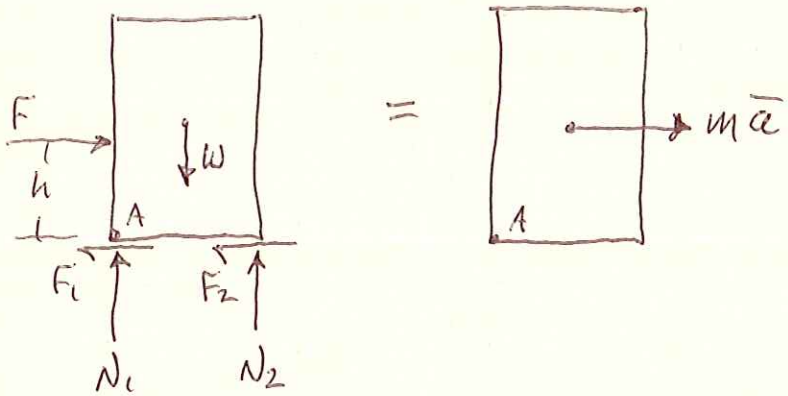
PROB. 16-8

$M = 20^{kg}$, $F = 100^{N}$, $\mu = 0.25$, FIND a, RANGE OF h FOR NO TIPPING



$W = mg = (20^{kg})(9.81\ \frac{m}{s^2}) = 196.2^{N}$

$\Sigma F_y = m\bar{a}_y$: $N_1 + N_2 - mg = 0$

$$N_1 + N_2 = 196.2$$

$\Sigma F_x = m\bar{a}_x$: $F - F_1 - F_2 = ma$

$F - \mu N_1 - \mu N_2 = ma$

$a = \frac{1}{m}\left[F - \mu(N_1 + N_2)\right]$

$a = \frac{1}{(20^{kg})}\left[(100^{N}) - 0.25(196.2^{N})\right] = 2.547\ \frac{m}{s^2}$

CABINET TENDS TO TIP CW ↻: $N_1 = 0$, $N_2 = 196.2^{N}$

$\Sigma \vec{M}_A = \Sigma(\vec{M}_A)_{EFF}$ +↺:

$-hF - 0.3mg + 0.6N_2 = -0.9ma$

$h = \frac{1}{F}(0.9ma - 0.3mg + 0.6N_2)$

PROB. 16-8 CONT.

$$h = \frac{1}{(100N)}\left[0.9(20^{kg})\left(2.547\,\frac{m}{s^2}\right) - 0.3(196.2^{N}) + 0.6(196.2^{N})\right]$$

$$\boxed{h = 1.047^{m}}$$

CABINET TENDS TO TIP CCW ↺: $N_2 = 0$

$N_1 = 196.2^{N}$

$\Sigma \vec{M}_A = \Sigma (\vec{M}_A)_{EFF}$ $+\circlearrowleft$:

$-hF - 0.3mg = -0.9ma$

$$h = \frac{1}{F}(0.9ma - 0.3mg) = \frac{m}{F}(0.9a - 0.3g)$$

$$h = \frac{(20\,kg)}{(100\,N)} \cdot [0.9(2.547) - 0.3(9.81)] = -0.1301^{m}$$

$$\boxed{0 \le h \le 1.047^{m}}$$