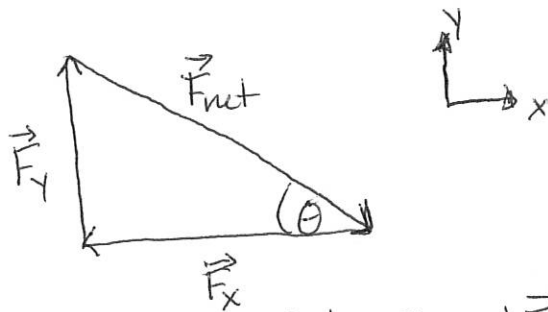


9/9/2019

Newton's 3rd Law

Entry



$$\cos \theta = \frac{|\vec{F}_x|}{|\vec{F}_{net}|} \quad \sin \theta = \frac{|\vec{F}_y|}{|\vec{F}_{net}|}$$

going to define $|\vec{F}_x| = F_x$, $|\vec{F}_y| = F_y$ $|\vec{F}_{net}| = F_{net}$

$$F_{net} \cdot \cos \theta = \frac{F_x}{F_{net}} \cdot F_{net} \rightarrow F_{net} \cos \theta = F_x$$

$$F_{net} \cdot \sin \theta = \frac{F_y}{F_{net}} \cdot F_{net} \rightarrow F_{net} \sin \theta = F_y$$

(Technically could also have use Pythagorean theorem, but rarely do we have the side information necessary for that)

Why does it hurt when the football players slam in to the wall?

→ They push on the wall and it pushes back!

this is Newton's 3rd Law

• For every action (force) there is an equal and opposite reaction (force)

• To show Newton's 3rd Law we set up force pairs

- Each force acts on a different object

- A exerts force on B, B exerts force on A

Free Body Diagrams and Force Pairs.....

9/19/2019

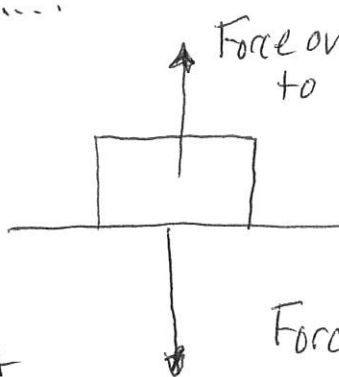


Force on ~~body~~ object due to Earth
Force on Earth due to ~~body~~ object

Earth FBD



Object FBD

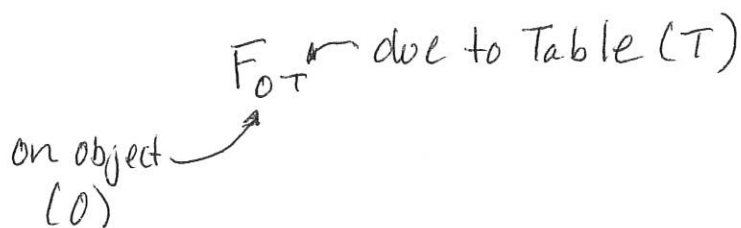


Force on ~~object~~ table due to object

Table FBD

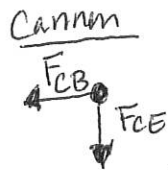
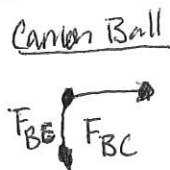


of course for Earth and the Table there are other forces as well...



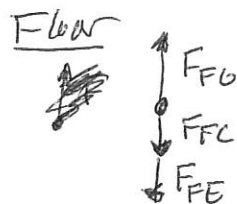
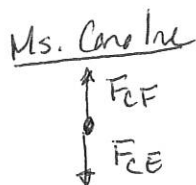
Examples:

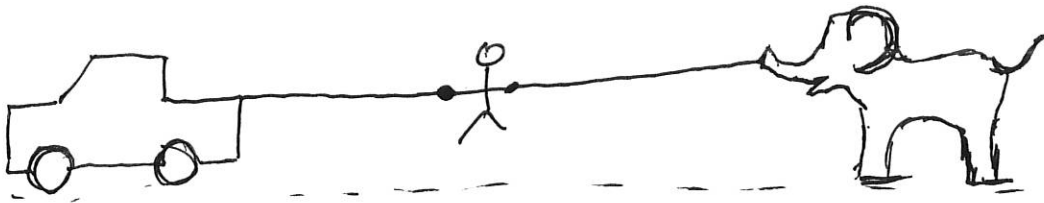
Cannon → Cannon Ball is propelled forwards, Cannon moves backwards



Rocket → Mass thrown out the back of the rocket provides 3rd Law pair force that thrusts Rocket in opposite direction.

Ms. Caroline → Ms. Caroline pushes against the floor, the floor pushes back.





Forces on Truck

$$F_{TBa}$$

$$F_{TG}$$

Forces on Guy

$$F_{Gba}$$

$$F_{GE}$$

$$F_{GT}$$

Forces on Elephant

$$F_{Eba}$$

$$F_{EG}$$

$Ea = \text{Earth}$
 $E = \text{Elephant}$
 $T = \text{Truck}$
 $G = \text{Guy}$

Forces on Earth

$$F_{EaE}$$

$$F_{EaG}$$

$$F_{EaT}$$