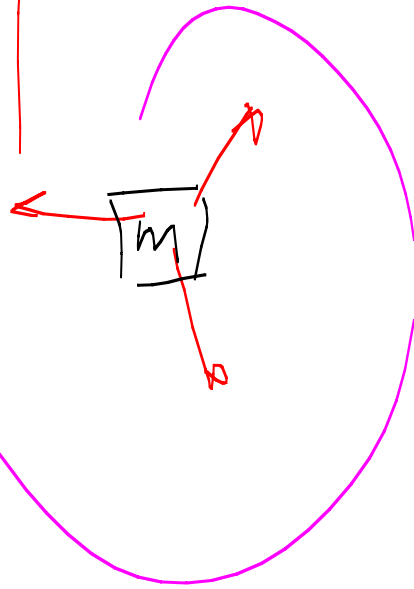
Phys 2110-5 9/21/12

Note Title 9/21/2012

Chap 4 Forces

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



Free-body diagram

4.29

Weight = mg

F_{floor} = apparent weight

$$F_{Floor} - mg = ma$$

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

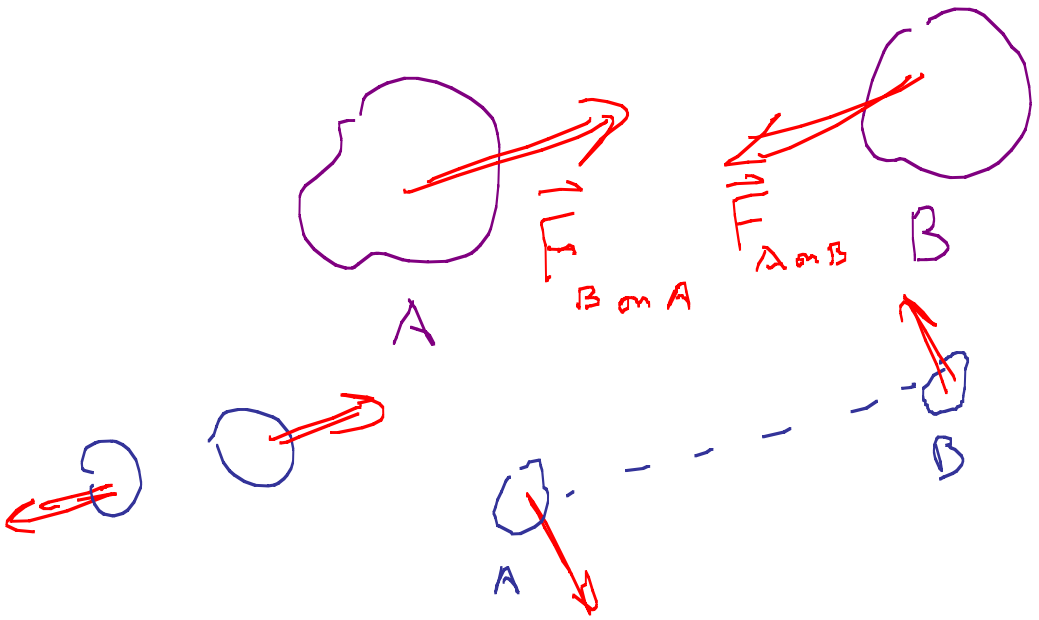
$F_{floor} = 384\ N$ < mg

$g = 9.8\ m/s^2$

If a were $+2.4\ m/s^2$ app wt > mg

Newton's 3rd Law

Forces come from some other mass.

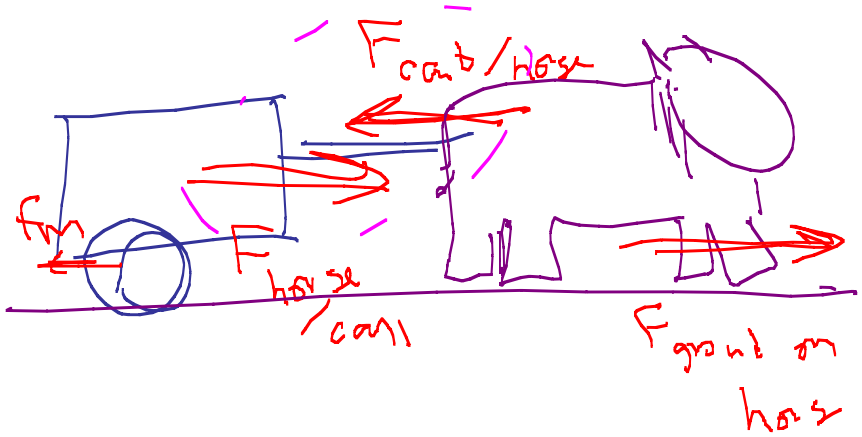


3rd Law: For two masses (A & B),

$$\vec{F}_{A\text{ on }B} = -\vec{F}_{B\text{ on }A}$$

forces

"Action" & "Reaction"

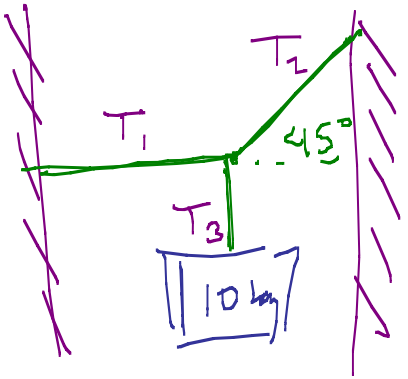


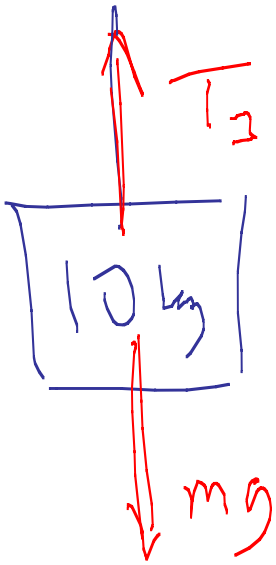
$\vec{F}_{net} = m\vec{a}$

single obj

Lots more problems

Example Mass (10 kg) is held up by ropes conn'd together as shown, find tension in all ropes

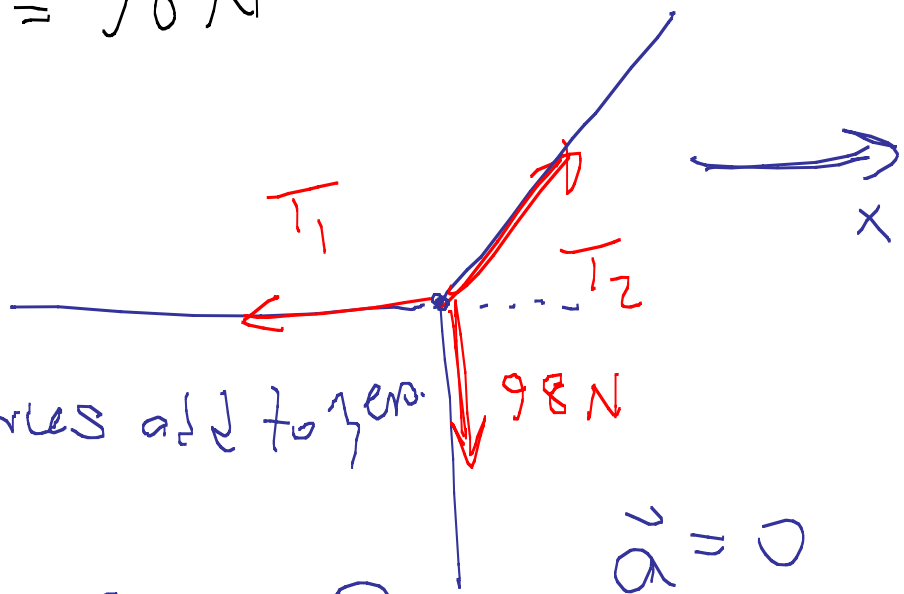




$\vec{a} = 0$

Forces cancel

$T_3 = mg = 98\ N$



$T_1 = T_2 \cos 45°$

$= 139_N \cos 45° = \boxed{98\ N}$

These forces add to zero.

x, y.

$\vec{a} = 0$

$a_x = 0$

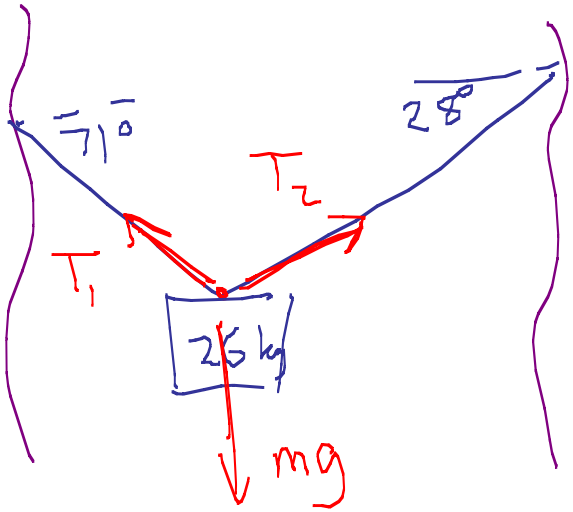
$a_y = 0$

x forces: $-T_1 + T_2 \cos 45° = 0$

y forces: $T_2 \sin 45° - 98\ N = 0$

$T_2 = \boxed{139\ N}$

4.36



These add to zero

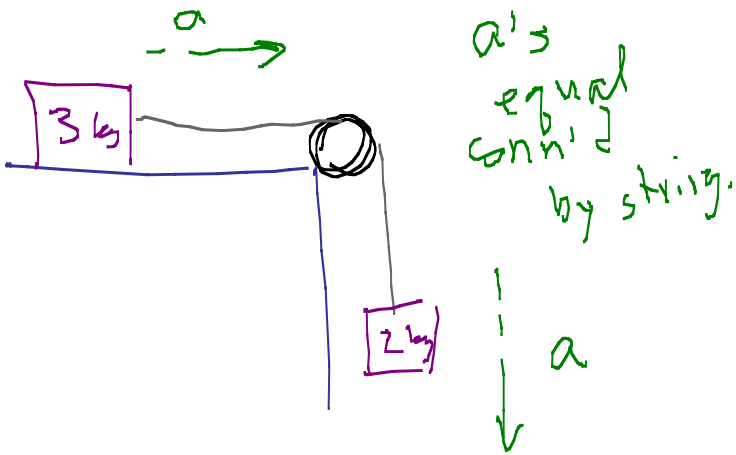
x comp

y comp

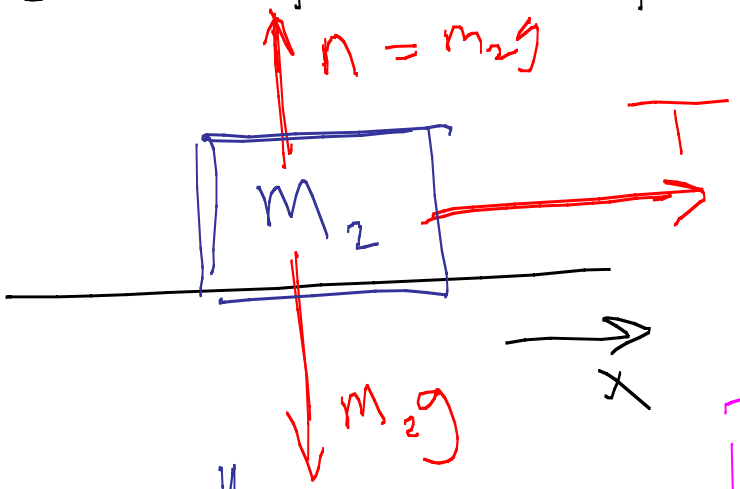
T_1, T_2

Example

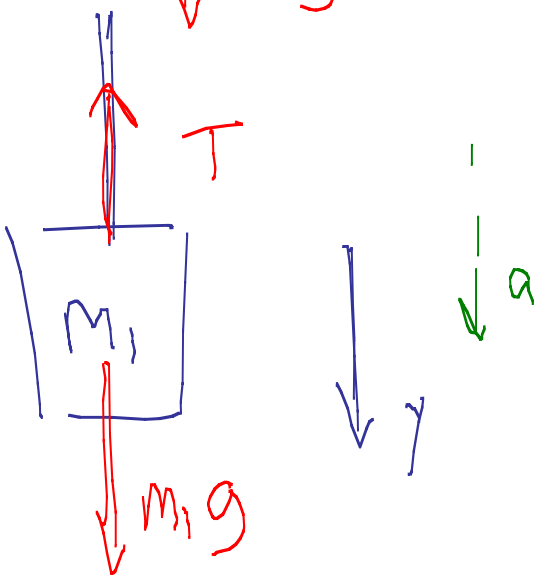
Two masses (3 kg, 2 kg) are attached as shown, surface is frictionless, pulley is ideal. Find accel. of masses.



Draw force diagram for each mass



$$T = m_2 a \qquad (1)$$



$$m_1 g - T = m_1 a \qquad (2)$$

Unk's: a, T

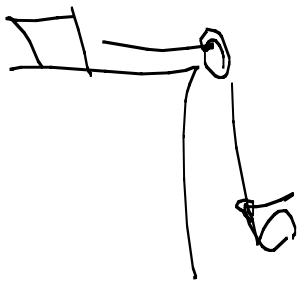
Sub. (1) into (2)

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

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

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

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



Check $m_1 = 0$ m_2

$a = 0$

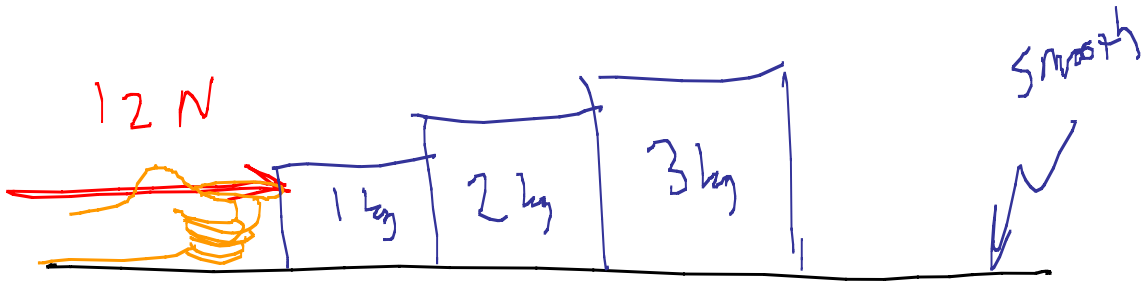
Check m_1 $m_2 = 0$

$$a = \frac{m_1 g}{m_1}$$

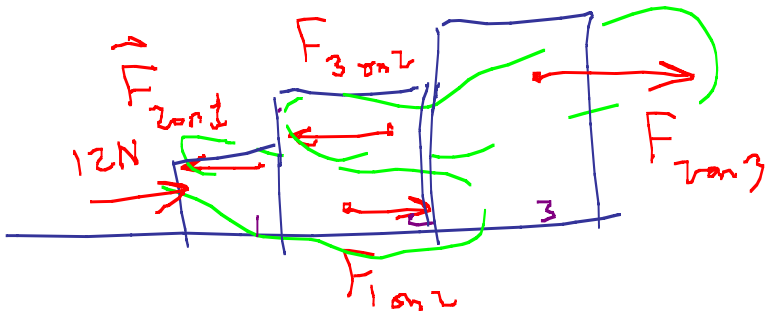
$$T = m_2 a = \frac{m_1 m_2 g}{(m_1 + m_2)}$$

$$a = \frac{(2\,kg)(9.8\,m/s^2)}{(5\,kg)} < 3.92\ \frac{m}{s^2} = g$$

4.45 Blocks 1, 2, 3, kg on horiz frictionless table.



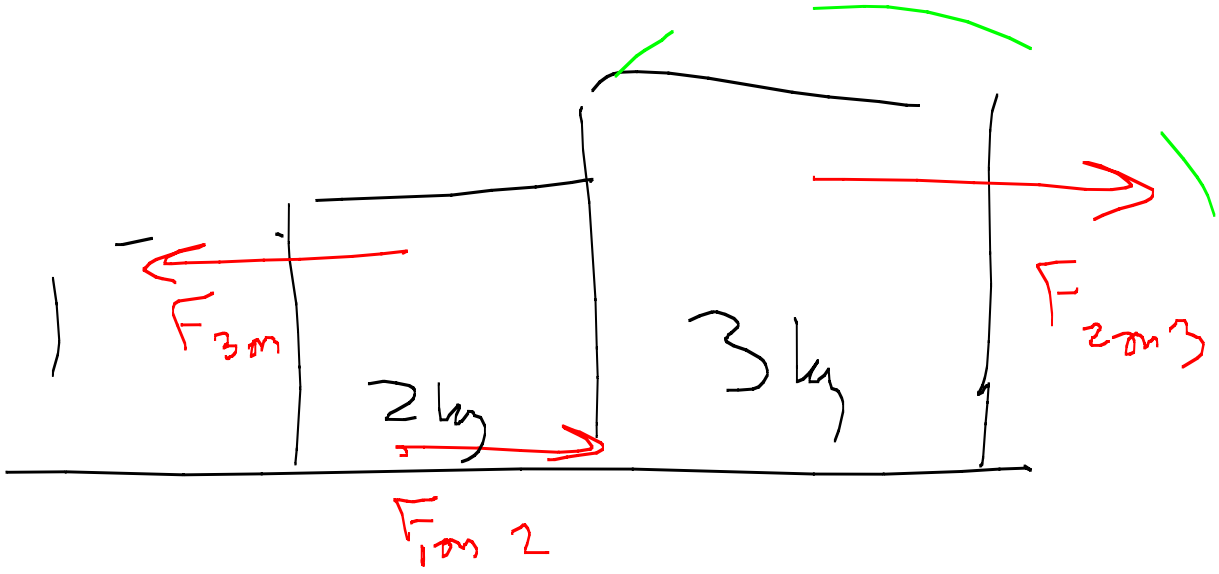
What force does middle block exert on rightmost block?



Same accel

Each $\Sigma F = ma$

Blocks all move together



$$\vec{F}_{2on3} = \vec{F}_{net} = m_3 a = (3\,kg)\left(2\,\frac{m}{s^2}\right)$$

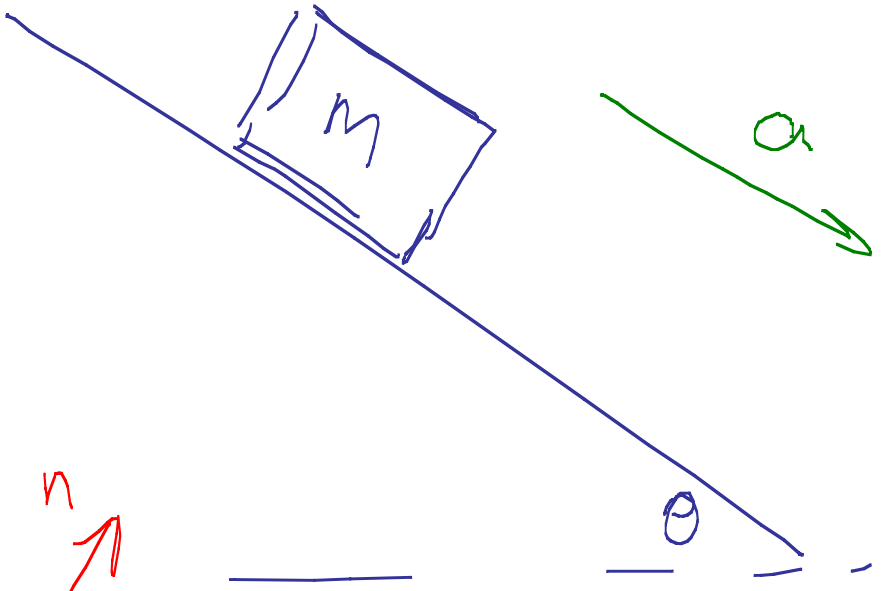
$$= 6\,N$$

Inclined plane:

Frictionless slope

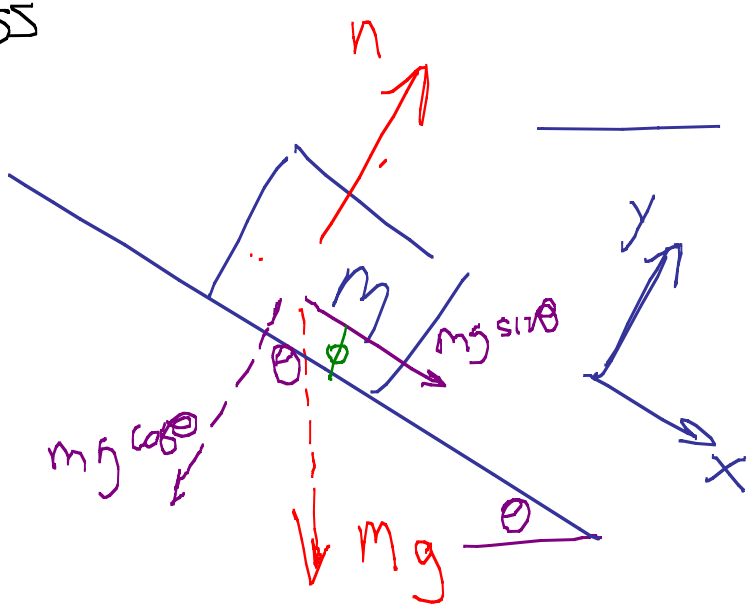
Angle θ

Release mass



y forces cancel

not x forces



Expect $a < g$!

a_x

$a_y = 0$