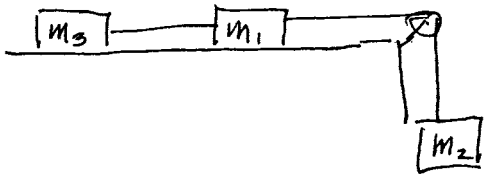
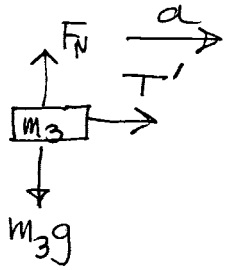
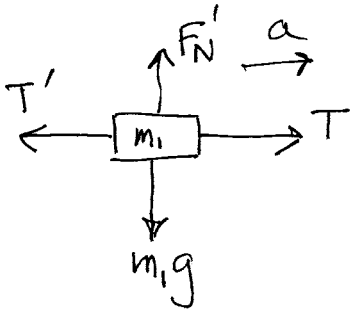
4.





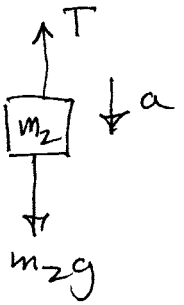
$\Sigma F_x = m a_x$

$$\boxed{T' = m_3 a} \quad (1)$$



$\Sigma F_x = m a_x$

$$\boxed{T - T' = m_1 a} \quad (2)$$



$+\downarrow \Sigma F_y = m a_y$

$$\boxed{m_2 g - T = m_2 a} \quad (3)$$

Adding (1), (2), & (3):

$$\cancel{T'} + \cancel{T} - \cancel{T'} + m_2 g - \cancel{T} = m_3 a + m_1 a + m_2 a$$

$$m_2 g = (m_1 + m_2 + m_3) a$$

$$\boxed{a = \frac{m_2}{m_1 + m_2 + m_3} g}$$

If $m_2 = 0$, expect $a = 0$

check: $a = \frac{0}{m_1 + m_2 + 0} g = 0$ ✓

If $m_3 = 0$, expect $a = \frac{m_2 g}{m_1 + m_2}$ (same as prob. 3)

check: $a = \frac{m_2}{m_1 + m_2} g$ ✓