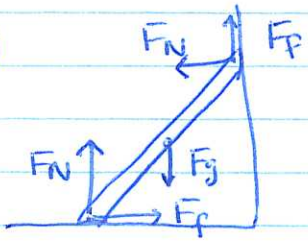
p 266 Concept 21
p 267 Problem 23, 48, 67 (7)

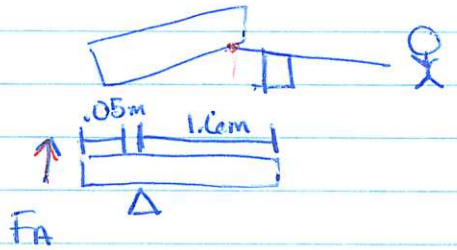
- Concept ladder on wall, draw F

21) (1)



- Problem

23) (1)

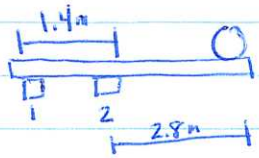


$l_1 = 1.6\,m$
$l_2 = .05\,m$ $F_2 = 8000\,N$

$\tau_1 = \tau_2$
$Fr = Fr$
$F_1 = \frac{F_2 r_2}{r_1} = \frac{(8000\,N)(.05m)}{1.6m}$

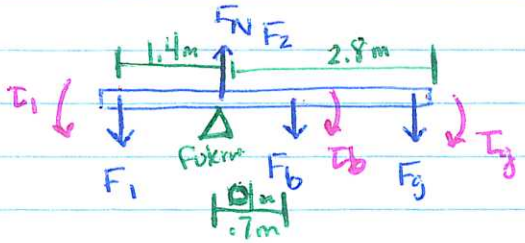
$= 250\,N$

48)



$m_b = 28\,kg$

$m_3 = 60\,kg$



① $\sum \tau = 0\,Nm$

$\tau_1 - \tau_b - \tau_g = 0\,Nm$

$F_1 r_1 - m_b g r_b - m_g g r_g = 0\,Nm$

(2)

$$F_1 = \frac{m_b g r_b + m_g g r_g}{r_1}$$

$$= \frac{(28\,kg)(9.81\,m/s^2)(.7\,m) + (60\,kg)(9.81\,m/s^2)(2.8\,m)}{1.4\,m}$$

$$= -1300\,N$$

② $\sum F = 0N$

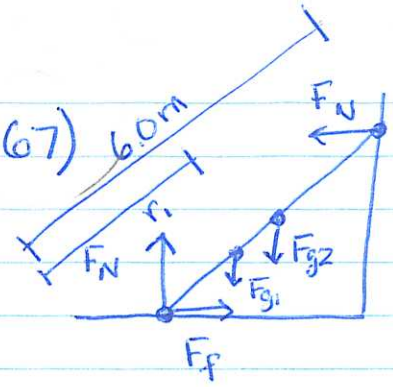
$F_N - F_1 - F_b - F_g = 0N$

$F_N = F_1 + m_b g + m_3 g$

$= (1300N) + (28kg)(9.81\,m/s^2) + (60kg)(9.81\,m/s^2)$

$= +2200\,N$

(67)

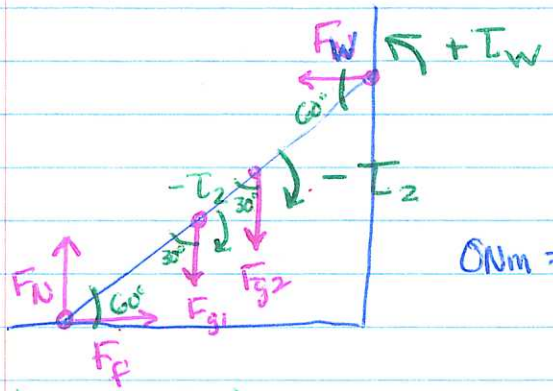


$m_1 = 70\,kg$ $\quad l = 6.0\,m$

$m_2 = 50\,kg$ $\quad \theta = 60°$

$r_1 = ?$ $\quad r_2 = 3.0\,m$ $\quad \mu = .40$

How high climb before slip?



(no τ bk pivot)

(3) ① ② ③

① $\sum F_y = 0N$

$F_N - F_{g1} - F_{g2} = 0N$

$F_N = m_1 g + m_2 g$

$= (70kg)(9.81 m/s^2) + (50kg)(9.81 m/s^2)$

$= 1200N$

② $\sum F_x = 0N$

$F_W - F_f = 0N$

$F_W = \mu F_N$

$= (.40)(1200N)$

$F_W = 480\,N$

③ $\sum \tau = 0Nm$

$\tau_W - \tau_p - \tau_l = 0Nm$

$0Nm = F_W l \sin\theta - m_1 g \sin\theta\, r_1 - m_2 g \sin\theta\, r_2$

$r_1 = \dfrac{F_W l - m_2 g \sin\theta\, r_2}{m_1 g \sin\theta}$

$= \dfrac{F_W l \sin\theta - m_2 g r_2 \sin\theta}{m_1 g \sin\theta}$

$= \dfrac{(480N)(6.0m)\sin 60° - (50kg)(9.81 m/s^2)(3.0m)\sin 60°}{(70kg)(9.81 m/s^2)\sin 30°}$

$r_1 = 5.1\,m$