

Assignment 7

$$\vec{F}_{\text{net}} = m \vec{a}$$

(vector)

$$\tau_{\text{net}} = I \alpha$$

(vector)



① Think about I

② $\tau_{\text{net}} = ?$

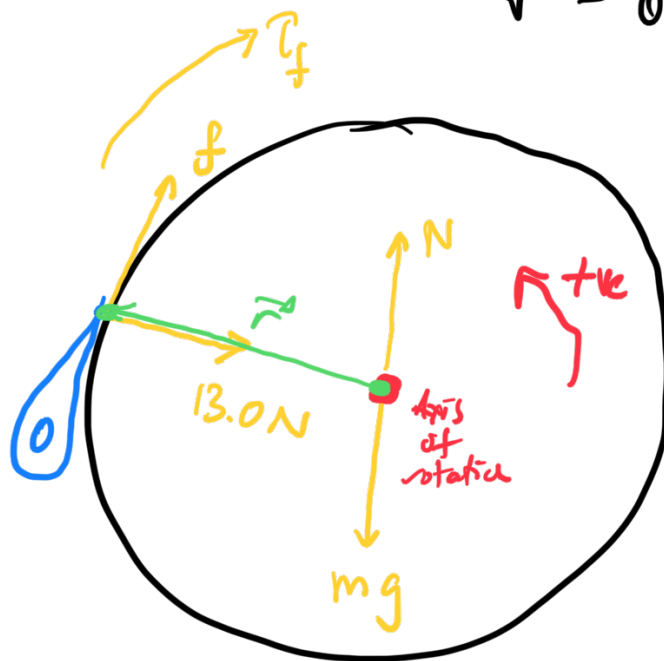
$$\vec{\tau}_P = \vec{r} \times \vec{F}$$

$$|\vec{\tau}_P| = |\vec{r}| |\vec{F}| \sin \theta$$

FBD

$$m = 83 \text{ kg}$$

$$r = 0.370 \text{ m}$$



$$\omega_i = 80 \text{ rpm}$$

A coordinate system with a vertical y -axis and a horizontal x -axis. A green circle with a cross inside is at the origin.

① identify all forces

② choose a coordinate system.

(i) choose an axis of rotation

(ii) choose +ve direction.

$$\textcircled{3} \quad \tau_{mg} = \underbrace{|\vec{r}|}_0 |\vec{F}| \sin \theta = 0 \quad \checkmark$$

$$\tau_N = 0 \quad (r = 0)$$

$$\begin{aligned}\tau_{13.0\text{ N}} &= |\vec{r}| |\vec{F}| \sin \theta \\ &= (.37)(13) \sin(180^\circ) \\ &= 0 \quad \checkmark\end{aligned}$$

$$\begin{aligned}\tau_f &= |\vec{r}| |\vec{F}| \sin \theta \\ &= -(0.37)(?) \sin(90^\circ)\end{aligned}$$

$$\boxed{f = \mu_k N} = (0.40)(13.0)$$

$$\tau_F = -(0.37) \times \overset{.4}{\cancel{0.40}} \times (13.0)$$

$$= -\cancel{1.924} \text{ N}\cdot\text{m}$$

$$1.924$$

$$\tau_{\text{NET}} = \cancel{\tau_{m_3}} + \cancel{\tau_N} + \cancel{\tau_{130}} + \tau_f$$

$$\tau_{\text{NET}} = -0.1924 \text{ N}\cdot\text{m}$$

$$\tau_{\text{NET}} = I \alpha$$



$$\begin{aligned} I_{\text{disk}} &= \frac{1}{2} M r^2 \\ &= \frac{1}{2} (83) (.37)^2 \\ &= 5.6814 \text{ kg}\cdot\text{m}^2 \end{aligned}$$

$$a) \alpha = \frac{\tau_{\text{NET}}}{I} = \frac{-\cancel{1.924}}{5.6814}$$

$\dots \dots 11.2$

$$= -0.337 \text{ rad/s}$$

b) "to rest" $\omega_f = 0$

$$\omega_i = 80 \text{ rpm}$$

$$= 80 \frac{\cancel{\text{rev}}}{\cancel{\text{min}}} \times \frac{2\pi \text{ rad}}{\cancel{\text{rev}}} \times \frac{1}{60}$$

$$= 8.378 \text{ rad/s}$$

$$\alpha = -0.339 \text{ rad/s}^2$$

$$\Delta\theta = ?$$

$$\cancel{\omega_f}^0 = \omega_i^2 + 2\alpha \Delta\theta$$

$$\Delta\theta = \frac{-\omega_i^2}{2\alpha} = 103.5 \text{ rad}$$

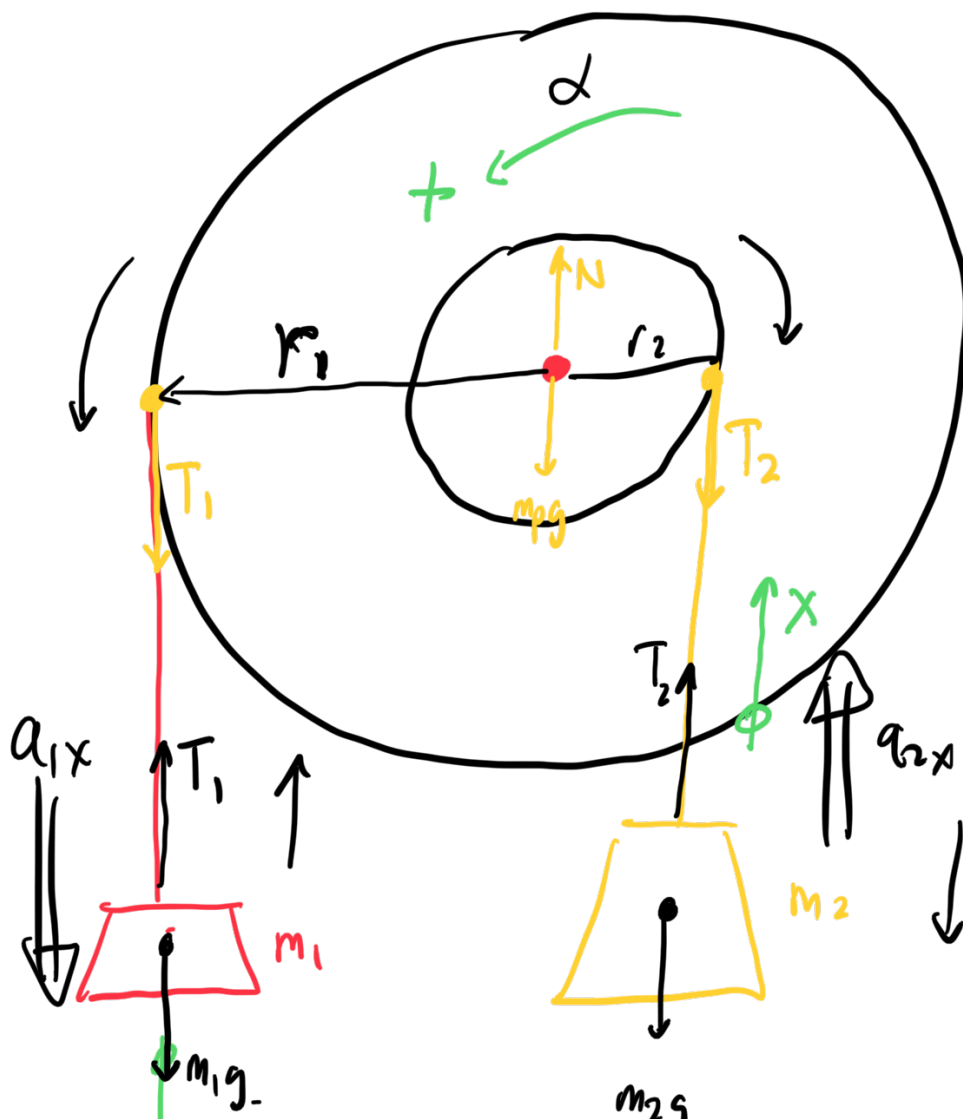
$$103.5 \text{ rad}$$

11 11 11

$$b) \Delta \theta_{(\text{rev})} = \frac{\cdot}{2\pi \text{ rad/rev}} = 16.78 \text{ rev}$$

Question 9.

$$I = 1.7 \text{ kg m}^2$$





$m_1:$

$m_2:$

$$\begin{aligned}
 m_1 g - T_1 &= m_1 \cancel{a_{1x}} \\
 T_2 - m_2 g &= m_2 \cancel{a_{2x}}
 \end{aligned}$$

$r_1 \alpha$

pulley:

$$\begin{aligned}
 \tau_{F_1} &= |\vec{r}| |\vec{F}| \sin \theta \\
 \tau_{T_1} &= \underline{r_1 T_1} \\
 \tau_{T_2} &= -|\vec{r}| |\vec{F}| \cancel{\sin \theta}^{90^\circ} \\
 &= -r_2 T_2
 \end{aligned}$$

$\tau_{\text{net}} =$

$$r_1 T_1 - r_2 T_2 = \underline{I \alpha}$$

3

~~3~~ unknowns

?

Then is α related to a_{1x}, a_{2x} :

$$\begin{aligned} a_{1x} &= r_1 \alpha \\ a_{2x} &= r_2 \alpha \end{aligned}$$

$$\begin{aligned} \textcircled{1} \quad m_1 a &= (1.0)(9.8) = 9.8 & \begin{aligned} & m_2 r_2 \alpha \\ & (2.6)(.2) \alpha \\ & m_1 r_1 \alpha \\ & (1.0)(.51) \alpha \end{aligned} \\ m_2 a &= (2.6)(9.8) = \end{aligned}$$

$$\begin{aligned} \textcircled{1} \quad 9.8 - T_1 &= 0.51 \alpha \\ \textcircled{2} \quad T_2 - 25.48 &= 0.52 \alpha \\ \textcircled{3} \quad \underbrace{0.51}_{r_1} T_1 - \underbrace{0.20}_{r_2} T_2 &= \underbrace{1.7}_{I} \alpha \end{aligned}$$

Wolfram Alpha.

$$\alpha = 0.0475 \text{ rad/s}^2$$

$$a_1 = r_1 \alpha = 0.0242 \text{ m/s}^2$$

$$a_2 = r_2 \alpha = 0.0095 \text{ m/s}^2$$