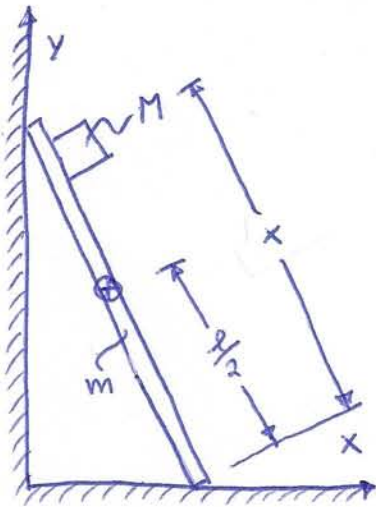




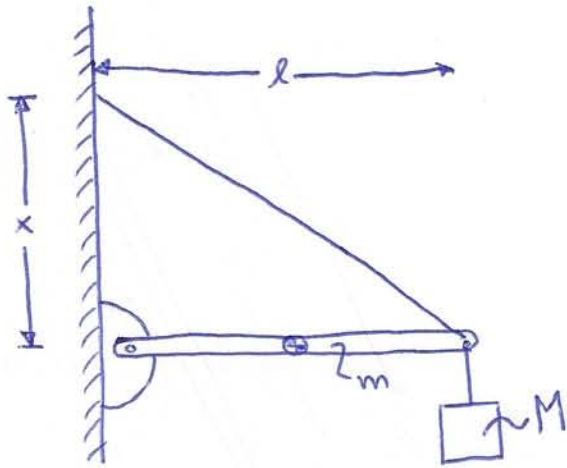
what is the normal force from

a) the ground?

b) the wall?

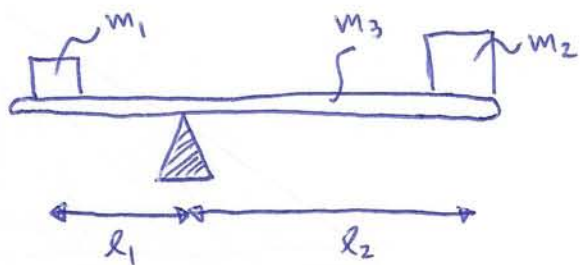
what is the friction force on
the ground?

what would the minimum coefficient
of friction have to be?



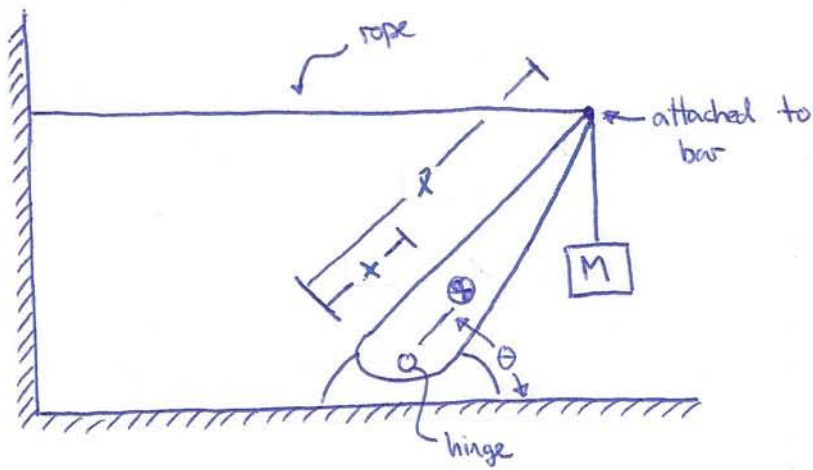
what is the tension in the rope?

what is the reaction force on the pin?

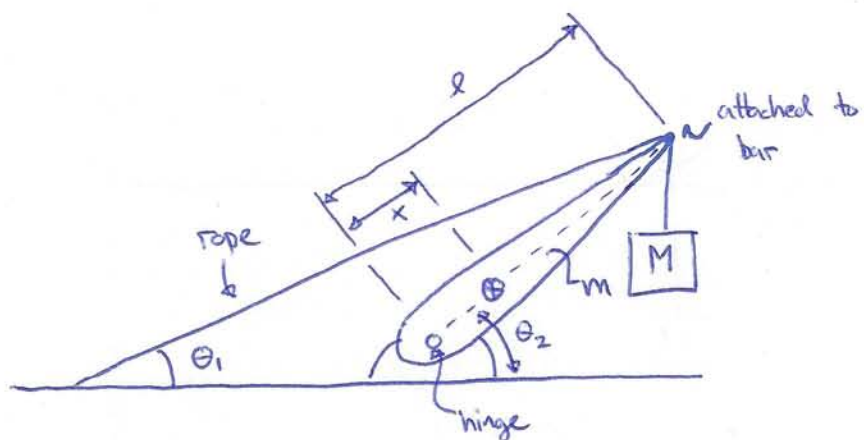


What is the normal force on the teeter-totter?

Given l_1 , what would l_2 have to be so the teeter-totter would balance?

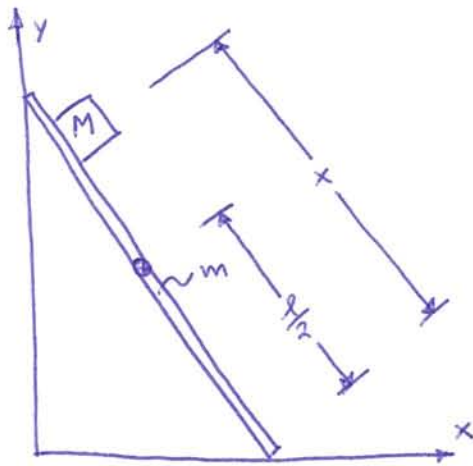


- what is the tension in the rope?
- what is the reaction force on the hinge?

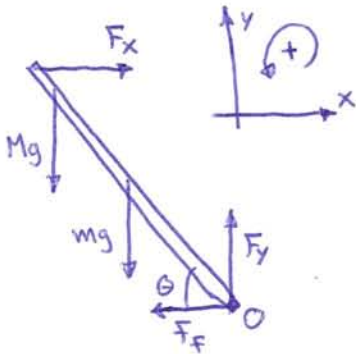


what is the tension in the rope?

what is the reaction force on the hinge.



FBD on ladder



$$\sum F_x = (m+M)a_x = F_x - F_f \quad (1)$$

$$\sum F_y = (m+M)a_y = F_y - mg - Mg \quad (2)$$

$$\sum M_o = I_o \alpha_o = (mg)\left(\frac{l}{2} \cos \theta\right) + (Mg)(x \cos \theta) - (F_x)(l \sin \theta) \quad (3)$$

Solve eq. (2) for F_y :

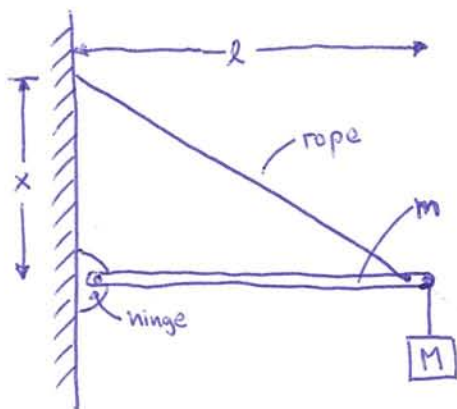
$$F_y = (m+M)g$$

Solve eq. (3) for F_x :

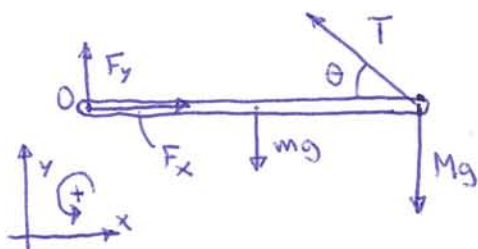
$$F_x = \frac{(mg)\left(\frac{l}{2} \cos \theta\right) + (Mg)(x \cos \theta)}{l \sin \theta}$$

Solve eq. (1) for F_f :

$$F_f = F_x = \frac{(mg)\left(\frac{l}{2} \cos \theta\right) + (Mg)(x \cos \theta)}{l \sin \theta}$$



FBD on bar:



$$\theta = \tan^{-1}\left(\frac{x}{l}\right)$$

$$\sum F_x = (m+M)a_x = F_x - T\cos\theta \quad (1)$$

$$\sum F_y = (m+M)a_y = F_y + T\sin\theta - mg - Mg \quad (2)$$

$$\sum M_o = I_o\alpha = (T\sin\theta)(l) - (mg)\left(\frac{l}{2}\right) - (Mg)(l) \quad (3)$$

Solve equ. (3) for T:

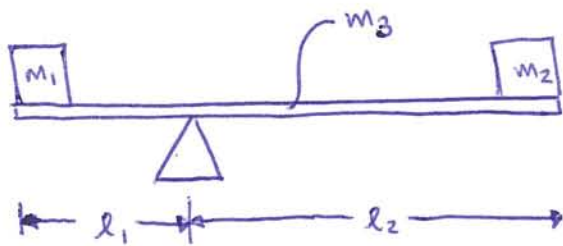
$$T = \frac{Mg + \frac{mg}{2}}{\sin\theta} \quad (3a)$$

sub (3a) into (1), solve for F_x :

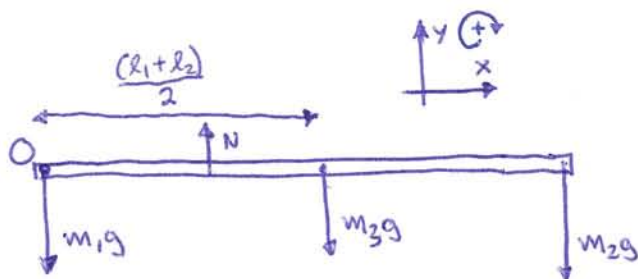
$$F_x = \left(Mg + \frac{mg}{2}\right)\left(\frac{\cos\theta}{\sin\theta}\right) \quad (1a)$$

sub (3a) into (2), solve for F_y :

$$F_y = \frac{mg}{2}$$



FBD on board:



$$\sum F_x = (m_1 + m_2 + m_3) a_x = 0 \quad (1)$$

$$\sum F_y = (m_1 + m_2 + m_3) a_y = N - m_1g - m_2g - m_3g \quad (2)$$

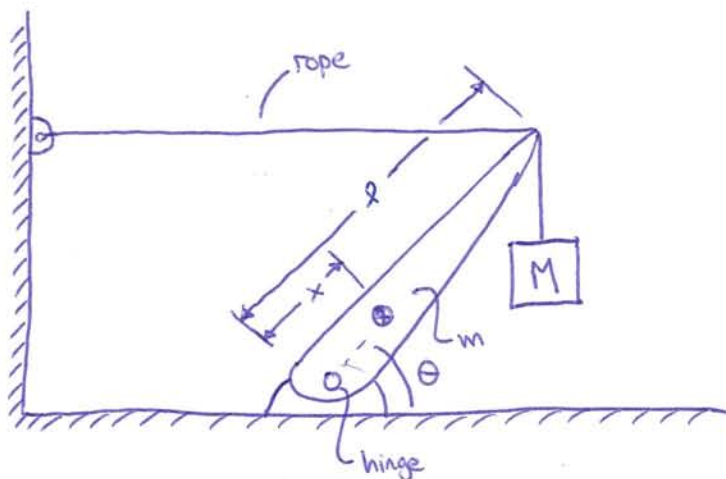
$$\sum M_O = I_O \alpha_O = (m_3g) \left(\frac{l_1 + l_2}{2} \right) + (m_2g)(l_1 + l_2) - (N)(l_1) \quad (3)$$

Solve eq. (2) for N :

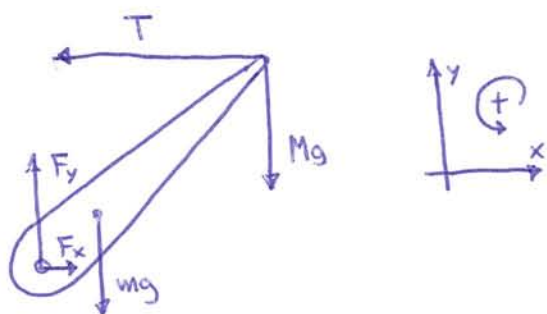
$$N = (m_1 + m_2 + m_3)g$$

Solve eq. (3) for l_2 :

$$l_2 = \frac{\left(N - \frac{m_3g}{2} - m_2g \right) (l_1)}{\left(\frac{m_3g}{2} + m_2g \right)}$$



FBD on lever arm



$$\sum F_x = (m+M)a_x = F_x - T \quad (1)$$

$$\sum F_y = (m+M)a_y = F_y - mg - Mg \quad (2)$$

$$\sum \tau_o = I_o \alpha_o = (T)(l \sin \theta) - (mg)(x \cos \theta) - (Mg)(l \cos \theta) \quad (3)$$

Solve equ. (3) for T:

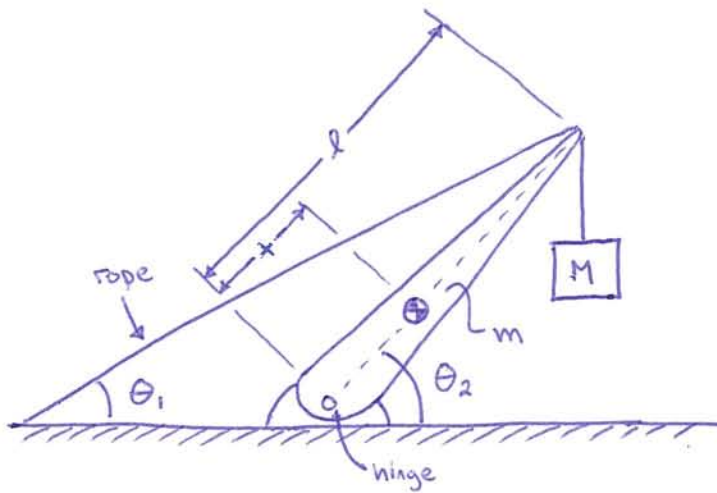
$$T = \frac{(g \cos \theta)(mx + Ml)}{l \sin \theta} \quad (3a)$$

Sub equ. (3a) into equ. (1) and solve for F_x :

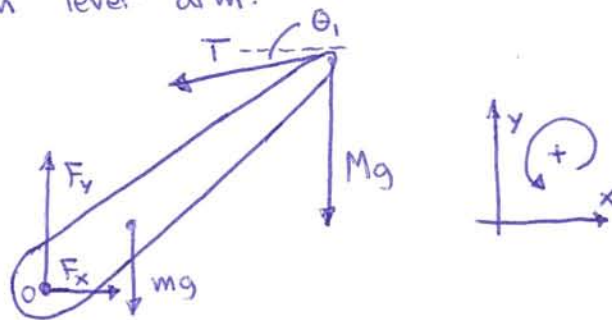
$$F_x = T = \frac{(g \cos \theta)(mx + Ml)}{l \sin \theta}$$

Solve equ. (2) for F_y :

$$F_y = (m+M)g$$



FBD on lever arm:



$$\sum F_x = (m+M)a_x = F_x - T \cos \theta_1 \quad (1)$$

$$\sum F_y = (m+M)a_y = F_y - mg - Mg - T \sin \theta_1 \quad (2)$$

$$\sum M_o = T \cos \theta_1 (l \sin \theta_2) - (Mg)(l \cos \theta_2) - (mg)(x \cos \theta_2) \quad (3)$$

Solve eq. (3) for T:

$$T = \frac{(g \cos \theta_2)(Ml + mx)}{l \cos \theta_1 \sin \theta_2} \quad (3a)$$

Sub eq. (3a) into (1) & (2) to solve for F_x & F_y :

$$F_x = T \cos \theta_1 = \frac{(g \cos \theta_2)(Ml + mx)}{l \sin \theta_2}$$

$$F_y = T \sin \theta_1 + (M+m)g$$