

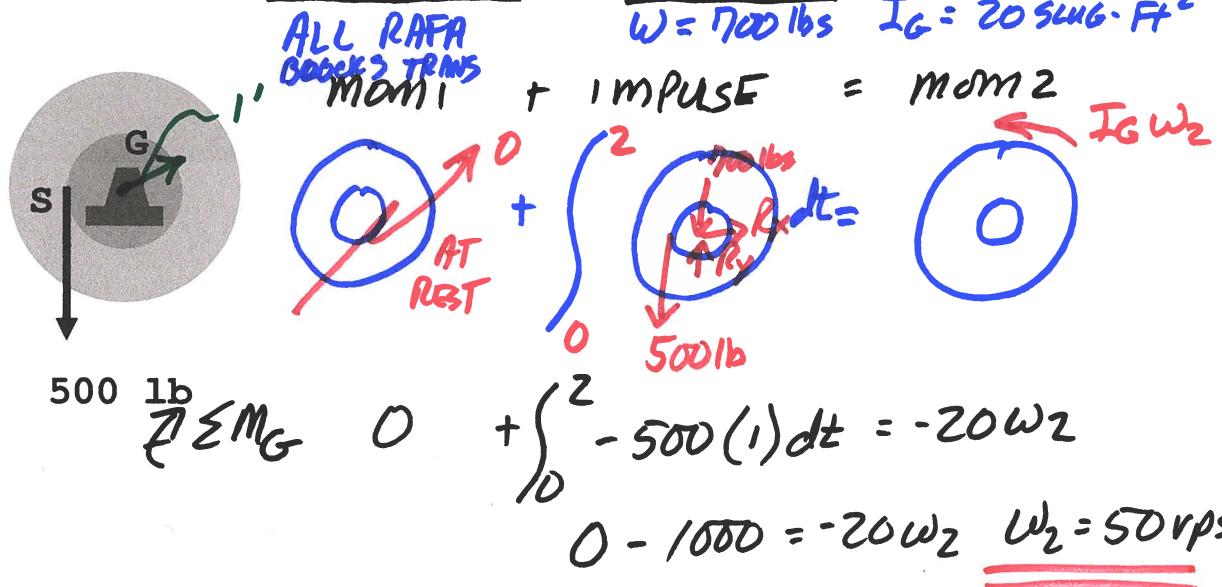
Problem 1 - Impulse Momentum I

Each of the double pulleys shown has a weight of the wheel is 700 lbs a mass moment of inertia of 20 slug-ft² and is initially at rest. The outer radius is 2 ft and the inner radius is 1 ft. Determine the angular velocity of each pulley at t = 2 sec.

CLASSIFY MOTIONPROPERTIES

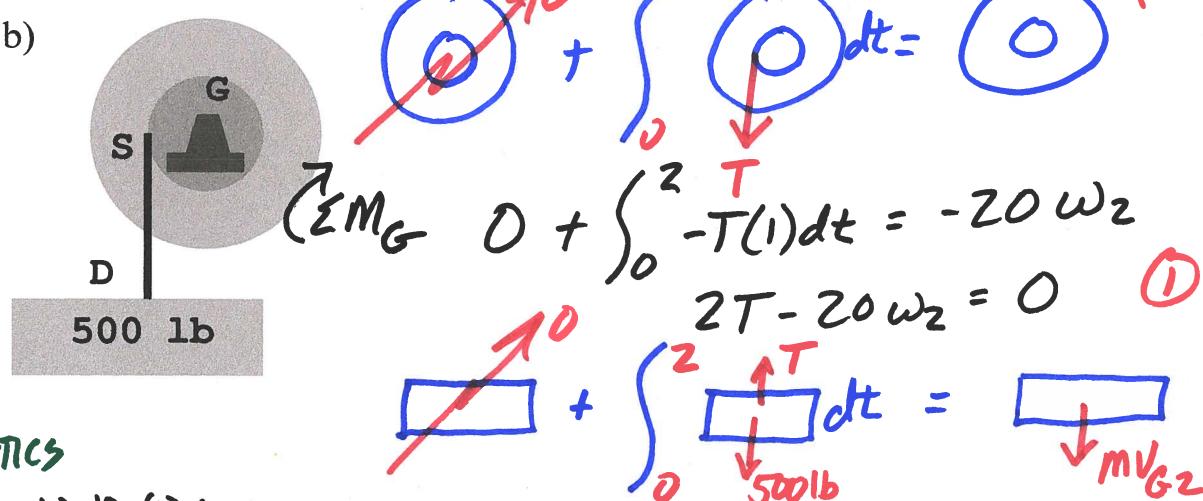
$$\omega = 700 \text{ lbs} \quad I_G = 20 \text{ slug} \cdot \text{ft}^2$$

a)

PROPERTIES

$$\omega_{\text{block}} = 500 \text{ lb} \quad M_{\text{block}} = \frac{500}{32.2} = 15.53 \text{ slug}$$

b)

KINEMATICS

$$V_{G2} = V_s = \omega_2 r = (1)\omega_2$$

$$\begin{bmatrix} 2 & -20 \\ 2 & 15.53 \end{bmatrix} \begin{Bmatrix} T \\ \omega_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 1000 \end{Bmatrix}$$

$$\int_0^2 (T - 500) dt = -15.53 V_{G2}$$

$$2T + 15.53 V_{G2} = 1000$$

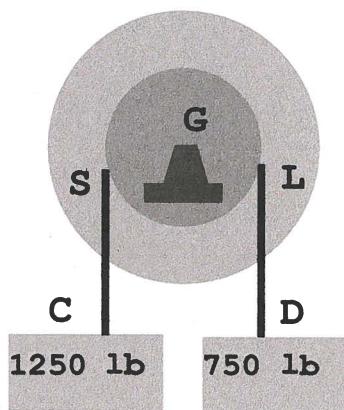
$$2T + 15.53 \omega_2 = 1000 \quad \textcircled{2}$$

SOLVE

$$\underline{\underline{\omega_2 = 28.1 \text{ rps}}}$$

Problem 27: Impulse Momentum (cont'd)

c)



$$\text{MOM}_1 + \text{IMPULSE} = \text{MOM}_2$$

$$\cancel{\text{MOM}_1} + \int_0^2 (-T_1(t) + T_2(t)) dt = \cancel{\text{MOM}_1} - I_G \omega_2$$

$$\sum_{\text{EMG}} \vec{O} + \int_0^2 (-T_1(t) + T_2(t)) dt = -20\omega_2$$

$$-2T_1 + 2T_2 + 20\omega_2 = 0 \quad (1)$$

PROPERTIES

$$\omega_C = 1250 \text{ lbs} \quad m_C = \frac{1250}{32.2} = 38.82 \text{ slug}$$

$$\omega_D = 750 \text{ lbs} \quad m_C = \frac{750}{32.2} = 23.3 \text{ slug}$$

$$\cancel{\text{MOM}_1} + \int_0^2 \begin{cases} T_1 \\ T_2 \end{cases} dt = \begin{cases} 1250 \text{ lbs} \\ mV_{GD2} \end{cases}$$

$$\uparrow \sum y \quad O + \int_0^2 (T_1 - 1250) dt = -38.82 V_{GD2}$$

$$2T_1 + 38.82 V_{GD2} = 2500 \quad (2)$$

KINEMATICS

$$V_S = V_L = V_C = V_D = \omega_2 r = (1)\omega_2$$

$$\cancel{\text{MOM}_1} + \int_0^2 \begin{cases} T_1 \\ T_2 \end{cases} dt = \begin{cases} 750 \text{ lbs} \\ mV_{GD2} \end{cases}$$

$$\uparrow \sum y \quad O + \int_0^2 (T_2 - 750) dt = 23.3 V_{GD2}$$

$$2T_2 - 23.3 V_{GD2} = 1500 \quad (3)$$

$$\begin{bmatrix} -2 & 2 & 20 \\ 2 & 0 & 38.82 \\ 0 & 2 & -23.3 \end{bmatrix} \begin{Bmatrix} T_1 \\ T_2 \\ \omega_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 2500 \\ 1500 \end{Bmatrix}$$

SOLVE $\omega_2 = 12.18 \text{ rps}$