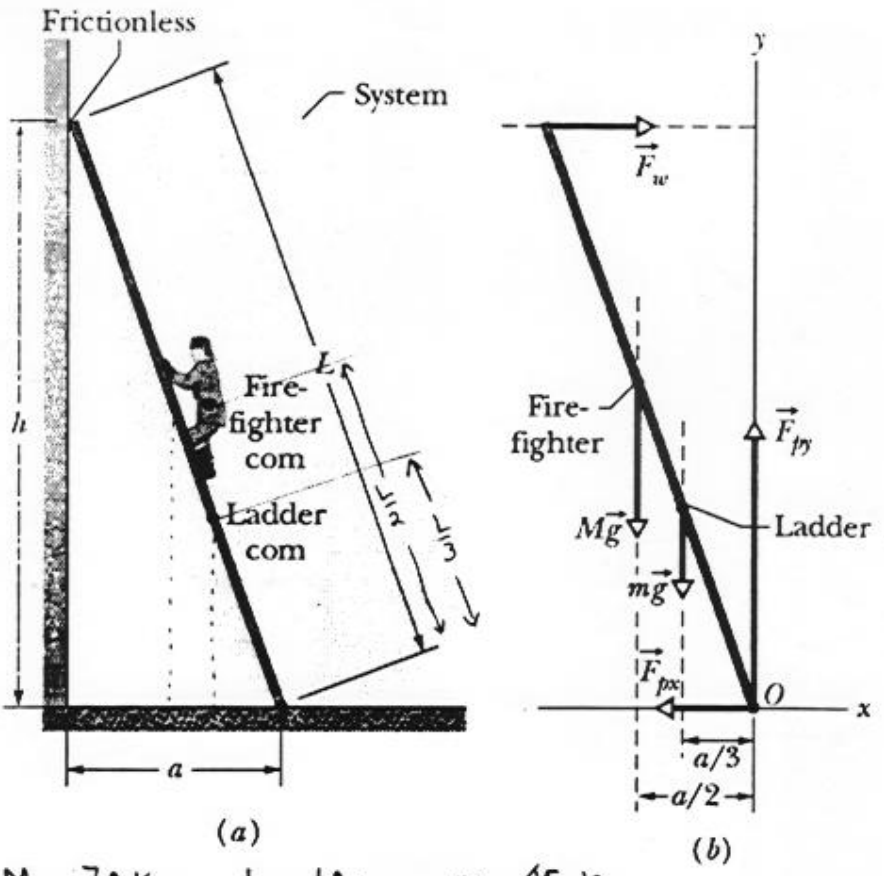
Example 13.2



$h = 9.3\,m \quad M = 72\,Kg \quad L = 12\,m \quad m = 45\,Kg$

$\vec{F}_{wall} = ? \qquad \vec{F}_{pavement} = ?$

$\Sigma \tau_o = 0 \Rightarrow -(h)F_w + \left(\frac{a}{2}\right) Mg + \left(\frac{a}{3}\right) mg = 0$

use Pythogore $\Rightarrow a = \sqrt{L^2 - h^2} = 7.58\,m$

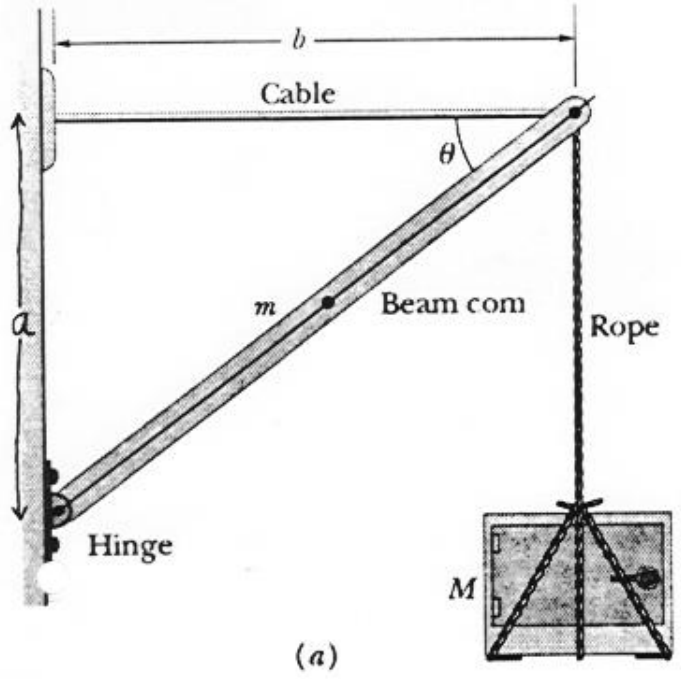
$\Rightarrow F_w = \dfrac{ag\left(\frac{M}{2} + \frac{m}{3}\right)}{h} = \boxed{407\,N}$

$\Sigma F_x = 0 \Rightarrow F_w - F_{Px} = 0 \Rightarrow F_{Px} = F_w = \boxed{407\,N}$

$\Sigma F_y = 0 \Rightarrow F_{Py} - Mg - mg = 0 \Rightarrow F_{Py} = (M+m)g = \boxed{1147\,N}$

$|\vec{F}_P| = \sqrt{407^2 + 1147^2} =$

Example 13.3



(a)

$M = 430\ Kg \quad m = 85\ Kg$

$a = 1.9\ m$

$b = 2.5\ m$

a) $\vec{T_c} = ?$

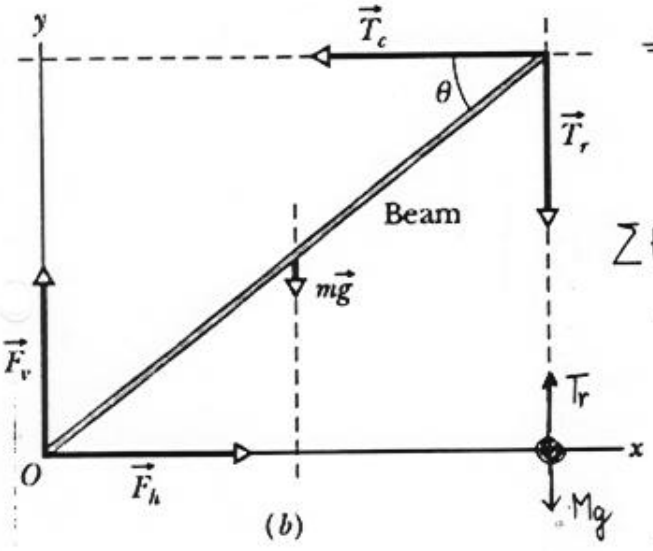
b) $\vec{F} = ?$ (force of the beam from the hinge)

$\sum \tau_o = 0 \Rightarrow (a)T_c - (b)T_r - \left(\frac{b}{2}\right)mg = 0$

but $T_r = Mg$

$\Rightarrow T_c = \dfrac{(b)Mg + \frac{b}{2}mg}{a}$

$\boxed{T_c = 6093N}$



(b)

$\sum F_x = F_h - T_c = 0$

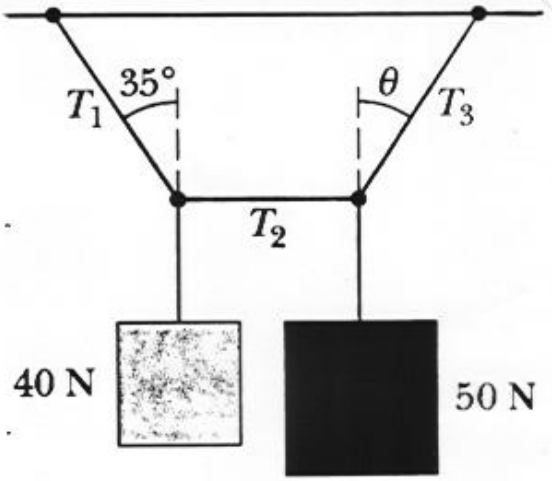
$\Rightarrow F_h = T_c = 6093N$

$\sum F_y = F_v - mg - T_r = 0$

$\Rightarrow F_v = T_r + mg.$

$= (M+m)g = \boxed{5047N}$

Pb #16. Find T_1, T_2 and T_3 and θ.



At point B

$\Sigma F_x = 0$

$T_3 \sin\theta - T_2 = 0$ — (1)

$\Sigma F_y = 0$

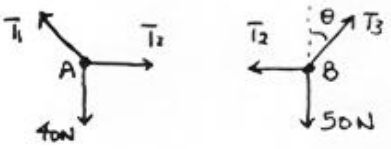
$T_3 \cos\theta - 50 = 0$ — (2)

At point A

$\Sigma F_x = 0$

$T_2 - T_1 \sin 35° = 0$ — (3)

$T_1 \cos 35° - 40 = 0$ — (4)



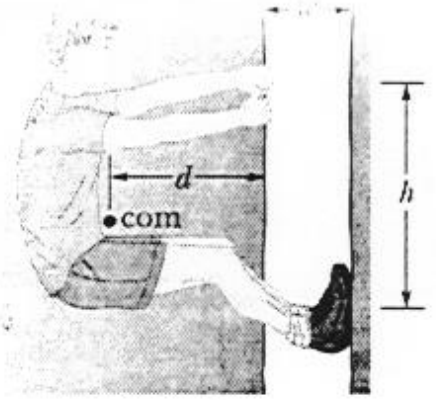
(4) $\Rightarrow T_1 = \frac{40}{\cos 35°} = \boxed{49N}$

(3) $\Rightarrow T_2 = T_1 \sin 35° = \boxed{28N}$

$\frac{(1)}{(2)} \Rightarrow \frac{T_3 \sin\theta}{T_3 \cos\theta} = \frac{T_2}{50} \Rightarrow \tan\theta = \frac{T_2}{50} = \frac{28}{50} = 0.56$

$\Rightarrow \theta = 29°$

(2) $\Rightarrow T_3 = \frac{50}{\cos 29°} = \boxed{57N}$



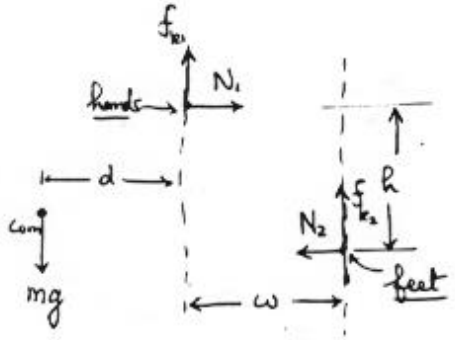
Problem # 2

$w = 0.20\ m$ $\quad m = 55\ kg$

$d = 0.40\ m$

$\mu_1 = 0.40$

$\mu_2 = 1.2$



a) $\sum F_x = 0 \Rightarrow N_1 - N_2 = 0 \Rightarrow N_1 = N_2$

$\sum F_y = 0 \rightarrow f_{k_1} + f_{k_2} - mg = 0$

$\mu_1 N + \mu_2 N - mg = 0 \Rightarrow N = \dfrac{mg}{\mu_1 + \mu_2}$

$\boxed{N = 337\ N}$

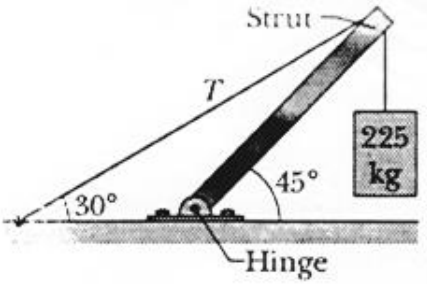
b) $\sum \tau_o = 0 \Rightarrow -N_1 h + mg(d+w) - f_{k_1} w = 0$

($f_{k_1} = \mu N_1$)

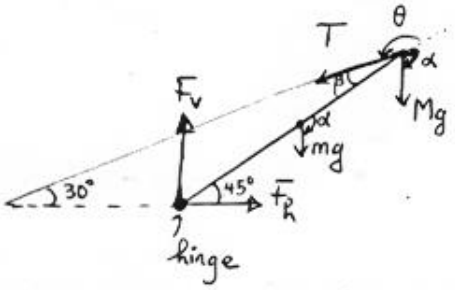
$\Rightarrow h = \dfrac{mg(d+w) - \mu N_1 w}{N_1} = \dfrac{(55 \times 9.8)(0.6) - 0.4 \times 337 \times 0.2}{337}$

$\boxed{h = 0.88\ m}$

c) μ_1 and μ_2 are reduced $\Rightarrow$ N should increase



Pb # 25



a) $\sum \tau_o = 0 \Rightarrow -mg\frac{\ell}{2}\sin\alpha - Mg\ell\sin\alpha + T\ell\sin\theta = 0$

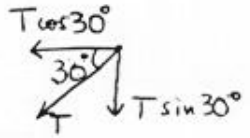
$\alpha = 45° + 90° = 135°$ $\quad \beta = 15°$

$\theta = 180° - 15° = 165°$

$$\Rightarrow \quad T = \frac{\left(\frac{m}{2} + M\right) g \sin\alpha}{\sin\theta} = \boxed{6630\,N}$$

b) $\sum F_x = 0$

$F_v - mg - Mg - T\sin 30° = 0$

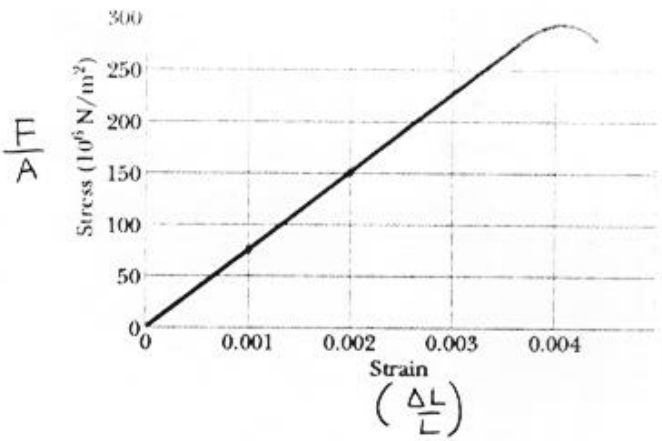


$\Rightarrow F_v = (m+M)g + T\sin 30° = \boxed{5961\,N}$

$\sum F_y = 0 \Rightarrow F_h - T\cos 30° = 0 \Rightarrow F_h = T\cos 30°$

$\boxed{F_h = 5742\,N}$

Problem # 36



a) Stress = modulus × strain

$$\frac{F}{A} = E \times \frac{\Delta L}{L}$$

(E: Young modulus)

$\Rightarrow E$ = slope of stress vs. strain curve

From the graph $E \simeq \frac{150 - 75}{0.002 - 0.001} = 7.5 \times 10^{10} \frac{N}{m^2}$.

b) S_y = yield strength

From the graph $S_y = 290 \times 10^6 \frac{N}{m^2}$