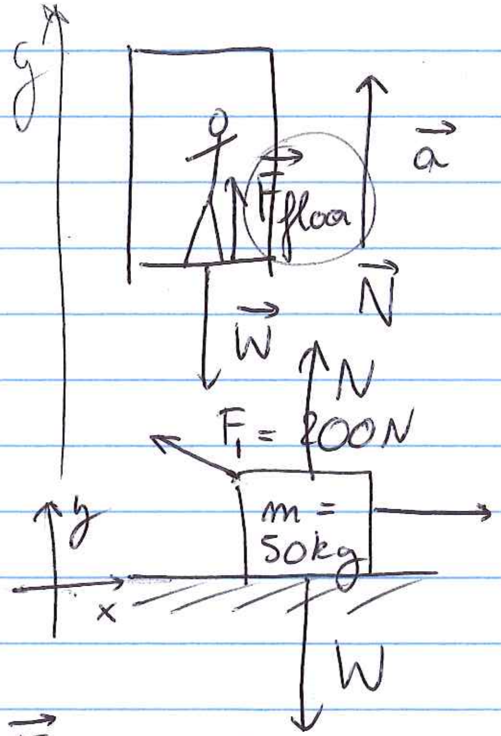
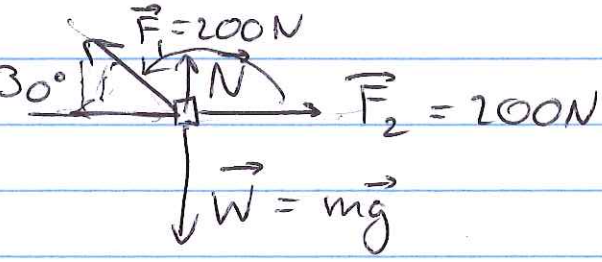


$N - W = ma > 0$

$N > W$



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

x: $-F_1 \cos 30° + F_2 = m a_x$

y: $F_1 \sin 30° + N - mg = m a_y$

$a_x = \frac{1}{m}\left(-F_1 \cos 30° + F_2\right) = +0.54\ m/s^2$

could a_y be non-zero?

assumption: $a_y = 0 \rightarrow$ calculate N

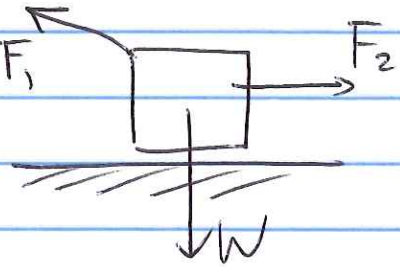
since N can only "push", N has to be positive

$F_1 \sin 30° + N - mg = 0$

$N = mg - F_1 \sin 30° = +390\,N > 0$

what if $F_1 = 1200\,N \rightarrow N = -110\,N < 0$

$\rightarrow a_y \neq 0$ but $N = 0$

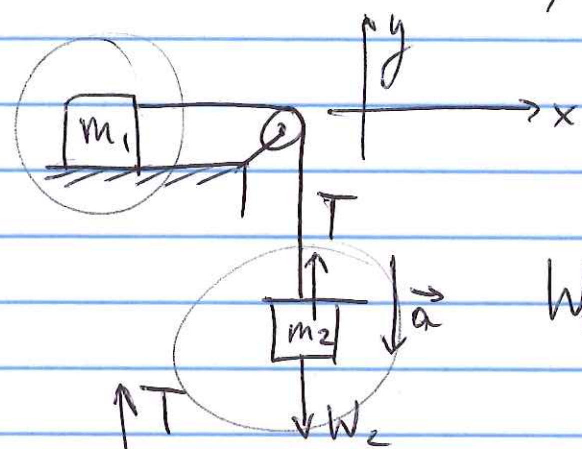


$$F_1 \sin 30° - mg = ma_y$$

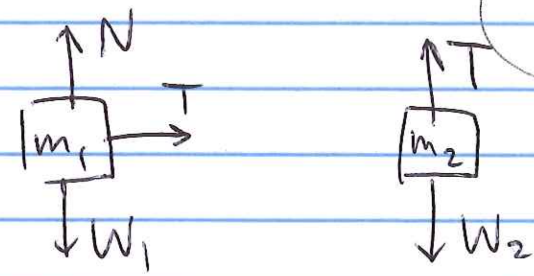
$$\hookrightarrow a_y = \frac{1}{m}\left(F_1 \sin 30° - mg\right)$$

$$= +2.2\ m/s^2$$

* Pulley



$W_2 > T$



$$\begin{cases} x: T = \underline{m_1 a_{1x}} \\ y: N - W_1 = 0 \end{cases} \qquad \begin{cases} x: 0 = a_{2x} \\ y: T - W_2 = \underline{m_2 a_{2y}} \end{cases}$$

$$|a_{1x}| = |a_{2y}| \rightarrow a_{1x} = -a_{2y}$$

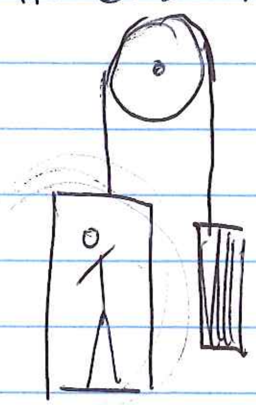
$$T = m_1 a_{1x} = -m_1 a_{2y} \rightarrow a_{2y} = -\frac{T}{m_1}$$

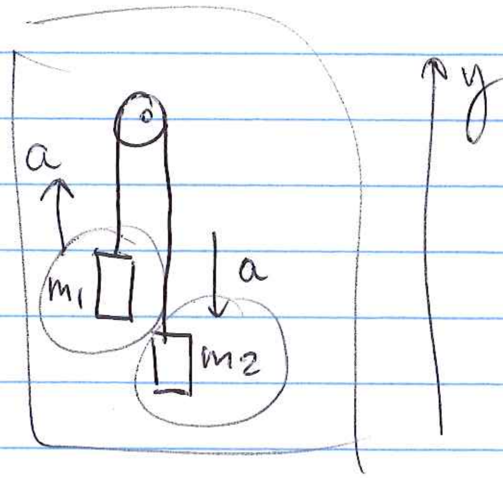
$$T - m_2 g = m_2\left(-\frac{T}{m_1}\right)$$

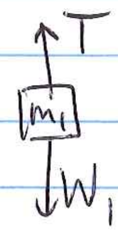
$$\rightarrow T - m_2 g = -\frac{m_2}{m_1} T$$

$$\rightarrow T\left(1 + \frac{m_2}{m_1}\right) = m_2 g \rightarrow T = \frac{\overbrace{m_2 g}^{W_2}}{\left(1 + \frac{m_2}{m_1}\right)} < W_2$$

* Atwood's machine







$$y: \quad T - W_1 = m_1 a_1 \qquad T - W_2 = m_2 a_2$$

$$|a_1| = |a_2| = a$$

$a<0$

$$a_1 = +a \qquad a_2 = -a$$

$$T - m_1 g = m_1 a \qquad T - m_2 g = -m_2 a$$

$$a = \frac{1}{m_1}(T - m_1 g)$$

$$T - m_2 g = -\frac{m_2}{m_1}(T - m_1 g)$$

$$T = \frac{2 m_1 m_2}{m_1 + m_2} g \quad W_2$$

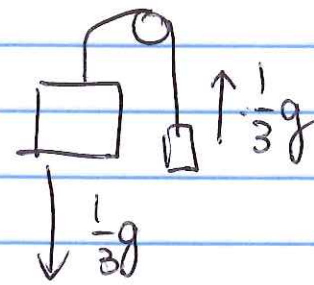
$$m_1 = 2m_2: \quad T = \frac{2(2m_2)}{2m_2 + m_2} W_2 = \frac{4}{3} W_2 > W_2$$

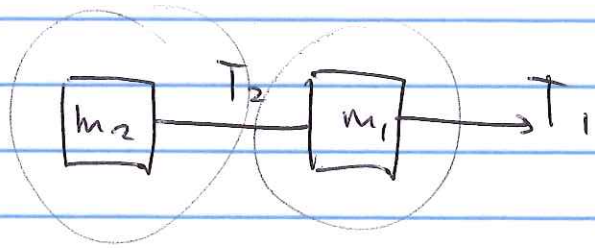
$$a = \frac{m_2 - m_1}{m_2 + m_1} g$$

$$m_1 = 2m_2 \rightarrow a = \frac{m_2 - 2m_2}{m_2 + 2m_2} g = \frac{-1}{3} g$$

$$a_1 = +a = -\frac{1}{3} g$$

$$a_2 = -a = \frac{1}{3} g$$





$$m_2 a_2 = T_2 \qquad m_1 a_1 = T_1 - T_2$$

$$a_2 = a_1 \longrightarrow a_2 = \frac{T_2}{m_2}$$

$$\frac{m_1}{m_2} T_2 = T_1 - T_2$$

$$T_1 = \frac{m_1}{m_2} T_2 + T_2 > T_2$$