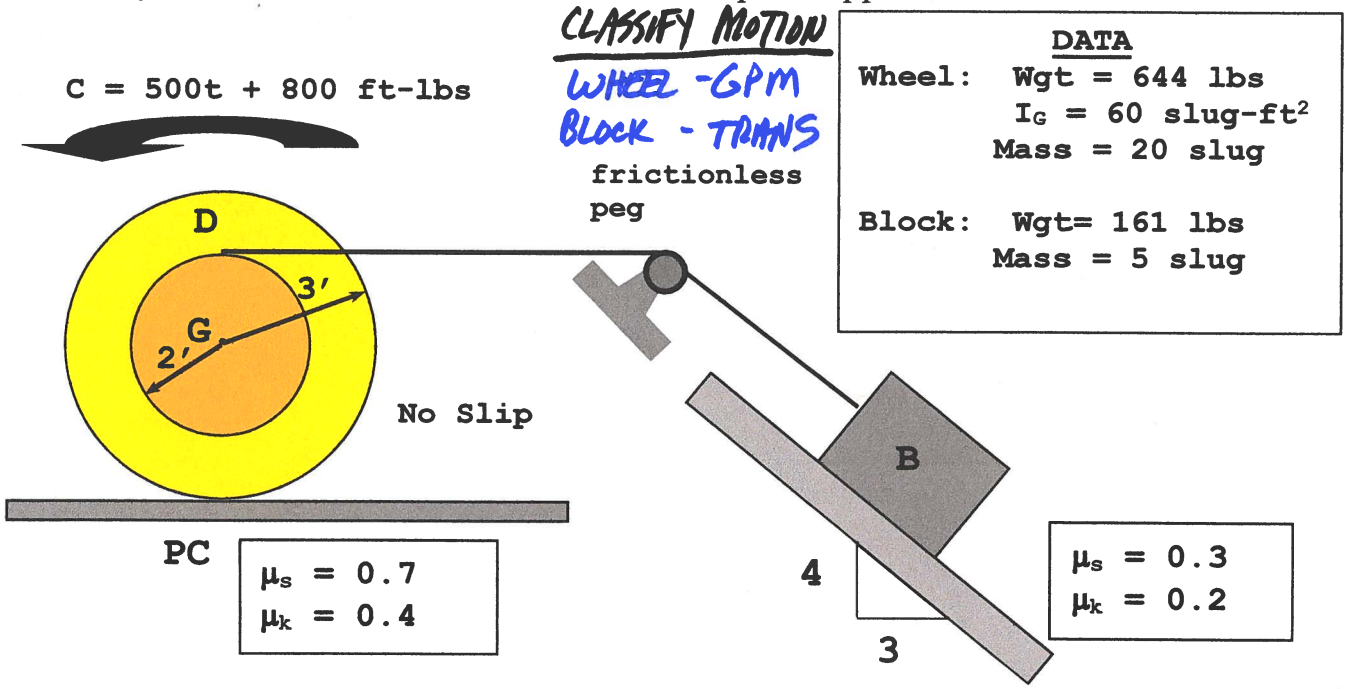
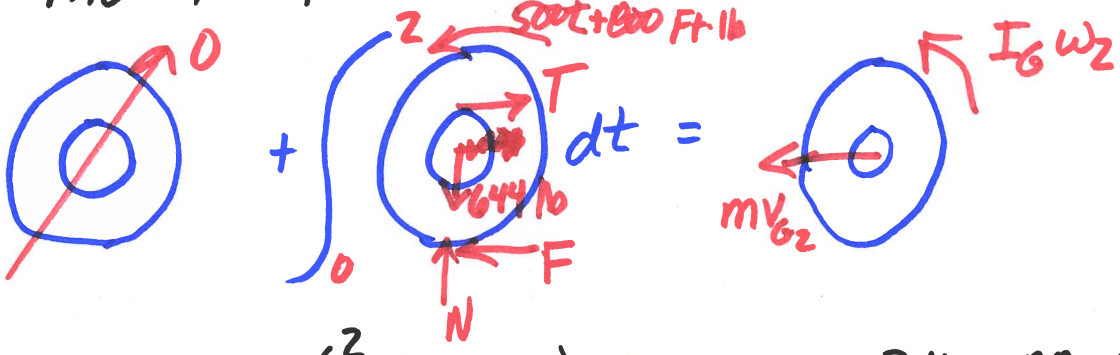
Problem 4 - Impulse Momentum I

The system is released from rest and the block moves up the incline. Find the velocity of the block two seconds after the couple is applied to the wheel.



MOM1 + IMPULSE = MOM 2



$\uparrow\Sigma X \quad 0 + \int_0^2 (N-644)dt = 0 \Rightarrow 2N-1288=0 \quad N = 644 \text{ lbs}\uparrow$

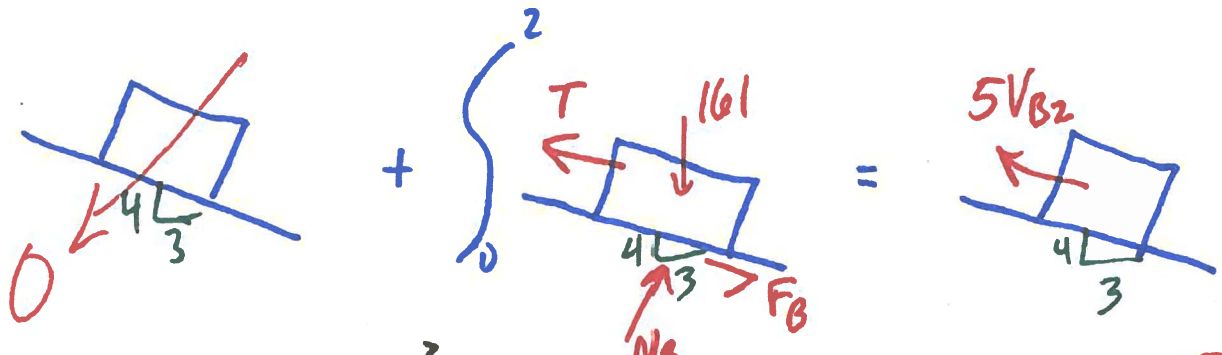
$\rightarrow\Sigma X \quad 0 + \int_0^2 (T-F)dt = -20V_{G2} \Rightarrow 2T-2F = -20V_{G2} = -60\omega_2$ (1)

NO SLIP WHEEL $V_{G_2} = \omega r = 3\omega_2$

$\circlearrowleft\Sigma M_G \quad 0 + \int_0^2 (-500t-800+2T+3F)dt = -60\omega_2$

$4T-3F+60\omega_2 = 2600$ (2)

Problem 2 - Impulse Momentum I



$$\rightarrow \quad 0 + \int_0^2 \left((T - F_B) - \tfrac{4}{5}(161)\right)dt = 5V_{B2} \qquad (3)$$

$$2T - 2F_B - 2576 = 5V_{B2} = 5(5\omega_2)$$

$$\uparrow \quad 0 + \int_0^2 \left(N_B - \tfrac{3}{5}(161)\right)dt = 0 \Rightarrow N = 96.6 \text{ lbs}$$

ASSUME $F_B = \mu_k N = 0.2(96.6) = 19.32$ lbs

$$V_{B2} = V_{D2} = \omega_2 r_{D/IC} = 5\omega_2$$

① $2T - 2F + 60\omega_2 = 0$

② $4T + 6F + 60\omega_2 = 2600$

③ $2T + 0 - 25\omega_2 = 296.2$

SOLVE

$T = 186$ lbs

$F = 278$ lbs →

$\omega_2 = 3.07$ rps ↻

$$V_{B2} = 5\omega_2 = 5(3.07) = 15.33$$

$$V_B = 15.33 \text{ Fps} \quad \tfrac{4}{3}$$