Assignment 7

$\vec{F}_{net} = m\vec{a}$ (vector)

$\tau_{net} = I\alpha$ (vector)

① Think about I

② $\tau_{net} = ?$

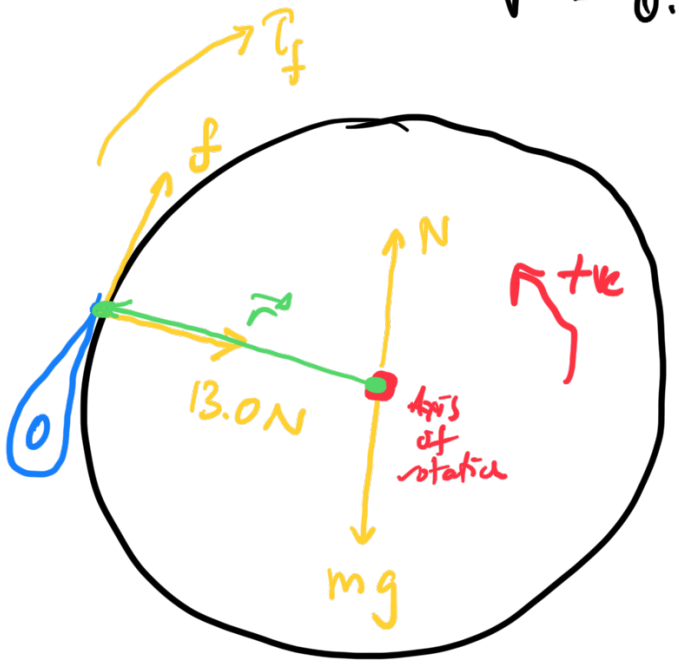
$\vec{\tau}_F = \vec{r} \times \vec{F}$

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

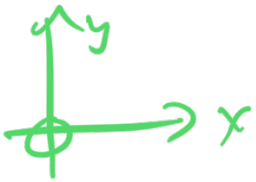
FBD

$m = 83\ kg$

$r = 0.370\ m$



$\omega_i = 80\ rpm$



(1) identify all forces

(2) choose a coordinate system.

(i) choose an axis of rotation

(ii) choose +ve direction.

(3) $\tau_{mg} = |\vec{r}||\vec{F}| \sin\theta = 0$ ✓

0 ✓

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

$\tau_{13.0\,N} = |\vec{r}||\vec{F}| \sin\theta$

$= (.37)(13) \sin(180°)$

$= 0$ ✓

$\tau_f = |\vec{r}||\vec{F}| \sin\theta$

$= -(0.37)(?) \sin(40°)$

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

$\tau_F = -(0.37)(.4)(13.0)$

$= -$ [illegible] N.m

1.924

$\tau_{NET} = \tau_{ms} + \tau_N + \tau_{130} + \tau_f$

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

$\tau_{NET} = I\alpha$

$I_{disk} = \frac{1}{2} M r^2$

$= \frac{1}{2}(83)(.37)^2$

$= 5.6814 \ kg \cdot m^2$

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

$= -0.339$ rad/s

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

$\omega_i = 80$ rpm

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

$= 8.378$ rad/s

$\alpha = -0.339$ rad/s^2

$\Delta\theta = ?$

$$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$$

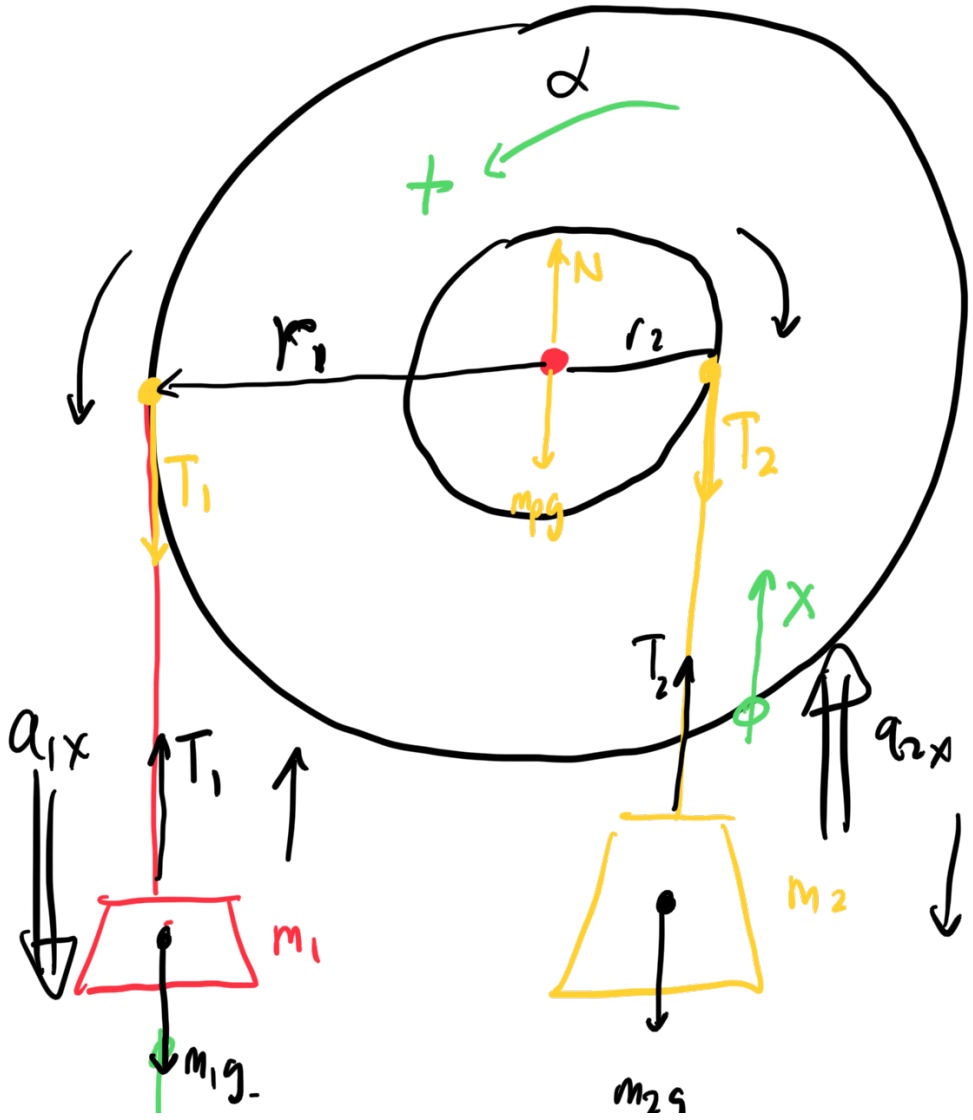
($\omega_f = 0$)

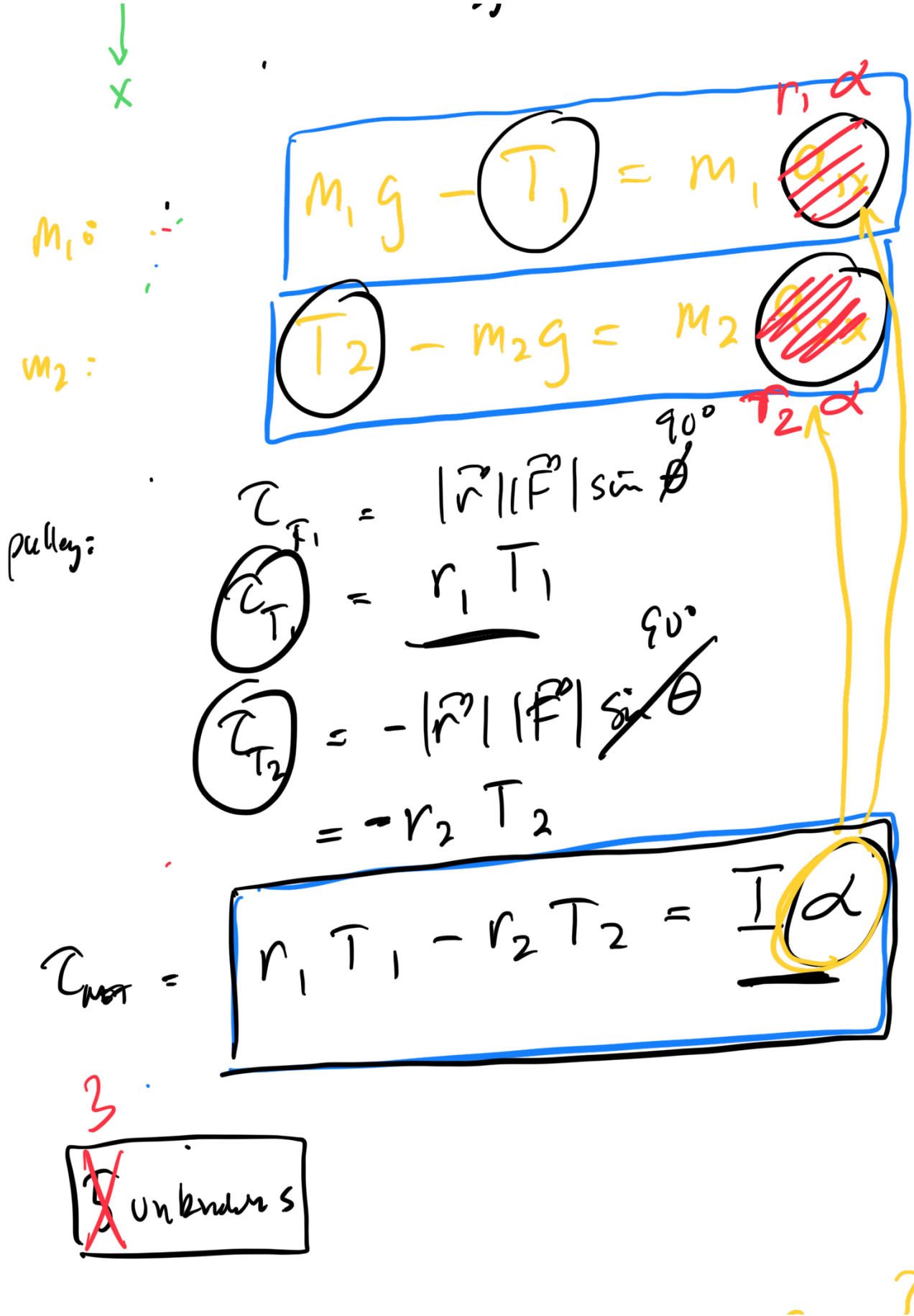
$$\Delta\theta = \frac{-\omega_i^2}{2\alpha} = 103.5 \text{ rad}$$

103.5 rad

b) $\Delta\theta_{(rev)} = \dfrac{\quad}{2\pi \text{ rad/rev}} = 16.48 \text{ rev}$

Question 9. $I = 1.7 \text{ kg m}^2$




x
m_1:
$m_1 g - T_1 = m_1 a_{1x}$
r_1 α
m_2:
$T_2 - m_2 g = m_2 a_{2x}$
T_2 α
pulley:
$\tau_{F_1} = |\vec{r}||\vec{F}| \sin 90°$
$\tau_{T_1} = r_1 T_1$
$\tau_{T_2} = -|\vec{r}||\vec{F}| \sin 90°$
$= -r_2 T_2$
$\tau_{NET} = r_1 T_1 - r_2 T_2 = I\alpha$
3
unknowns

How is α related to a_{1x}, a_{2x}?

$$a_{1x} = r_1 \alpha$$

$$a_{2x} = r_2 \alpha$$

① $m_1 g = (1.0)(9.8) = 9.8$

$m_2 g = (2.6)(9.8) =$

$m_2 r_2 \alpha$

$(2.6)(.2)\alpha$

$m_1 r_1 \alpha$

$(1.0)(.51)\alpha$

① $9.8 - T_1 = 0.51\alpha$

② $T_2 - 25.48 = 0.52\alpha$

③ $0.51 T_1 - 0.20 T_2 = 1.7\alpha$

$r_1 T_1 - r_2 T_2 = I\alpha$

Wolfram Alpha.

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

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

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