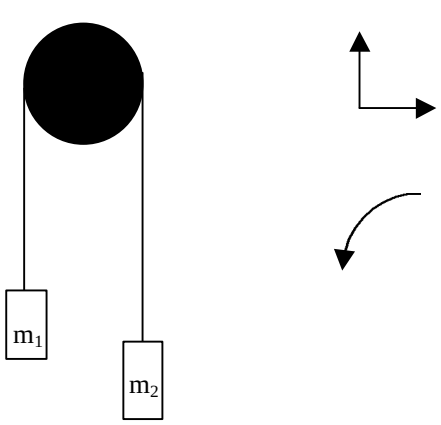
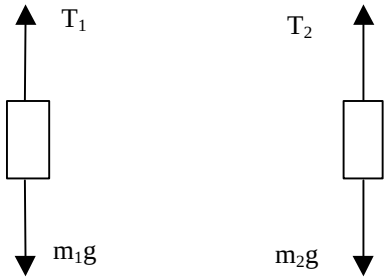
Example: Find the acceleration of the following system ($m_1 > m_2$). The pulley has mass M and radius R. Note $T_1 \neq T_2$.

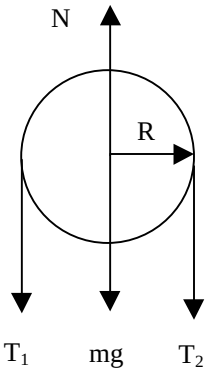




- $T_1 - m_1 g = -m_1 a_1$
- $T_2 - m_2 g = m_2 a_2$
- $T_1 R - T_2 R = Ia = MR^2 a$

Note: $a_1 = a_2 = a_t = Ra$

Note: N & mg exert no torque about the pivot.



1. $T_1 - m_1 g = -m_1 a$
2. $T_2 - m_2 g = m_2 a$
3. $T_1 - T_2 = Ma$

Multiply equation #1 by -1 and add all three together:

$$-T_1 + m_1 g + T_2 - m_2 g + T_1 - T_2 = m_1 a + m_2 a + Ma$$

$$m_1 g - m_2 g = m_1 a + m_2 a + Ma \therefore a = \frac{m_1 - m_2}{m_1 + m_2 + M} g$$