to a coord. system accelerating with bucket

$\downarrow a = g$

$aM = mg$

$$ma' = mg - ma = mg - mg = 0$$

b) 

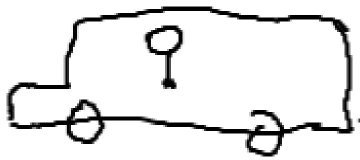
$F_\parallel = mg \sin 30°$

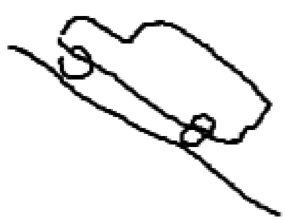
$$\text{Power} = \frac{\text{Work}}{\Delta t} = \frac{F_\parallel \, \Delta r_\parallel}{\Delta t} = \overset{50kg}{m}\underset{9.8}{g} \overset{1/2}{\sin 30°} \cdot \overbrace{10 cm/se}^{0.1 m/sec}$$

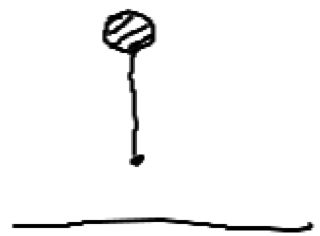
$$= 50 \times \frac{1}{2} \times 9.8 \times 0.1 \qquad \underbrace{\overbrace{kg \frac{m^2}{sec^2}}^{joules} \frac{1}{sec}}_{watts}$$

≈ 25 Watt

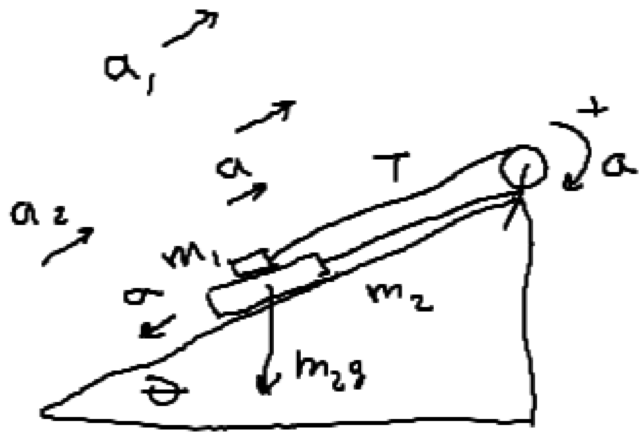
c) ~~www~~ $\overset{v}{\leftarrow}$ $\overset{a}{\rightarrow}$

d) 





$\downarrow mg$



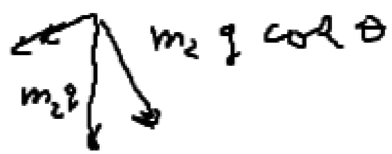
$m_2 >> m_1$

$$m_1 a = T - m_1 g \sin\theta - \mu m_1 g \cos\theta$$

a, T

$$m_2 a = -T + m_2 g \sin\theta - \mu m_1 g \cos\theta$$

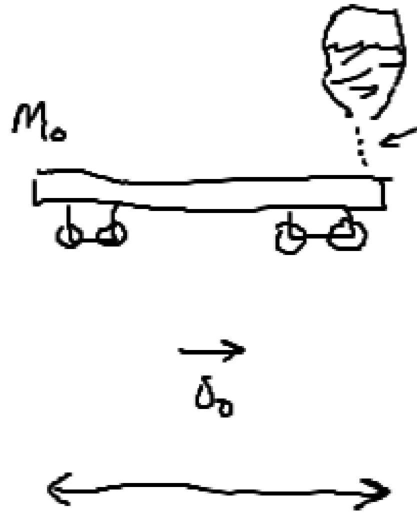
?



$$a_1 = -a_1$$

$$-\mu(\underline{m_1} + m_2) g \cos\theta$$

$$\cancel{(m_1+m_2)}\, a = \frac{(m_2 - m_1) g \sin\theta - \mu(3m_1 + m_2) g \cos\theta}{m_1 + m_2}$$



λ rate mass/time

(a) $M(t) = M_0 + \lambda t$

(b)
Horizontal momentum $= P(t) = v(t)\, M(t) = \text{const}^t \quad \frac{dP}{dt} = F_{horz} = 0$

$$M_0 v_0$$

$$v(t) = \frac{M_0 v_0}{M_0 + \lambda t}$$

c) $$x(t) = \int_0^t \frac{dx(t')}{dt'} dt' = \int_0^t \frac{M_0 v_0}{M_0 + \lambda t'} dt' = \frac{1}{\lambda}\left[M_0 v_0 \ln(M_0 + \lambda t) - M_0 v_0 \ln(M_0)\right]$$

$$= \frac{M_0 v_0}{\lambda} \ln\left(1 + \frac{\lambda}{M} t\right)$$

d) $$x(T) = L = \frac{M_0 v_0}{\lambda} \ln\left(1 + \frac{\lambda}{M} t\right), \quad \frac{\lambda L}{M_0 v_0} = \ln\left(1 + \frac{\lambda}{M} t\right),$$

$$e^{\frac{\lambda L}{M_0 v_0}} = 1 + \frac{\lambda}{M} T \qquad T = \frac{M_0}{\lambda}\left(e^{\frac{\lambda L}{M_0 v_0}} - 1\right)$$