Newton's 3rd Law

- For every action force there is a reaction force that is equal in magnitude and opposite in direction.
- These two forces act on TWO DIFFERENT objects.

1. Iggy is driving his bumper car (total mass = 230 kg) with a velocity of 16 m/s [E] when he collides with Selma's bumper car (total mass = 185 kg) that is initially moving at 19 m/s [W]. The collision lasts for 0.22 s. The velocity of Iggy's car after the collision is 7 m/s [E]. Determine

a) the acceleration of Iggy's car during the collision.
b) the net force acting on Iggy's car during the collision.
c) the acceleration of Selma's car during the collision.

a) $\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$

$\vec{a} = \frac{7 - (16)}{0.22}$ = -40.9

= 40.9 m/s^2 [W]

b) $\vec{F}_{net} = m\vec{a}$ = (230)(-40.9)

= 9407 N [W]

c) Reaction force (force exerted on Selma's car by Iggy's car) = 9407 N [E]

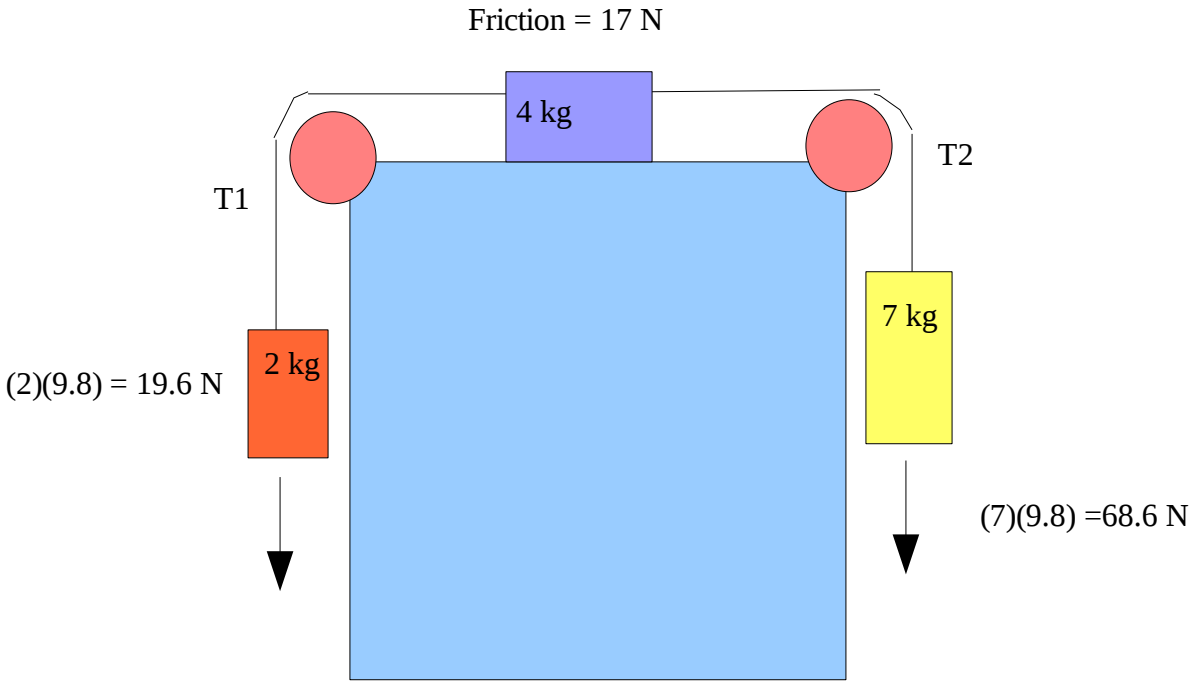
$$\vec{F}_{net} = m\vec{a}$$

$$9407 = (185)\vec{a}$$

$$\vec{a} = 50.8 \ m/s^2 [E]$$

2. For the following system of connected masses, determine

a) the acceleration of the system.
b) the tension in each of the ropes.



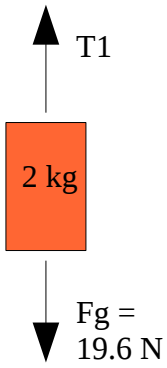
a) Take clockwise to be the positive direction:

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

$$68.6 - 19.6 - 17 = (2+4+7)\vec{a}$$

$$\vec{a} = 2.46\, m/s^2 [clockwise]$$

b) For tension T_1, use an FBD for 2 kg mass:



$$T_1 - 19.6 = (2)(2.46)$$

$T_1 = 24.5\,N$

Finish (b) for homework, and p. 86#20,21 & p. 87#3,5,6,7,9