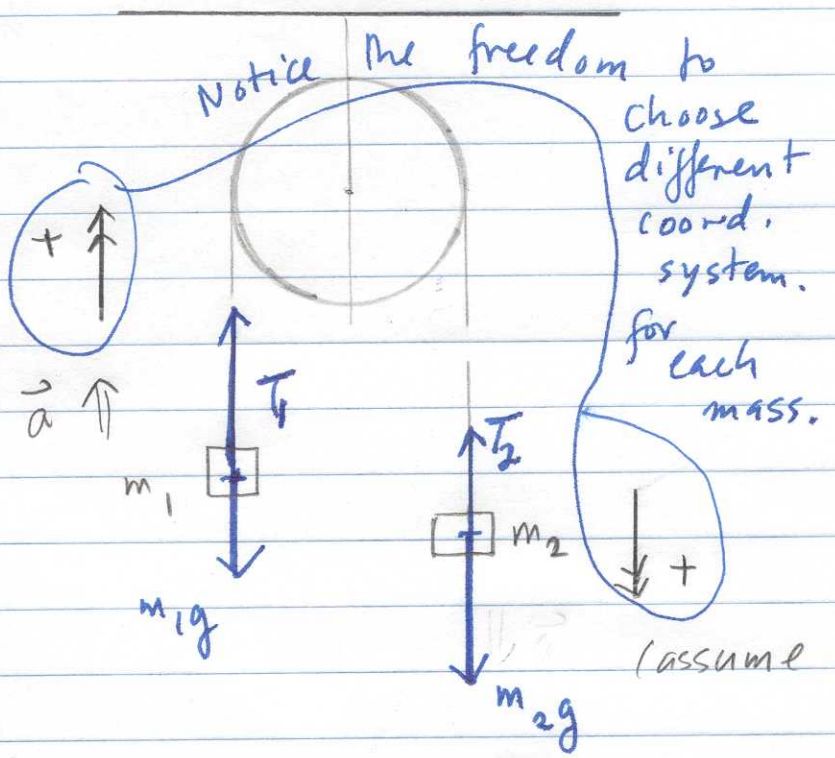
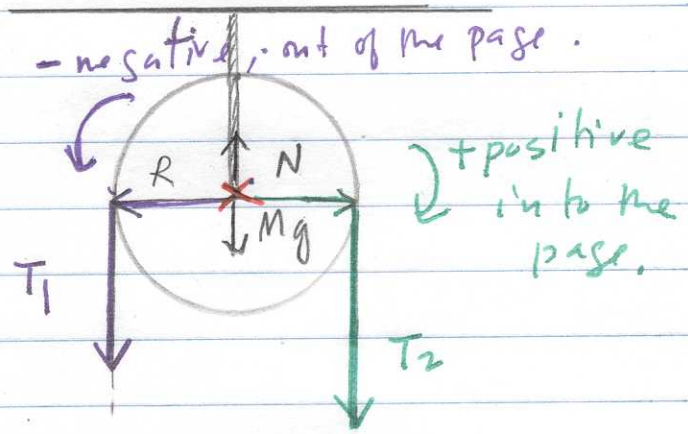
Lecture Quiz # 11, Monday May 5.





(assume $m_2 > m_1$)

For the pulley: $\tau_{net,ext} = I\alpha$ calculating torques and moment of inertia about the center of mass.

$$T_2 R - T_1 R = I_{cm}\alpha$$

$$(T_2 - T_1)R = \frac{1}{2}MR^2\alpha$$

$$\Rightarrow \boxed{T_2 - T_1 = \frac{1}{2}MR\alpha} \quad 1.$$

For object 1: $F_{net,ext} = m_1 a$

$$\boxed{T_1 - m_1 g = m_1 a} \quad 2.$$

For object 2: $F_{net,ext} = m_2 a$

$$\boxed{m_2 g - T_2 = m_2 a} \quad 3.$$

Note that a is related to α as $\boxed{a = R\alpha}$.

You know why, right?

$\Rightarrow T_2 - T_1 = \frac{1}{2} M \cancel{R} \frac{a}{\cancel{R}}$ ← * On the Quiz, I didn't ask for the rest of this.

$\Rightarrow T_2 - T_1 = \frac{1}{2} Ma$ eq 1'

$T_1 - m_1 g = m_1 a \Rightarrow T_1 = m_1 g + m_1 a$

$m_2 g - T_2 = m_2 a \Rightarrow T_2 = m_2 g - m_2 a$

substituting in eq

$(m_2 g - m_2 a) - (m_1 g + m_1 a) = \frac{1}{2} Ma$

$\Rightarrow m_2 g - m_1 g = \frac{1}{2}(M + m_1 + m_2) a$

$\Rightarrow a = \frac{m_2 g - m_1 g}{2(M + m_1 + m_2)}$

$\Rightarrow a = \frac{(m_2 - m_1) g}{2(M + m_1 + m_2)}$

* Note that if $M \doteq 0$, then we go back to the result you would've gotten back in the earlier part of the semester when we didn't have to worry about the rotation of the pulley - Also, in that case T_1 would be equal to T_2.