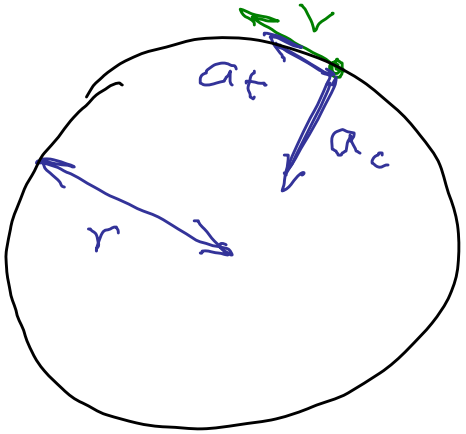
Phys 2110-4 9/21/11

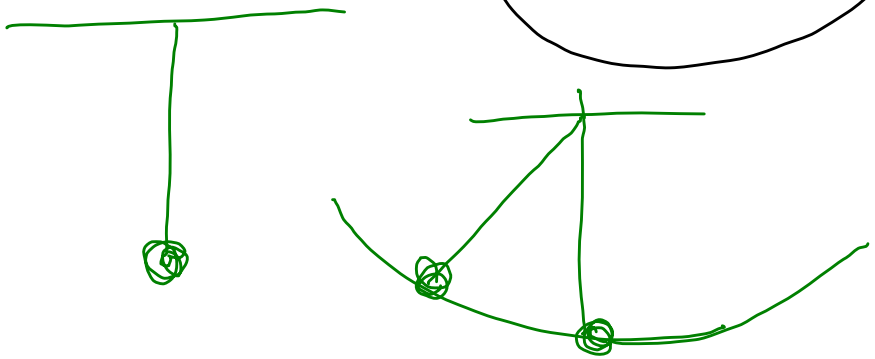
Note Title 9/21/2011

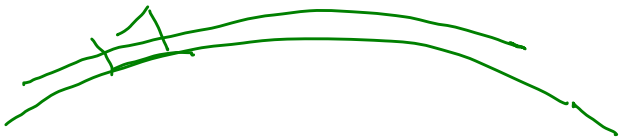
Chap 3 Circular motion



$$a_c = \frac{v^2}{r}$$

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





Chap 4 Kinematics

Reasons for motion: Dynamics (Forces, ..)

Ideas go way back

Aristotle: Laws of motion.

Motion needs something to maintain

Things seem to naturally come to a state rest.

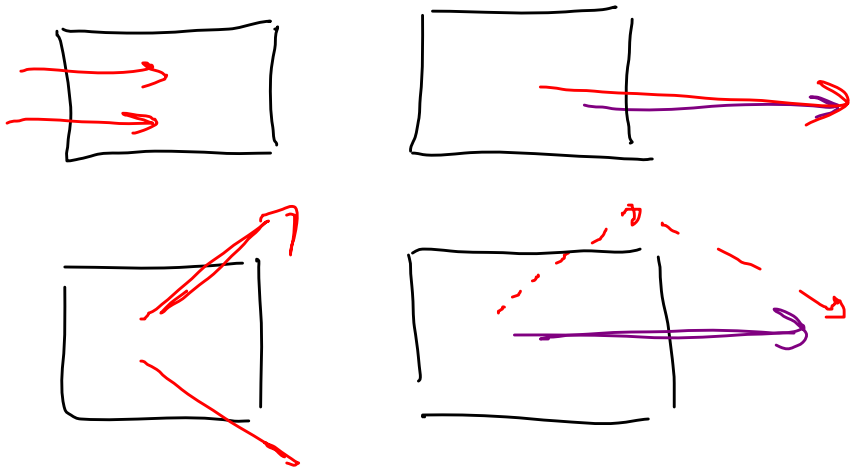
If we take away all influences on motion, motion continues

Galileo: How does motion change

Newton's 1st law

Body in uniform motion remains in uniform motion unless a (net) force on it.

Can have a combination of force

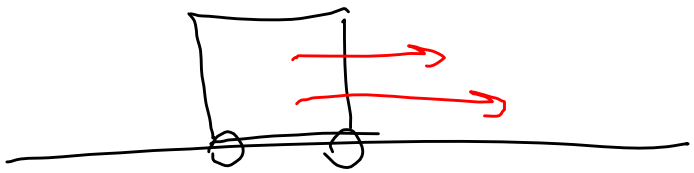


Combine forces as in vector addition.

Newton's 2nd Law

Forces causes accelerations.

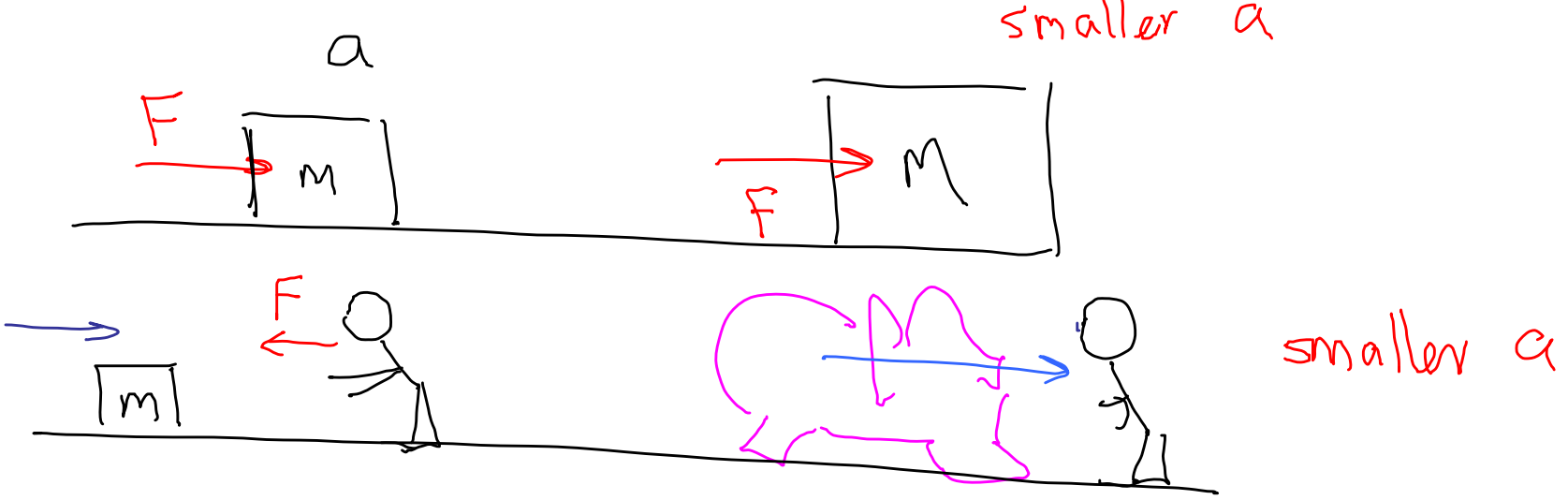
$\vec{F} \rightarrow \vec{a}$



$a \propto F$ $\propto$ proportional

The same force exerted on different objects gives diff. accelerations.

"Inertia" Mass



mass is measured in kg

$a \propto 1/m$ $\quad$ $a \propto F$

$a \propto F/m$

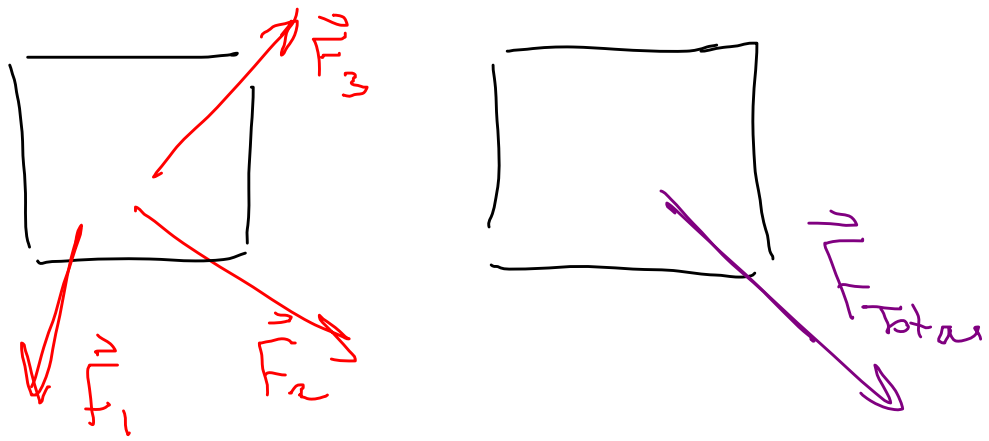
Equality: $F = ma$

Vectors

Force, accel's have directions

$\vec{F} = m\vec{a}$ $\quad \begin{cases} F_x = ma_x \\ F_y = ma_y \end{cases}$

Combination of forces



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

Newton's 2nd law.

Units

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

$$kg \; m/s^2$$

F is meas'd $\frac{kg\,m}{s^2}$ Abbreviated: N

$1\,N = \frac{kg\,m}{s^2}$ Newton

Other systems: pound, lb

dyne $\frac{g\,cm}{sec^2} = 10^{-5}\,N$

4.12 A subway train's mass is 1.5×10^6 kg. What force is req'd to accel train at $2.5\ m/s^2$?

$$F_x = m a_x$$

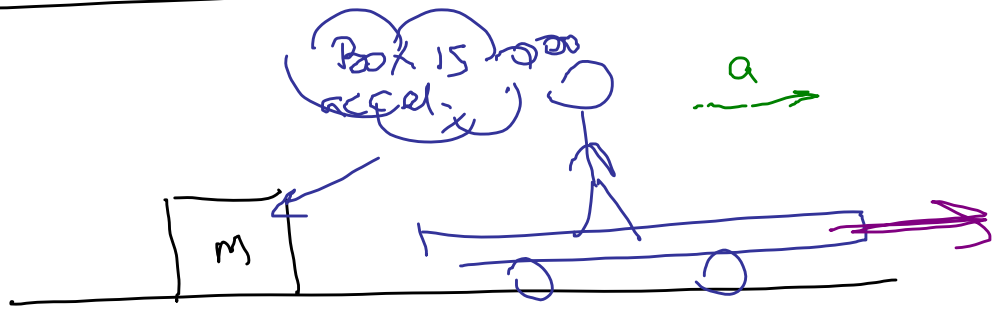
$$F_x = (1.5 \times 10^6\ \text{kg})(2.5\ m/s^2)$$

$$= 3.75 \times 10^6\ \text{N}$$

More concepts

Reference frames

("Relative motion")
Adding velocity



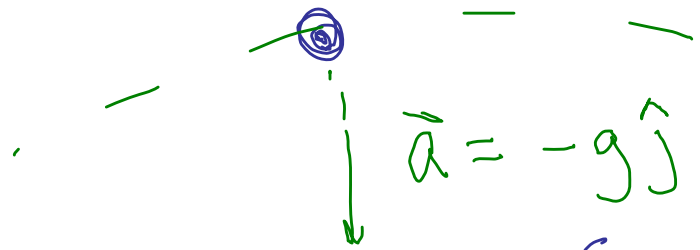
Accel he "sees" did not come from a force

Preferred ways to do measurements
Inertial reference frame.

(Also N3 3rd law.)

Solve problems involving forces

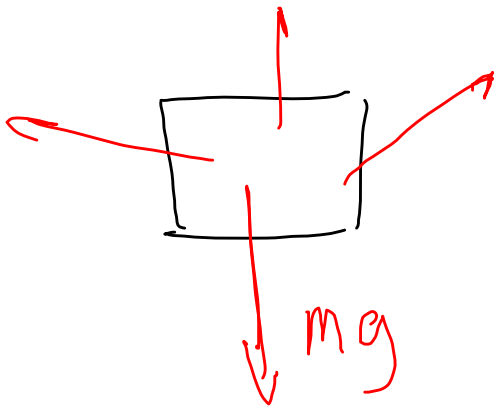
Simplest one



Comes from force of gravity

$$F_{grav} = ma = -mg\hat{j}$$

Force of grav has mag. mg (points downward)



Weight $= mg$

$\left(\vec{W} = -mg\,\hat{j}\right)$

Mass does not change with location of object!

Weight does change! (g change)

W, N m, kg

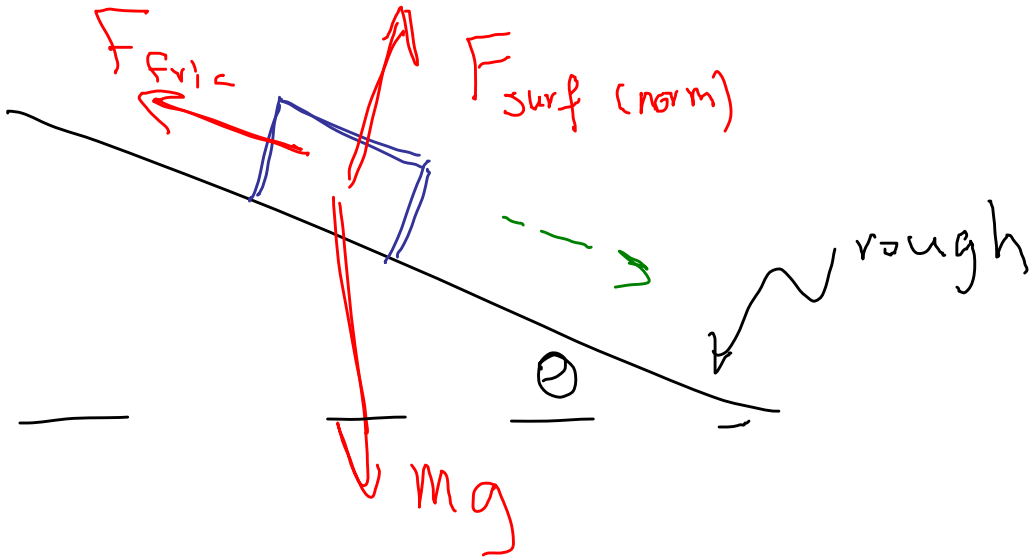
In advanced physics 4 kinds of forces

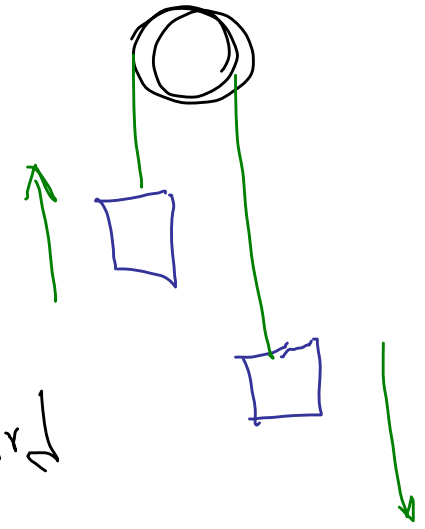
- Gravity ✓ 2nd
- Electromagnetic ✓ 2nd

  Everyday forces are complicated manifestations of electrical

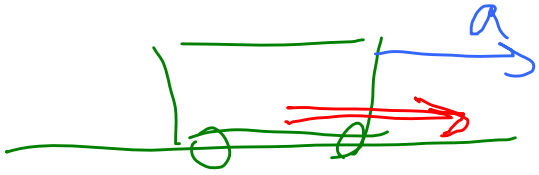
  - Weak force
  - Strong force

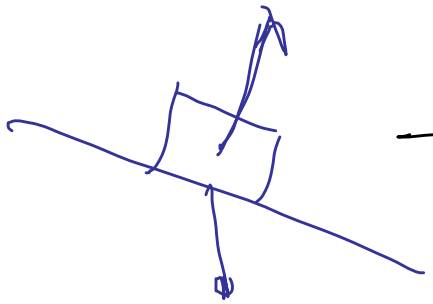
In our problems: Strings, surfaces, Springs, gravity, friction

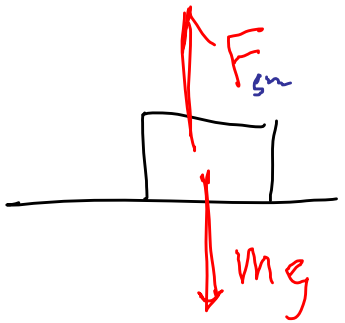




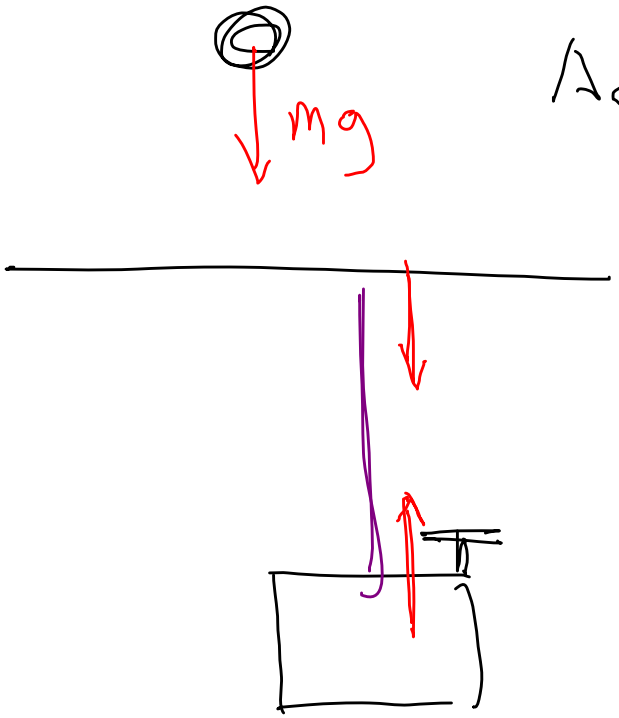
Surface (for nal) pushes outward perp. to surface (normal)







$F = mg$



Action at a distance

String exerts tension force, T