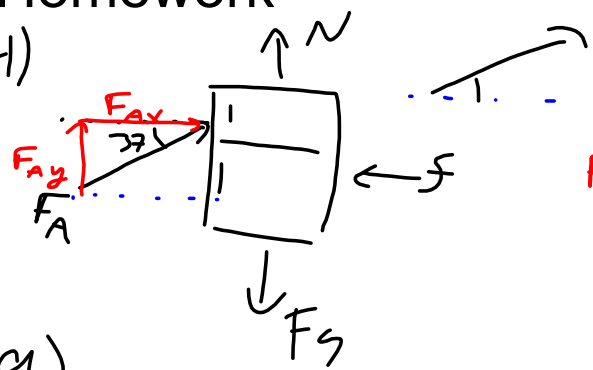
Homework

4)



$F_{Ax} = F_A \cos\theta$
$= 600N \cos 37°$
$= 480N$

$F_{Ay} = 600N \sin 37°$
$= 360N$

a)

x

$\Sigma F_x = ma_x$

$F_{Ax} - f = ma_x$

$480N - 475N = (150kg)a_x$

$\frac{5N}{150kg} = a_x = 0.03 m/s^2$

b)

$\Sigma F_x = ma_x$

$F_{Ax} - f = ma_x$

$480N - \mu N = (150kg)a_x$

$\mu = 0.4$

$480N - 0.4(1110N) = (150kg)a_x$

$480N - 444N = (150kg)a_x$

$36N = (150kg)a_x$

$a_x = \frac{36N}{150kg} = 0.24 m/s^2$

y

$\Sigma F_y = 0$

$N + F_{Ay} - F_g = 0$

$N = F_g - F_{Ay}$

$= (150kg)(9.8 m/s^2) - 360N$

$= 1110N$

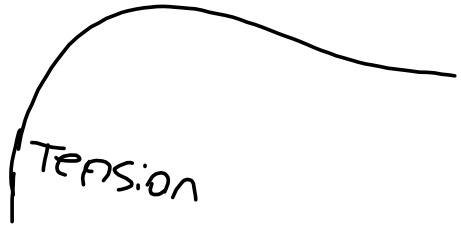
Ropes: *Stringing you Along*

If you and some one else are holding a rope and you pull with 5 N on one end of a rope, how much force do you think the person at the other end of the rope will experience?

Force In a rope is Constant

One challenge with ropes is that ropes are flexible and can change direction. Ropes can only pull in the direction the rope is aligned in. Since ropes are flexible, the direction of the force may continuously change.

In a rope we talk about tension. Tension is the magnitude of the force **NO DIRECTION.** The direction a rope applies a force in depends on how the rope is attached to the object.



Pulleys:

Are a device that redirects a rope and thereby the direction of the force from the rope.

Pulleys **DO NOT** change the magnitude of a force..

A System:

A system is made up of many objects that are rigidly connected together.

In a system we can sum the masses of the system to get the total inertia and sum all the forces acting on each object in the system.

Newton's Second Law looks like: $\sum F_{sys} = m_{sys}a$

Ropes become rigid under tension.

Example

A 5 kg mass and a 4 kg mass are tied together. a 18 N force is pulling on the 4 kg mass while a 27 N force is pulling the 5 kg mass in the opposite direction.

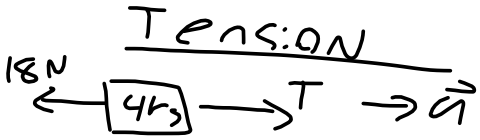
What is the acceleration of the system?

What is the tension in the rope?

$\Sigma F_{sys} = m_{sys} a_{sys}$

$27N - 18N = (9kg)a$

$a = \frac{9N}{9kg} = 1m/s^2$



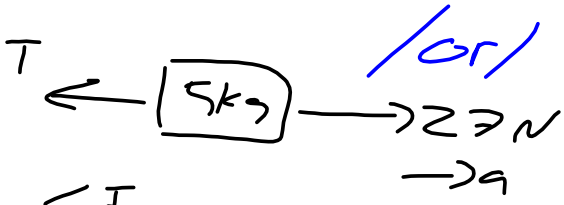
$\Sigma F_4 = m_4 a_4$

$T - 18N = (4kg)(1m/s^2)$

$T = 18N + 4N$

$= 22N$

/or/



$\Sigma F_5 = m_5 a_5$

$27N - T = (5kg)(1m/s^2)$

$27N - 5N = T$

$22N = T$

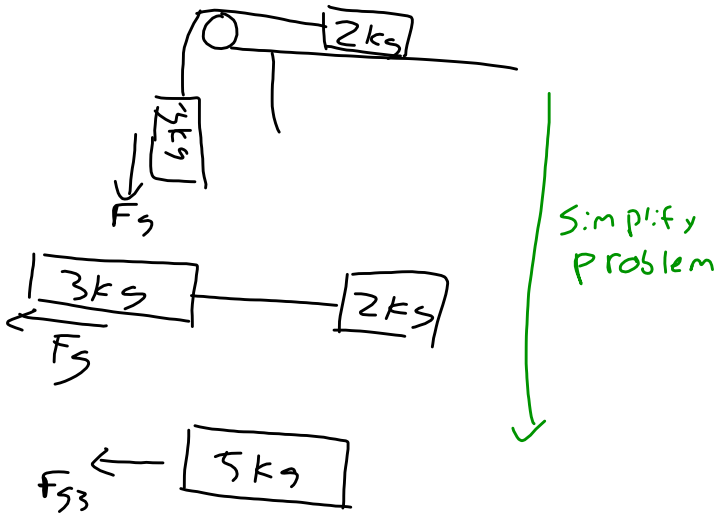
Same Problem Now With a Pulley

The pulley makes this problem look like it's more than 1D, but it's not! ***Get rid of the pulley and straighten out the rope in your analysis.***

A 3 kg mass and a 2 kg mass are tied together and hung over a pulley fastened to a table. The 3 kg mass hangs off the side of the table while the 2 kg mass sits on the table. Assuming the table top is frictionless,

what is the acceleration of the masses?

what is the tension in the rope?

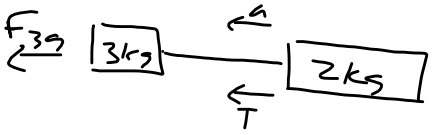


$$\Sigma F_{sys} = m_{sys} a_{sys}$$

$$F_{g3} = (5kg)\, a_{sys}$$

$$(3kg)(9.8 m/s^2) = (5kg)\, a_{sys}$$

$$a_{sys} = 5.88 m/s^2$$



$$\Sigma F_2 = m_2 a$$

$$T = m_2 a$$

$$= (2kg)(5.88 m/s^2)$$

$$= 11.76 N$$

Homework:

Finish problem set

Can practice up to Q.14 on Forces and Friction worksheet