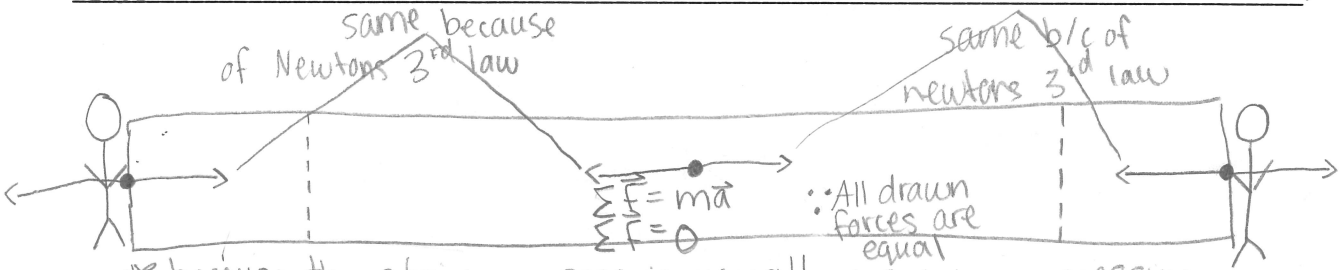
Jamie
Physics 11

Section 5.4: Tension

Tension occurs within a material (usually a rope or string) that is being pulled or stretched.

Tension occurs because every peice of the string pulls on the peices beside it.



* because the string or rope is usually way less massive than the other things in the problem, we assume its massless.

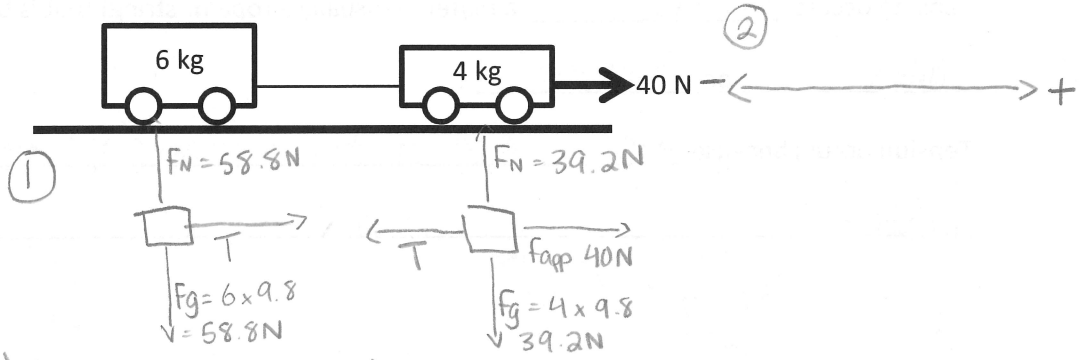
This helps to illustrate why tension is the same everywhere in a rope and equals the force at both ends.

The steps for solving tension problems are...

1) FBD for each object
2) Choose an "axis of motion" (can be curved)
3) Find acceleration of whole system. ($\sum \vec{F} = m\vec{a}$ for all objects together)
4) Find tension ($\sum \vec{F} = m\vec{a}$ for one object)

Example: Two carts, attached by a rope, are being pulled to the right with a force of 40 N.

a) Find the acceleration of the carts.
b) Find the tension in the rope.



③ $\sum \vec{F} = m\vec{a}$ whole system

$+T - T + 40 = (6+4)\vec{a}$

$40 = 10\vec{a}$

$\vec{a} = \boxed{4 m/s^2 \text{ right}}$

④ $\sum \vec{F} = m\vec{a}$ for one object (6kg cart)

$+T = (6)(4)$

$T = 24N$

or

$-T + 40 = (4)(4)$

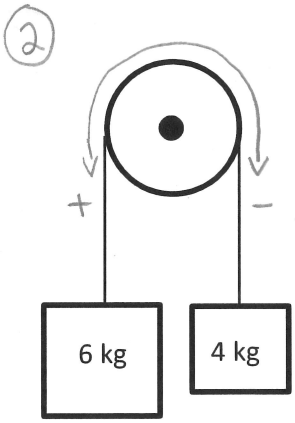
$-T + 40 = 16$

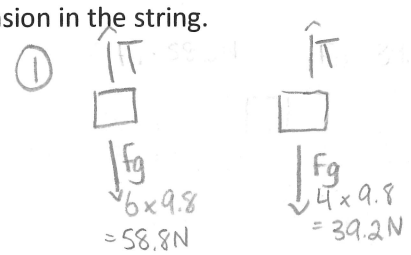
$-T = -24$

$T = 24$

Example: Two masses hanging from a *massless* string over a *frictionless* pulley are released from rest.

a) Find the acceleration of the system.
b) Find the tension in the string.





③ $\sum \vec{F} = m\vec{a}$

$+58.8 + T - T - 39.2 = 10\vec{a}$

$\boxed{\vec{a} = 1.96 m/s^2}$

④ $\sum \vec{F} = m\vec{a}$

$+T + 58.8 = (6)(1.96)$

$\boxed{T = 47.04N}$