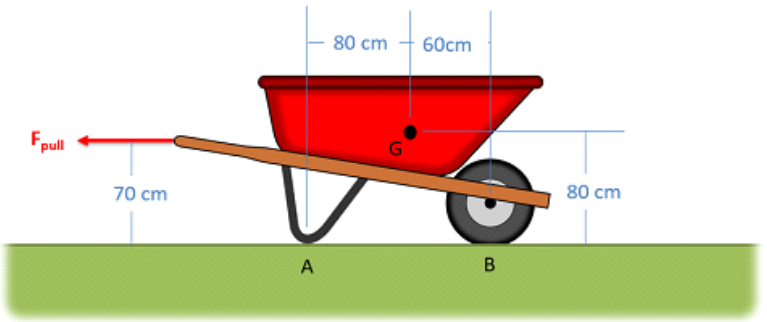
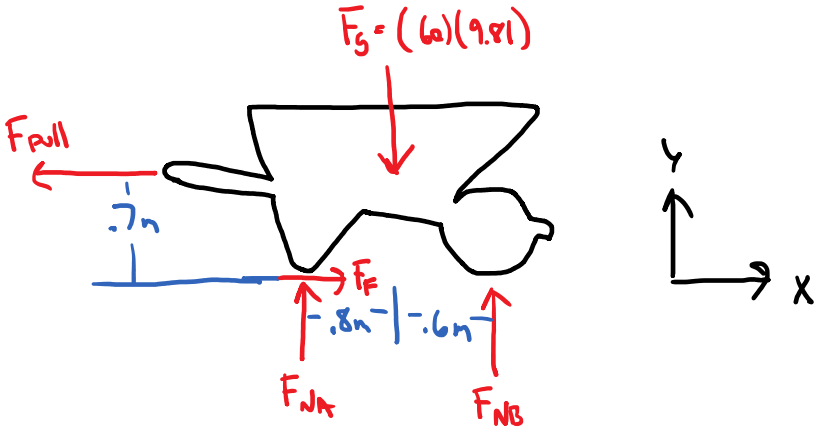
Problem 4

A 60 kg wheelbarrow with the dimensions shown below is subjected to a pulling force. If there is assumed to be no friction at the wheel at B, and the static coefficient of friction at A is assumed to be .4, what is the expected pulling force needed to get the wheelbarrow moving?





$$\Sigma F_x = F_F - F_{pull} = 0$$

$$\Sigma F_y = F_{NA} + F_{NB} - (60)(9.81) = 0$$

$$\Sigma M_A = (F_{pull})(.7) - (60)(9.81)(.8) + (F_{N_B})(1.4) = 0$$

Impending motion

$$F_F = \mu_s F_{NA} \rightarrow F_F = .4 F_{NA}$$

$F_F = F_{pull} = .4\,F_{N_A}$ $\leftarrow \Sigma F_x$

$F_{N_B} = 588.6 - F_{N_A}$ $\leftarrow \Sigma F_y$

$(.4\,F_{N_A})(.7) - 470.88 - (588.6 - F_{N_A})(1.4) = 0$ $\leftarrow \Sigma M_A$

$.28\,F_{N_A} + 824.04 - 1.4\,F_{N_A} = 470.88$

$F_{N_A} = 315.3\ N$

$F_F = .4\,F_{N_A} = 126.1\ N$

$\boxed{F_{pull} = F_F = 126.1\ N}$