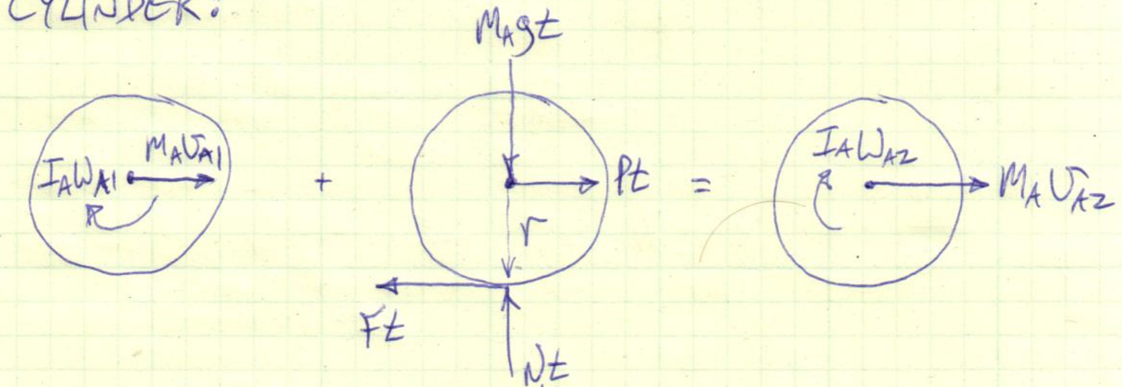
$r = \frac{9}{12} = \frac{3}{4}\text{ ft}$, $W_A = 18^{LB}$, $W_B = 6^{LB}$, $P = 2.5^{LB}$, $t = 1.2^{s}$

FIND v_{A2}, v_{B2}

CYLINDER:



X-DIR. LIN. MOM.:

$$m_A \cancel{v_{A1}}^{0} - Ft + Pt = m_A v_{A2}$$

$$\boxed{Ft = Pt - m_A v_{A2}} \quad ①$$

ANG. MOMENTUM ↻:

$$-I_A \cancel{\omega_{A1}}^{0} - Ft \cdot r = -I_A \omega_{A2}$$

$$Ft = \frac{I_A \omega_{A2}}{r}$$

$$I_A = \frac{1}{2} m_A r^2$$

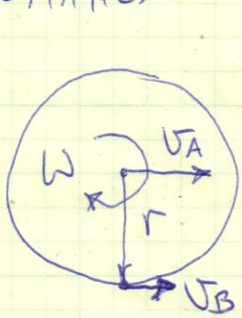
$$\boxed{Ft = \frac{1}{2} m_A r \omega_{A2}} \quad ②$$

SET ① = ②:

$$Pt - m_A v_{A2} = \frac{1}{2} m_A r \omega_{A2}$$

17.73 CONT.

KINEMATICS: RELATIVE VELOCITY



$$\vec{v}_B = \vec{v}_A + \vec{v}_{B/A} = \vec{v}_A + \omega\hat{k} \times \vec{r}$$

$$v_B = v_A - r\omega$$

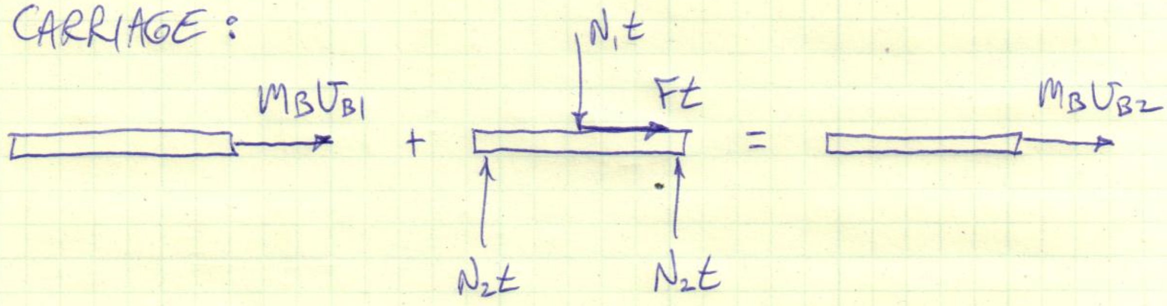
$$\omega_{A2} = \frac{1}{r}\left(v_{A2} - v_{B2}\right)$$

$$Pt - m_A v_{A2} = \frac{1}{2} m_A r \cdot \frac{1}{r}\left(v_{A2} - v_{B2}\right)$$

$$v_{B2} = 3v_{A2} - \frac{2Pt}{m_A}$$

$$\boxed{v_{B2} = 3v_{A2} - \frac{2Ptg}{W_A}} \tag{3}$$

CARRIAGE:



X-DIR. LIN. MOMENTUM:

$$m_B \cancel{v_{B1}}^{=0} + \boxed{Ft = m_B v_{B2}} \tag{4}$$

SET 1 = 4:

$$Pt - m_A v_{A2} = m_B v_{B2}$$

USE EQN. 3:

$$Pt - m_A v_{A2} = m_B\left[3v_{A2} - \frac{2Pt}{m_A}\right]$$

$$v_{A2} = \frac{Pt\left[1 + 2\left(\frac{m_B}{m_A}\right)\right]}{(3m_B + m_A)} = \frac{Ptg\left[1 + 2\left(\frac{W_B}{W_A}\right)\right]}{(3W_B + W_A)}$$

$$v_{A2} = \frac{(2.5^{LB})(1.2^{s})(32.2\,\frac{ft}{s})\left[1 + 2\left(\frac{6^{LB}}{18^{LB}}\right)\right]}{\left[3(6^{LB}) + (18^{LB})\right]}$$

$$\boxed{v_{A2} = 4.472\,\frac{ft}{s}}$$

$$v_{B2} = 3\left(4.472\,\frac{ft}{s}\right) - \frac{2(2.5^{LB})(1.2^{s})(32.2\,\frac{ft}{s^2})}{(18^{LB})}$$

$$\boxed{v_{B2} = 2.683\,\frac{ft}{s}}$$