1 2D Torque

Verge of tipping location of N is at an extreme point

1.1 Example 1

$$\sum F_x = 0 \tag{1}$$
$$F - f = 0 \tag{2}$$
$$F = f \tag{3}$$
$$F = \mu N \tag{4}$$

$$\sum F_y = 0 \tag{5}$$
$$N - mg = 0 \tag{6}$$
$$N = mg \tag{7}$$

$$\boxed{F = \mu mg}$$

$$\sum \tau_\star = 0 \tag{8}$$
$$\frac{w}{2}mg - xN - hF = 0 \tag{9}$$
$$xN = \frac{w}{2}mg - hF \tag{10}$$
$$x = \frac{\frac{w}{s}mg - h(\mu mg)}{mg} \tag{11}$$
$$= 0.125\,\mathrm{m} - (0.4)(0.125\,\mathrm{m}) \tag{12}$$
$$x = 0.075\,\mathrm{m} \tag{13}$$

$$\boxed{x = 0.075\,\mathrm{m}}$$

$$\sum \tau_\star = 0 \tag{14}$$
$$\frac{w}{2}mg - hF = 0 \tag{15}$$
$$h = \frac{\frac{w}{2}mg}{\mu mg} \tag{16}$$
$$= \frac{w}{2\mu} \tag{17}$$
$$= \frac{0.25\,\mathrm{m}}{2(0.4)} \tag{18}$$
$$h = 0.31\,\mathrm{m} \tag{19}$$

$$\boxed{h = 0.31\,\mathrm{m}}$$

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(a)

$$\sum F_y = 0 \tag{20}$$
$$N_B + N_F - mg = 0 \tag{21}$$
$$N_B + N_F = 80\,\mathrm{lb} \tag{22}$$

$$\sum F_x = 0 \tag{23}$$
$$F - f_F - f_B = 0 \tag{24}$$
$$F = f_F + f_B \tag{25}$$
$$= \mu(N_B + N_F) \tag{26}$$
$$= (0.2)(80\,\mathrm{lb}) \tag{27}$$
$$F = 16\,\mathrm{lb} \tag{28}$$

(b)

$$\sum \tau_\star = 0 \tag{29}$$
$$2\,\mathrm{ft}N_B + 2\,\mathrm{ft}N_F + 3\,\mathrm{ft}P = 0 \tag{30}$$

1.3 Example 3