Phys 2110-3 9/24/10

Note Title 9/24/2010

Chap 4 Dynamics, forces

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

Add up all the forces, get $m\vec{a}$

Units F is in N, $= \frac{kg\,m}{s^2}$

Gravity force

Force from the entire earth.

Forces always come from other objects

Forces arise in 4 different ways

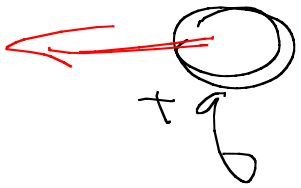
- Gravity
- Electromagnetism
- Nuclear Weak
- Nuclear Strong

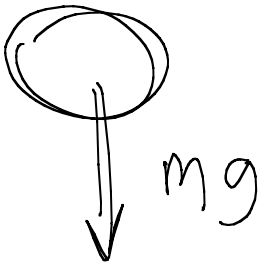
We'll see these

Relevant on atomic scale

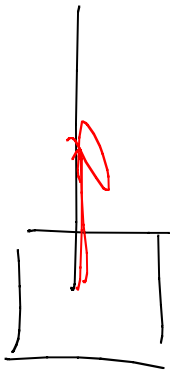
We'll deal with macroscopic forces.

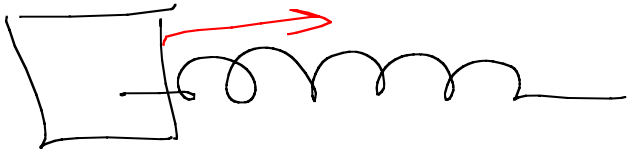
Action-at-a distance



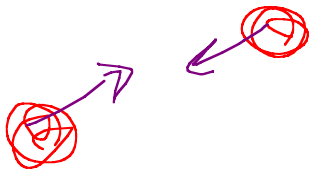


Contact forces

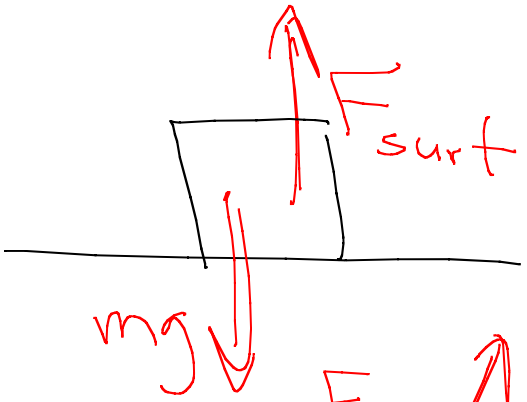




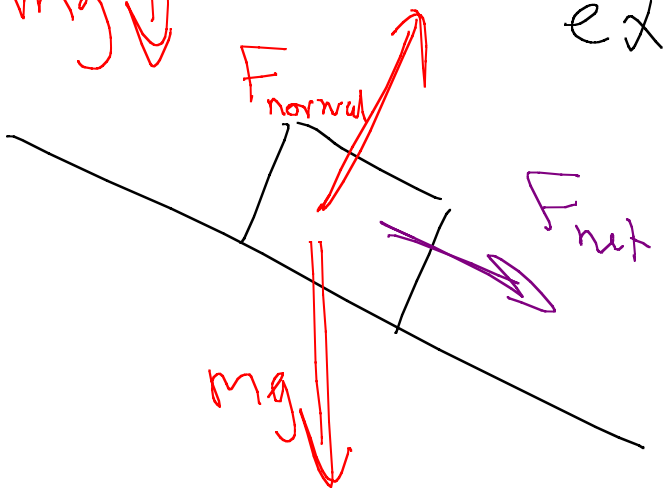
Examples of forces

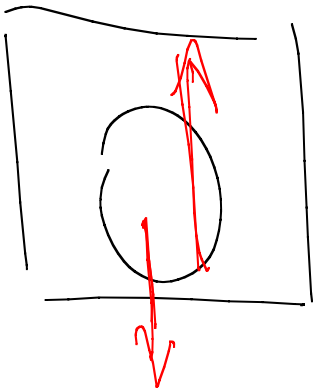


Force of gravity near earth's surface



At first consider smooth surfaces, (no friction) exerts force perp to surface

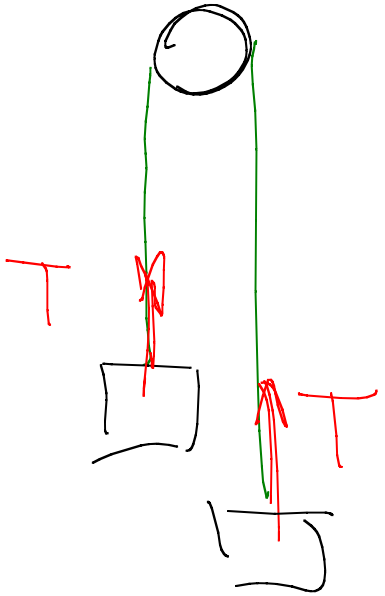




Strings

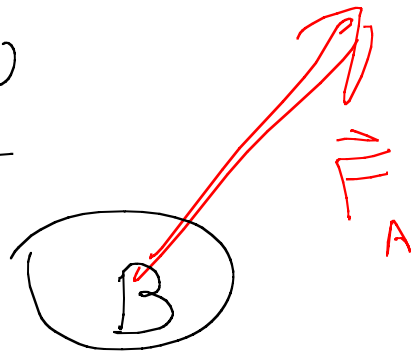
String pulls inward along its length w/ force of magnitude T (tension)

May see an ideal pulley massless

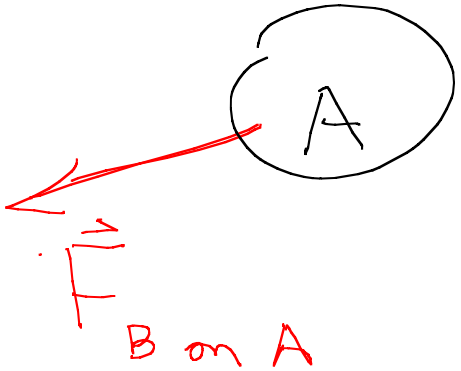


Rod

Newton's 3rd Law



(This can't happen!)

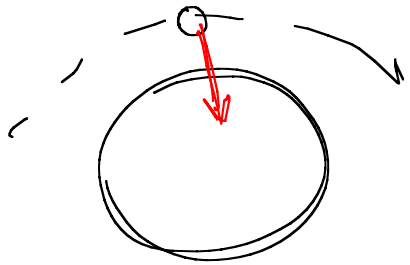


If A exerts a force on B then B exerts "equal & opposite" force on A

(equal in mag opp in dir.)

~~"Equal & opp. reaction"~~

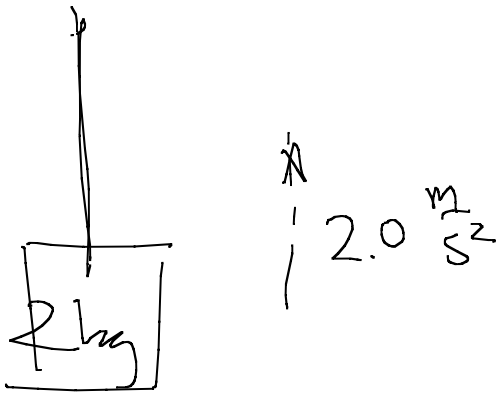
"Weightlessness"



Everything in the Shuttle falls together under gravity.

Examples of force problems

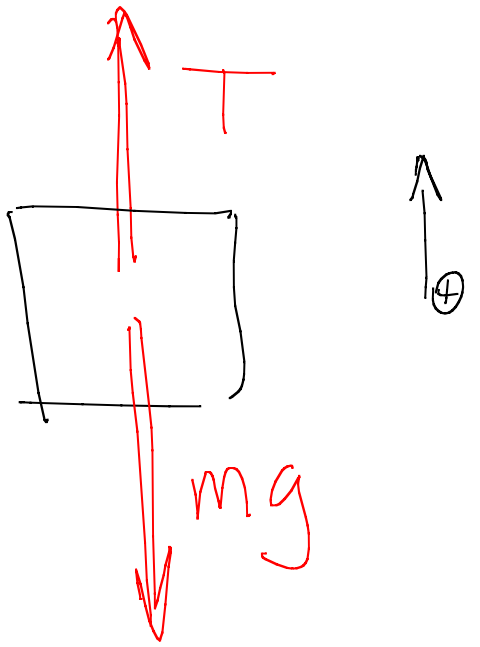
String attached to 2 kg mass, pulls it upward so that its accel. is $2.0\ m/s^2$ upward. What is tension in string?



Think of all forces acting on mass

Force diagram

"Free body diagram"



$m = 2\,kg$

$F_{net} = ma$

$$T - mg = ma$$

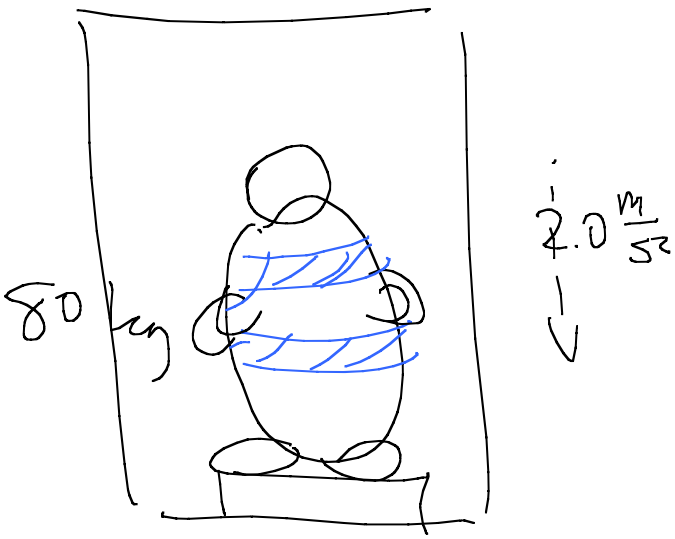
$$T = mg + ma = m(g + a)$$

$$= (2.0\,kg)\left(9.8\,\tfrac{m}{s^2} + 2.0\,\tfrac{m}{s^2}\right)$$

$$= 23.6\,N$$

Man stands on scale in elevator, it accel's downward at $2.0 \frac{m}{s^2}$

What does the scale read.



Forces on man

$2.0 \frac{m}{s^2}$

$F_{net} = ma$

$F_{scale} - mg = ma$

$= 624\ N$

$F_{scale} = m(g+a) = (80kg)(9.8 \frac{m}{s^2} - 2.0 \frac{m}{s^2})$