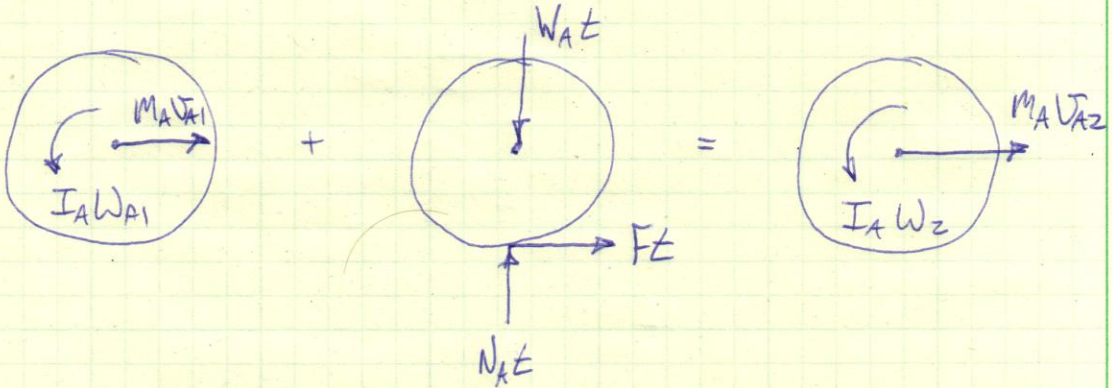
$r = \frac{9}{12} = \frac{3}{4}$ ft, $W_A = 18^{LB}$, $W_B = 6^{LB}$, $v_{A1} = 0$, $v_{B1} = 0$

$P = 2.5^{LB}$, $t = 1.2^{s}$, FIND v_A, v_B

PRINCIPLE OF IMPULSE AND MOMENTUM:

CYLINDER:



X-DIR. LINEAR MOMENTUM:

$m_A v_{A1}^{\nearrow 0} + Ft = m_A v_{A2}$

$$\boxed{Ft = m_A v_{A2}} \quad (1)$$

ANGULAR MOMENTUM $+\circlearrowleft$:

$$I_A \omega_1 + Ft \cdot r = I_A \omega_2$$

$$Ft = \frac{I_A \omega_2}{r}$$

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

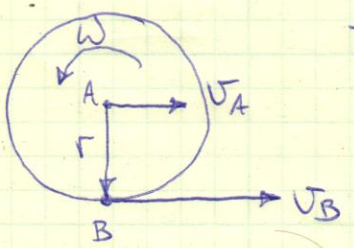
$$\boxed{Ft = \frac{1}{2} m_A r \omega_2} \quad (2)$$

SET ① = ②:

$$M_A v_{A2} = \tfrac{1}{2} M_A r \omega_2$$

$$\boxed{v_{A2} = \tfrac{1}{2} r \omega_2} \quad ③$$

KINEMATICS: RELATIVE VELOCITY



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

ALL IN POSITIVE $\hat{i}$ DIRECTION

$$v_B = v_A + r\omega$$

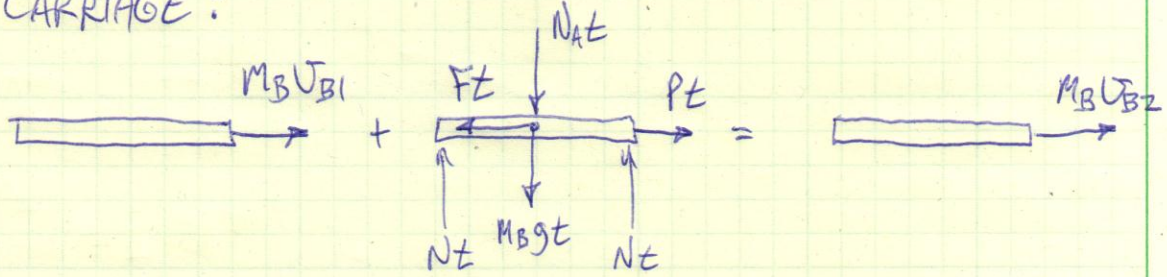
$$\omega_2 = \frac{1}{r}(v_{B2} - v_{A2})$$

USING EQN. ③:

$$v_{A2} = \tfrac{1}{2} r \left[\frac{1}{r}(v_{B2} - v_{A2}) \right]$$

$$\boxed{v_{A2} = \tfrac{1}{3} v_{B2}} \quad ④$$

CARRIAGE:



X-DIR. LIN. MOM.:

$$M_B \cancel{v_{B1}}^{\,0} - Ft + Pt = M_B v_{B2}$$

USE EQN. ①:

$$-(m_A v_{A2}) + Pt = m_B v_{B2}$$

USE EQN. ④:

$$-m_A\left(\frac{1}{3} v_{B2}\right) + Pt = m_B v_{B2}$$

$$v_{B2} = \left(\frac{3}{3m_B + m_A}\right) \cdot Pt \qquad W = mg, \; m = \frac{W}{g}$$

$$v_{B2} = \left(\frac{3g}{3W_B + W_A}\right) \cdot Pt$$

$$v_{B2} = \left[\frac{3\left(32.2 \frac{ft}{s^2}\right)}{3(6^{LB}) + (18^{LB})}\right] \cdot (2.5^{LB})(1.2^{s})$$

$$\boxed{v_{B2} = 8.05 \frac{ft}{s}}$$

$$\boxed{v_{A2} = \frac{1}{3}(8.05) = 2.683 \frac{ft}{s}}$$