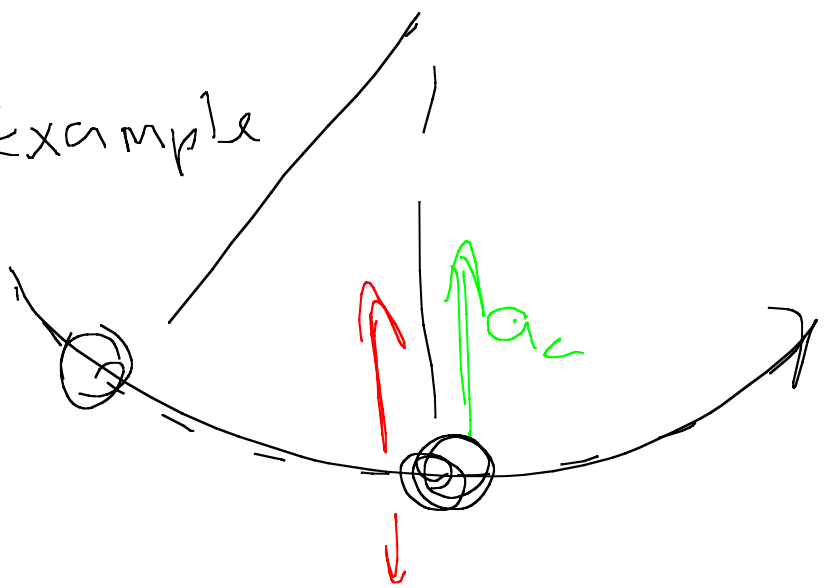
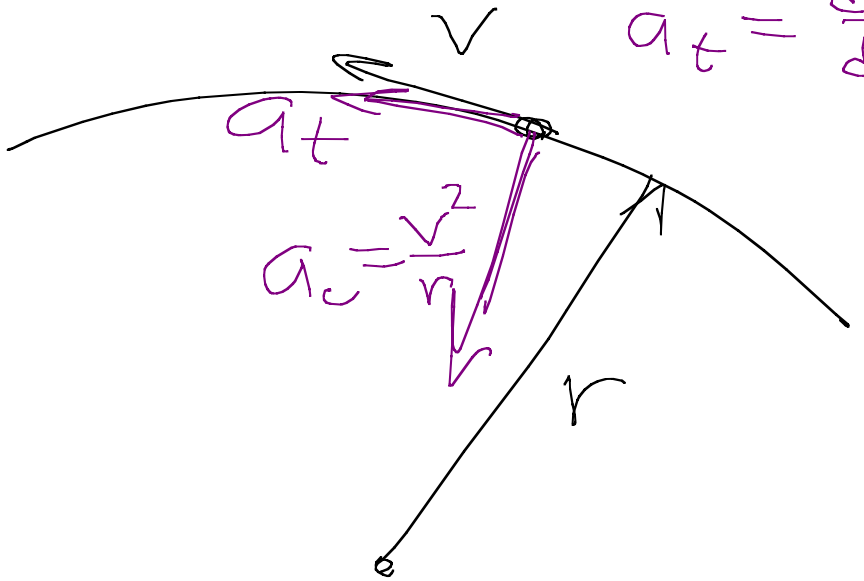
Phys 2110-3 9/22/10

Note Title 9/22/2010

Circular Motion

Example





$a_t = \frac{dv}{dt}$

Chap 4

Kinematics

Dynamics (Forces)

Why does motion take place?

What maintains motion?

"Natural" state of things is to be at rest.

Wrong question.

Right question: What changes motion.

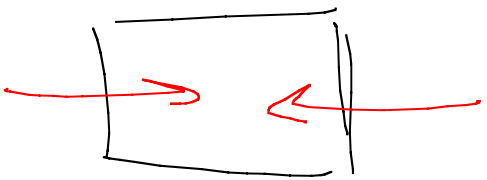
What gives accelerations Forces

How does a force change motion?

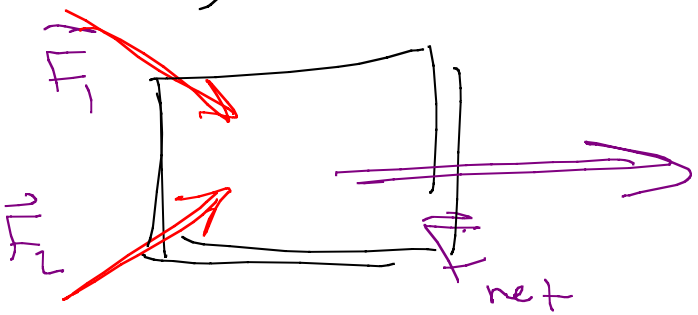
Galileo

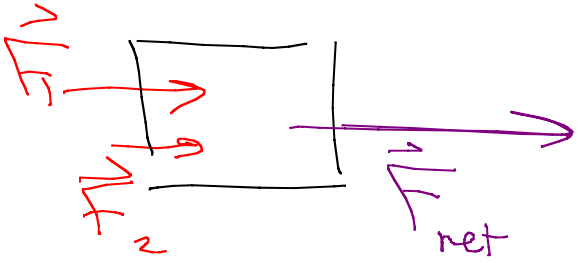
Newton's 3 Laws Motion

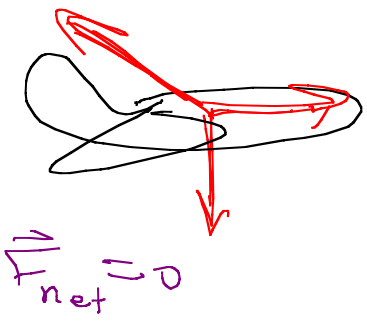
1st Law An object in uniform motion stays in uniform motion unless a net force acts.



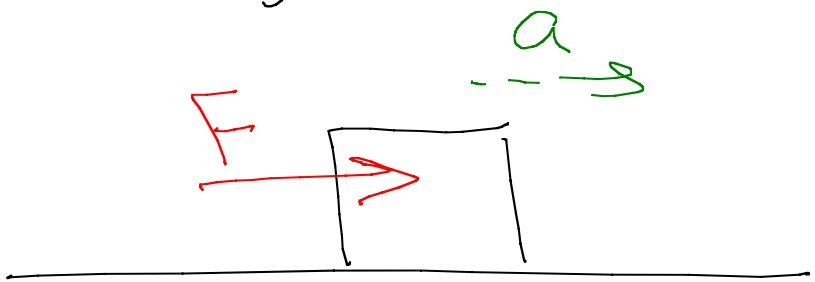
Adding forces (add force vectors)







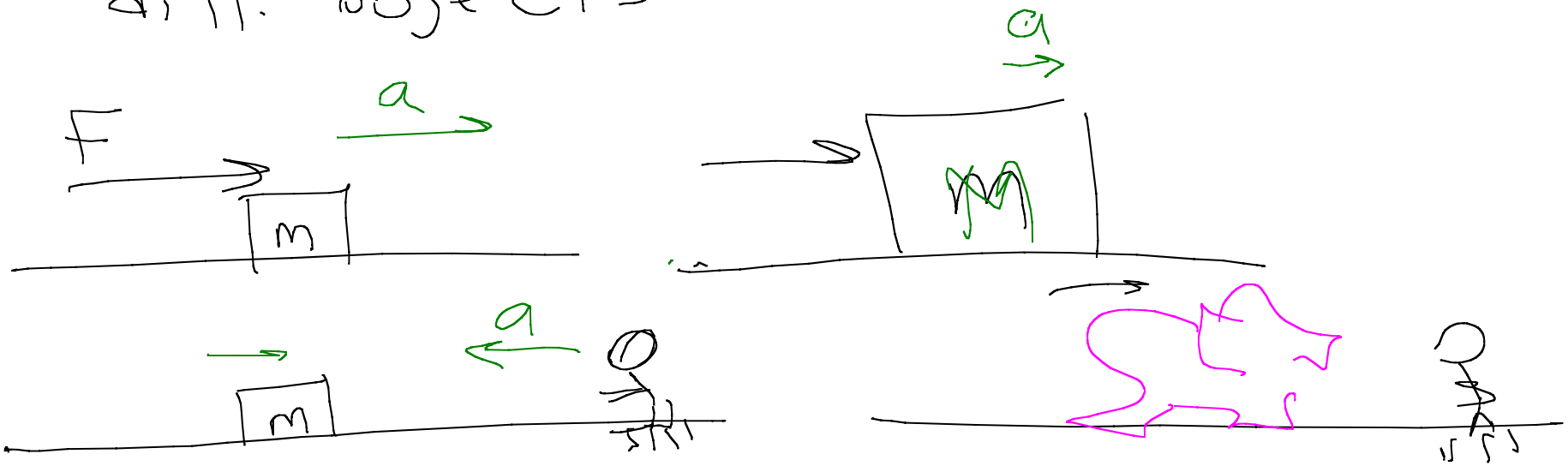
Forces give accelerations



Bigger force, bigger accel

$a \propto F$

A force may give diff. accel's to diff. objects



New property of objects

Mass m, kg kilograms

$a \propto F$

$a \propto 1/m$

equality

$a = F/m$

inversely prop. to mass

$F = ma$

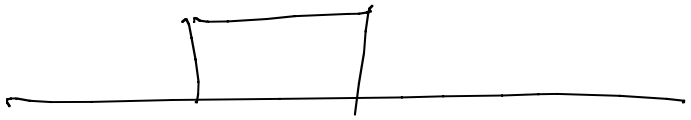
Units

$[F] = \frac{kg\ m}{s^2} = 1\ N$

$= 1$ Newton

Another unit pound

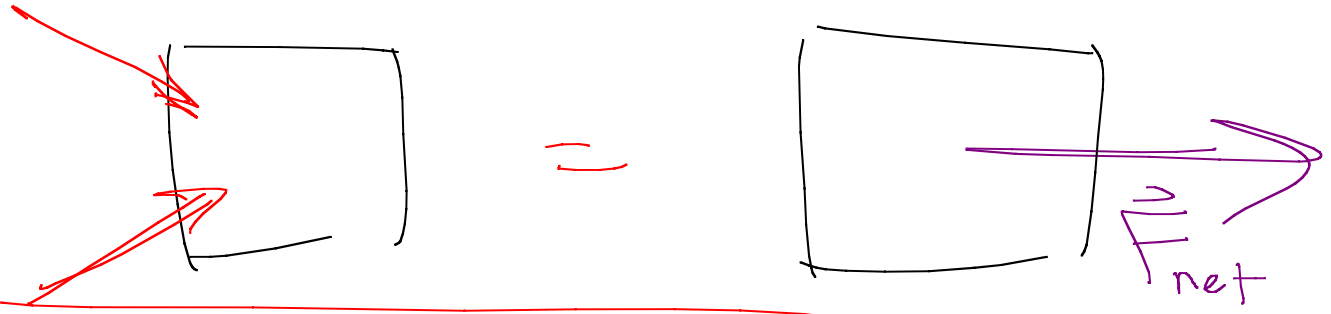
1 pound $= 4.448$ N



F, a have directions

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

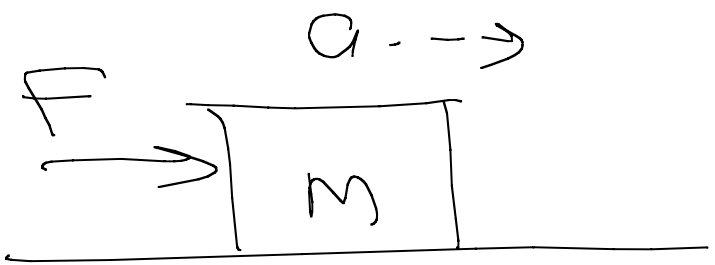
Can have more than one force



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

Newton's 2nd Law

4.13 A subway train has a mass of 1.5×10^6 kg. What force is required to accelerate the train at $2.5 \frac{m}{s^2}$



$$F_x = ma_x$$
$$= (1.5 \times 10^6 \text{ kg})\left(2.5 \frac{m}{s^2}\right)$$
$$= 3.75 \times 10^6 \text{ N}$$

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

p.52

Not a definition of force.

$F = m_{known} a_{known}$ $\quad F = m_{unkn} a_{unkn}$

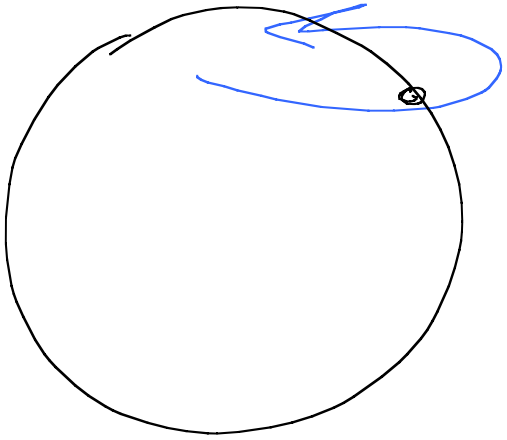
N's 2nd law can predict things

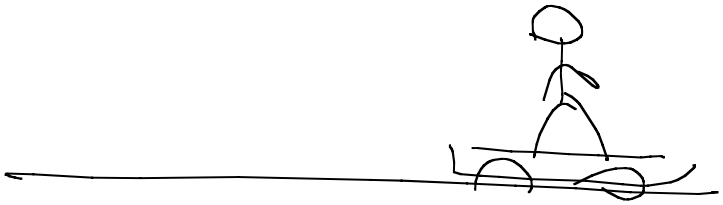
Theory.

Reference Frame

p.53

Must use N's 2nd Law in an inertial ref frame





You are in an acc'ing ref. frame?

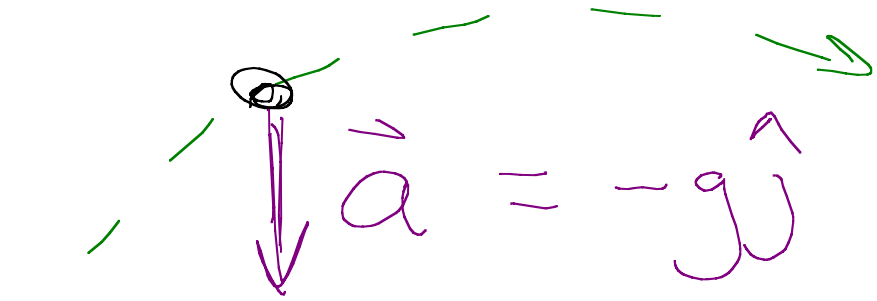
Doesn't matter much.

Examples of forces

Force of gravity

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

$$= -mg\hat{j}$$



Accel doesn't depend on mass

Force of grav. does

Magnitude of force of gra. is mg = weight

Mass is same anywhere

Weight depends on where you are

mg