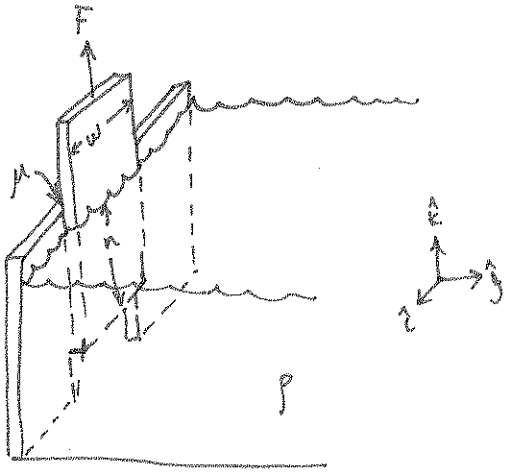
8.1.6. SOLUTION



a. find F to pull board up

b. find F for:

$g = 10\ m/s^2$

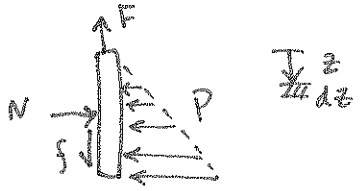
$h = 1m$

$w = 1m$

$\rho = 1000\ kg/m^3$

$\mu = 0.5$

a. FBD of board (side view):



(neglecting weight of board)

$\{\Sigma \vec{F} = \vec{0}\} \cdot \hat{j} \Rightarrow N - \int P\,dA = 0 \Rightarrow N = \int P\,dA$

$$N = \int_0^h \underbrace{\rho g z}_{P} \underbrace{w\,dz}_{dA} = \frac{\rho g w h^2}{2}$$

$\{\Sigma \vec{F} = \vec{0}\} \cdot \hat{k} \Rightarrow F - f = 0 \Rightarrow F - \mu N = 0 \Rightarrow F = \mu N$

$$\boxed{F = \frac{\mu \rho g w h^2}{2}}$$

b. $$F = \frac{(0.5)(1000\ kg/m^3)(10\ m/s^2)(1m)(1m)^2}{2} = 2500\ \frac{kg\ m}{s^2}$$

$$\boxed{F = 2500\ N = 560\ lbf}$$