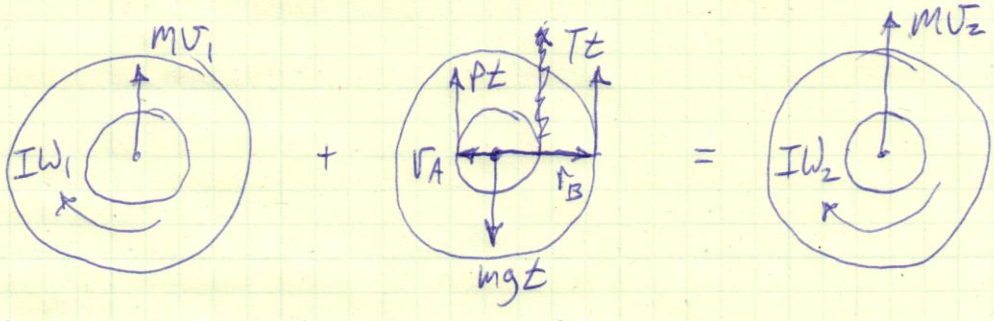
$m = 3^{kg}$, $k = 0.1^{m}$; $\omega_1 = 0$, $v_1 = 0$, $P = 24^{N}$

FIND v_2 AFTER $t = 1.5^{s}$, T_c

PRINCIPLE OF IMPULSE AND MOMENTUM:



Y-DIR. LINEAR MOMENTUM:

$$m\cancel{v_1}^{0} + Pt + Tt - mgt = mv_2$$

$$\boxed{Tt = mv_2 - Pt + mgt} \quad ①$$

ANGULAR MOMENTUM ABOUT O ↺:

$$-I\cancel{\omega_1}^{0} - Pt \cdot r_A + Tt \cdot r_B = -I\omega_2$$

$$Tt = \left(\frac{r_A}{r_B}\right)Pt - \frac{I\omega_2}{r_B}$$

$$I = mk^2$$

KINEMATICS: $v_2 = r_B\omega_2$, $\omega_2 = \frac{v_2}{r_B}$

$$Tt = \left(\frac{r_A}{r_B}\right)Pt - \frac{(mk^2)\left(\frac{v_2}{r_B}\right)}{r_B}$$

$$\boxed{Tt = \left(\frac{r_A}{r_B}\right)Pt - mv_2\left(\frac{k}{r_B}\right)^2} \quad ②$$

SET ① = ②:

$$mv_2 - Pt + mgt = \left(\frac{r_A}{r_B}\right)Pt - mv_2\left(\frac{k}{r_B}\right)^2$$

$$v_2 = \frac{Pt\left[1+\left(\frac{r_A}{r_B}\right)\right] - mgt}{m\left[1+\left(\frac{k}{r_B}\right)^2\right]}$$

$$v_2 = \frac{(24^N)(1.5^s)\left[1+\left(\frac{80}{150}\right)\right] - (3^{kg})(9.81\,\frac{m}{s^2})(1.5^s)}{(3^{kg})\left[1+\left(\frac{100}{150}\right)^2\right]}$$

$$\boxed{v_2 = 2.551\ \frac{m}{s}}$$

EQUATION ①:

$$T = mg - P + \frac{mv_2}{t}$$

$$T = (3^{kg})(9.81\,\frac{m}{s^2}) - (24^N) + \frac{(3^{kg})(2.551\,\frac{m}{s})}{(1.5^s)}$$

$$\boxed{T = 10.53^N}$$