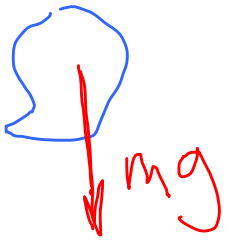
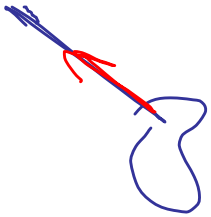
Phys 2110-4 2/8/12

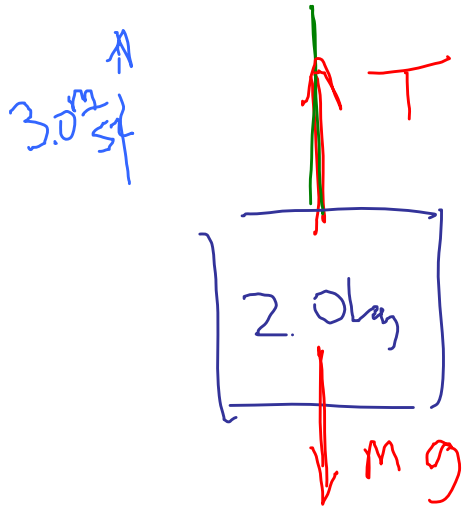
Note Title 2/8/2012

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





Example A 2.0 kg mass attached to a string, string is pulled so that mass acc's upward at $3.0\ m/s^2$. Find tension in string.



$$F_{net,y} = ma_y$$

$$T - mg = ma_y$$

$$T = mg + ma$$

$$= m(g+a) = (2.0\,kg)(9.8\ m/s^2 + 3.0\ m/s^2)$$

$$= 25.6\ N$$

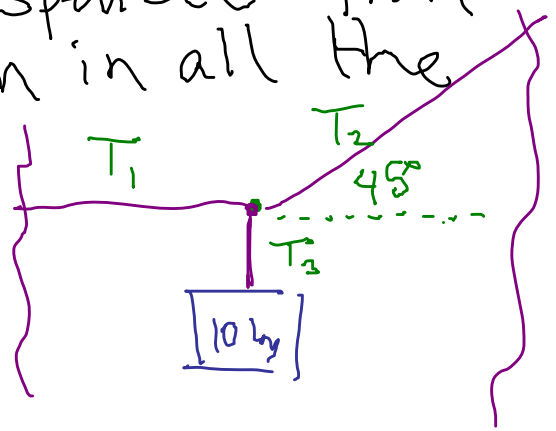
Guy in elevator

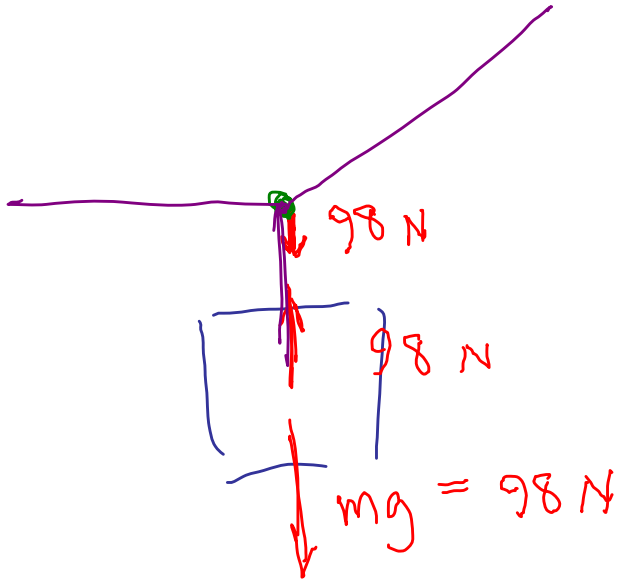
$\therefore 2.4\ m/s^2 \downarrow$

F_{floor} = "Apparent weight"

$a_y = -2.4\ m/s^2$

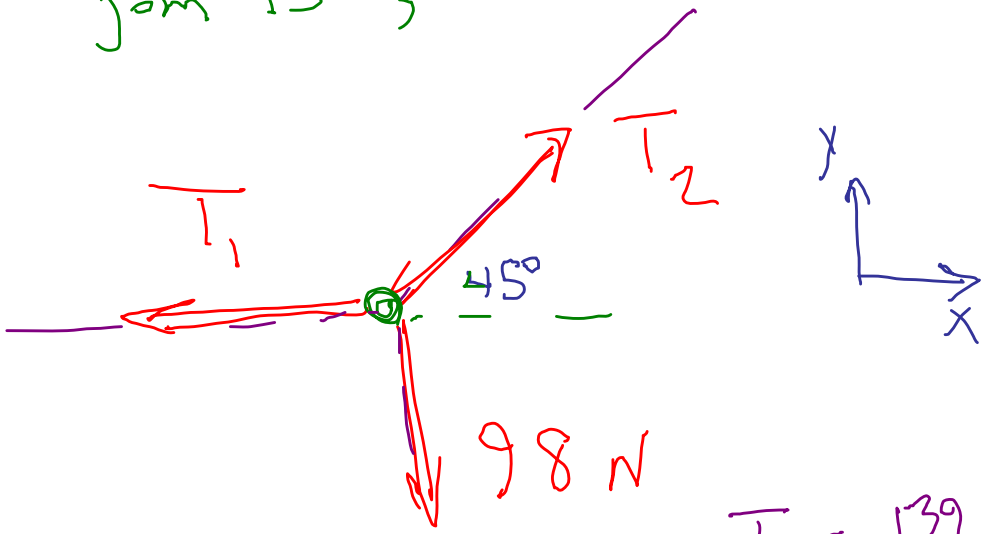
Example: A 10-kg mass is suspended from ropes as shown. Find tension in all the ropes.





$T = 98\ N$

Sum of forces where ropes join is zero



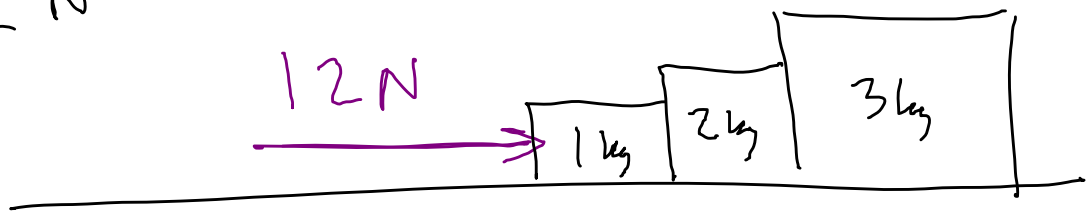
$T_2 = 139\ N$

$T_1 = 98N$

X - forces $\quad -T_1 + T_2 \cos 45° = 0$

Y - forces $\quad +T_2 \sin 45° - 98\ N = 0$

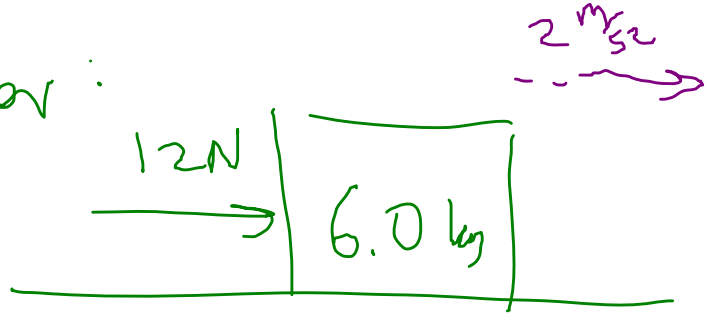
4.45 Blocks are lined up as shown, 12 N force applied to leftmost

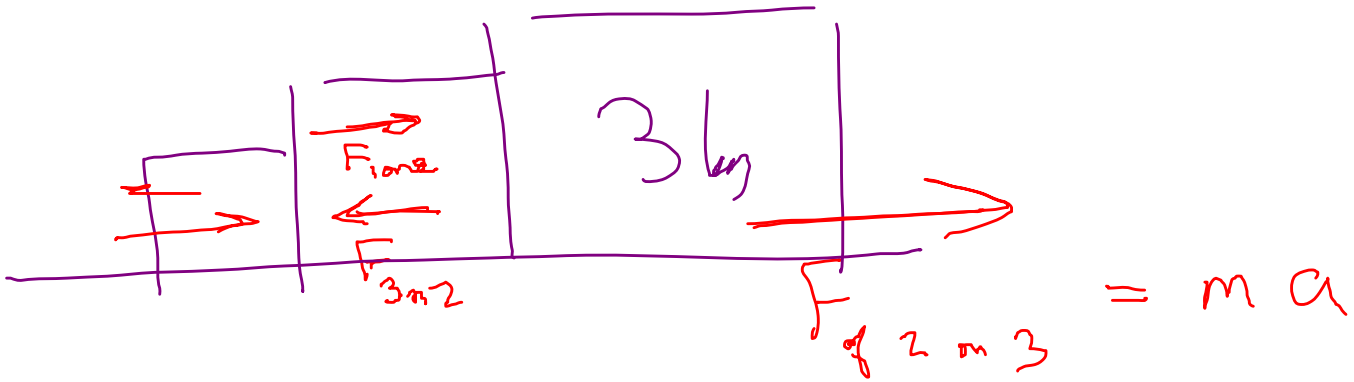


What force does middle block exert on rightmost block.

All blocks move together:

Accel of all blocks in $2\ m/s^2$ to the right.

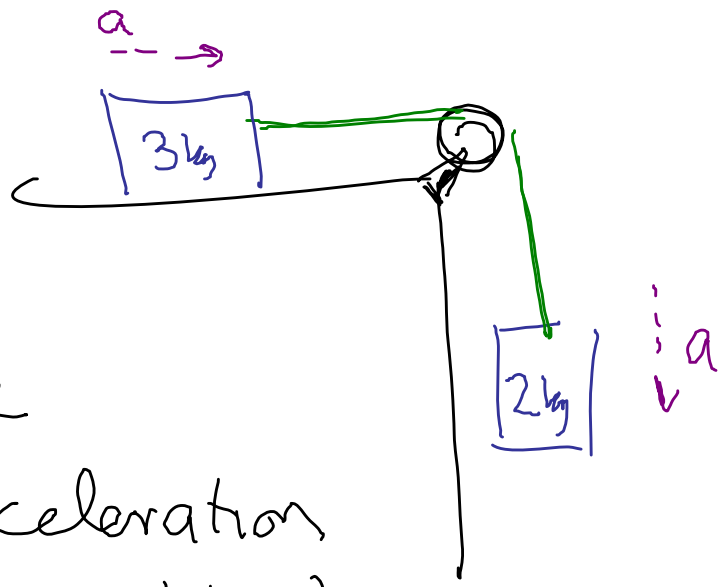




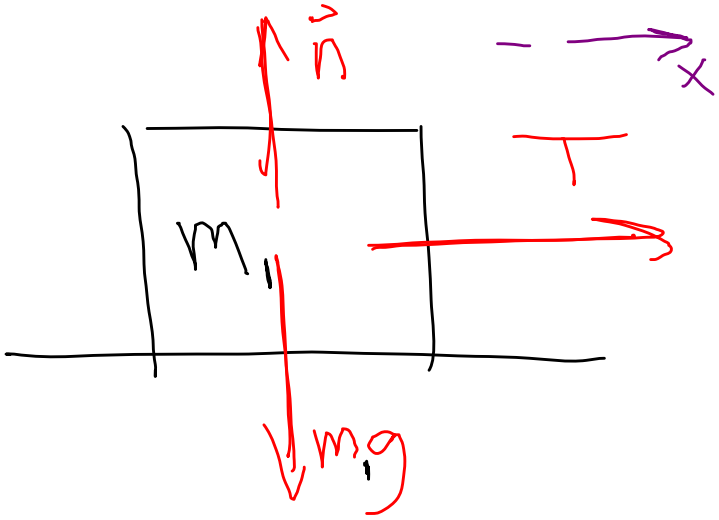
$$F_{2 \text{ on } 3kg} = m a = (3kg)\left(2 \tfrac{m}{s^2}\right)$$

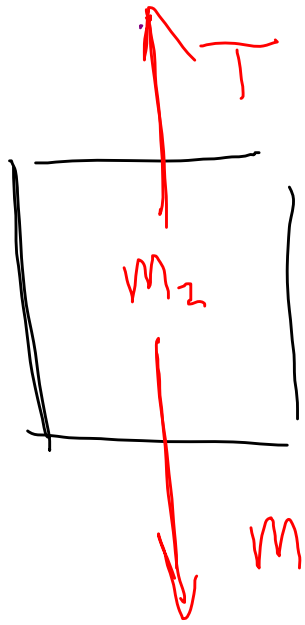
$$= 6N$$

Example: Masses joined by string as shown, string goes over idea pulley, table is frictionless. Find acceleration of masses (& tension in string).



Mag's of accel's are same (joined by string!)





Same T

+ a

These cancel

$$T = m_1 a_x$$
$$= m_1 a$$

$$m_2 g - T = m_2 a$$

Do math, --

T, a

$$T = m_1 a$$

$$m_2 g - T = m_2 a$$

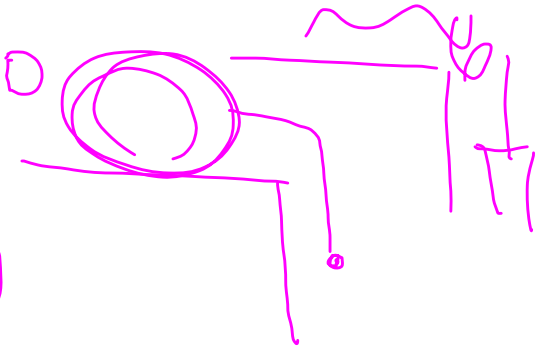
Add

$$m_2 g = m_1 a + m_2 a = (m_1 + m_2)\, a$$

$$\boxed{a = \frac{m_2 g}{(m_1 + m_2)}} = \frac{2.0\,\text{kg}\quad (9.8\,\frac{m}{s^2})}{5.0\,\text{kg}}$$

$$= 3.9\,\frac{m}{s^2}$$

$m_1 = 0$



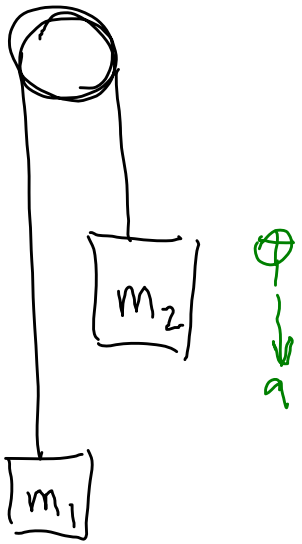
$$\frac{m_2 g}{(0 + m_2)} = g$$

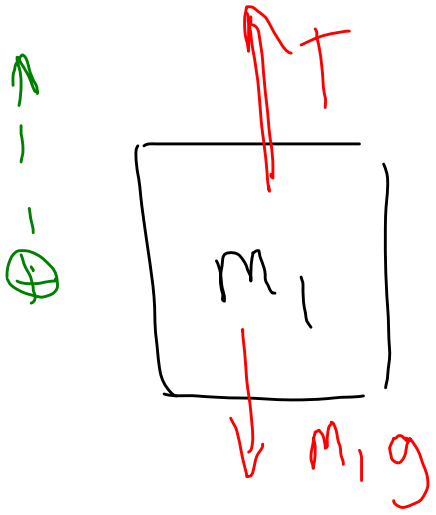
Similar problem

Suppose $m_2 > m_1$

Find accel of masses, tension in string.

Atwood machine.





$$T - m_1 g = m_1 a$$

$$T - m_1 g = m_1 a$$

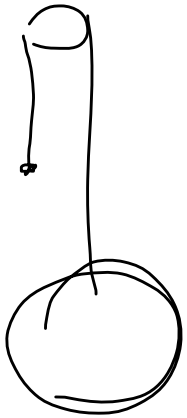
$$m_2 g - T = m_2 a$$

Add,

$m_1 = m_2$

$$m_2 g - m_1 g = m_1 a + m_2 a$$

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



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