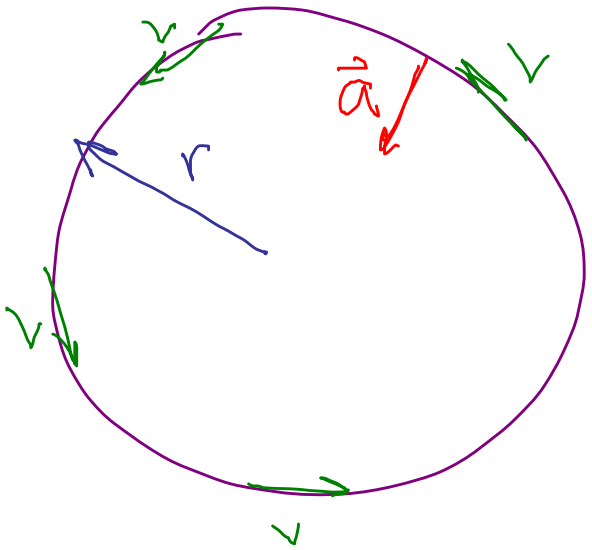
Phys 2110-4 2/1/12

Note Title 2/1/2012

2D Motion



Uniform circ. motion

Speed v radius r

Period = T

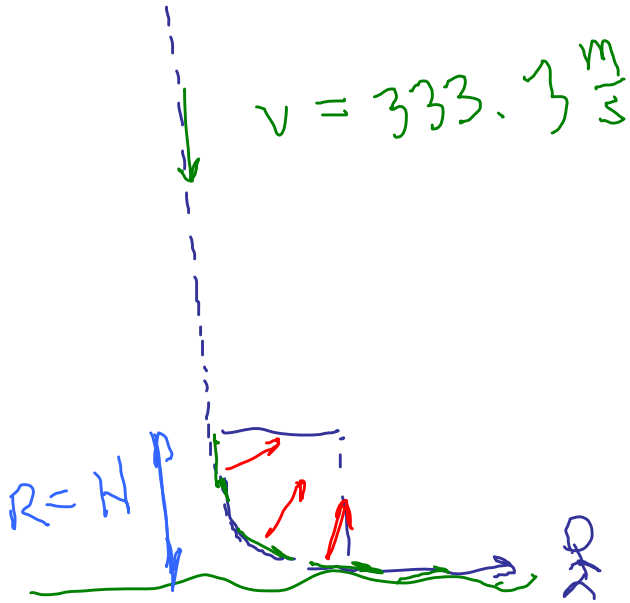
$$V = \frac{2\pi r}{T} \qquad T = \frac{2\pi r}{V}$$

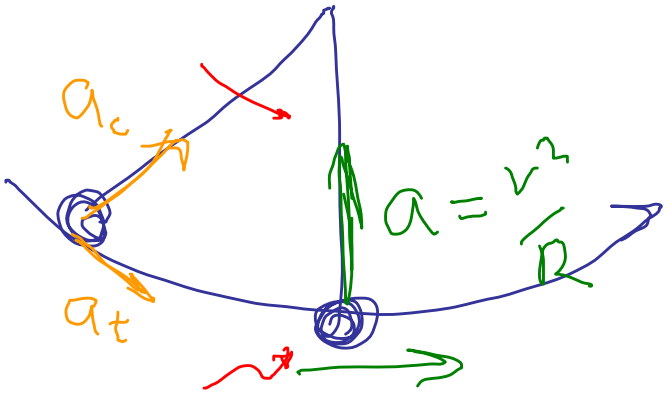
$$a = \frac{v^2}{r}$$

3.69 A jet diving vertically downward at 1200 $\frac{km}{h}$. Pilot can withstand accel of 5g. At what height must plane start quarter turn to pull out of dive? Speed = constant.

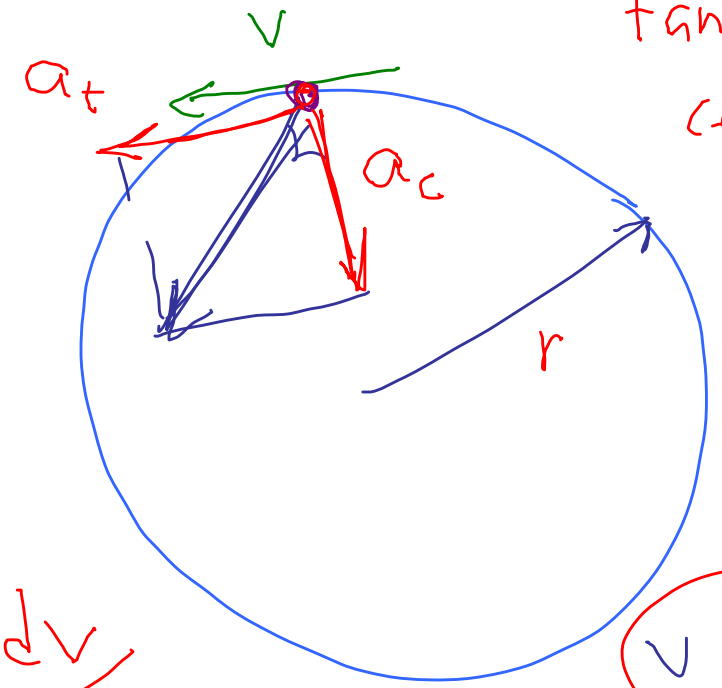
$$a = \frac{v^2}{R} = 5g$$

$$R = \frac{v^2}{5g} = 2.3\ km$$





Non-uniform circular motion



tangential
centripetal

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

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

v is changing

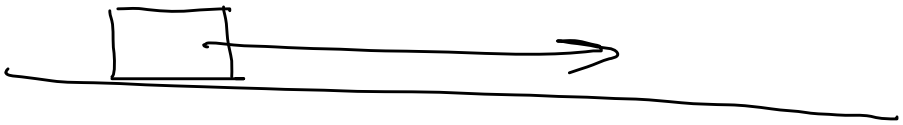
$$a = \sqrt{a_t^2 + a_c^2}$$

Kinematics motion

Dynamics Reasons for motion (Forces.)

Misconception:

Wrong Question

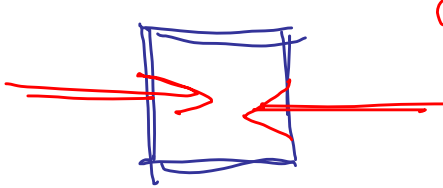


Galileo, Newton

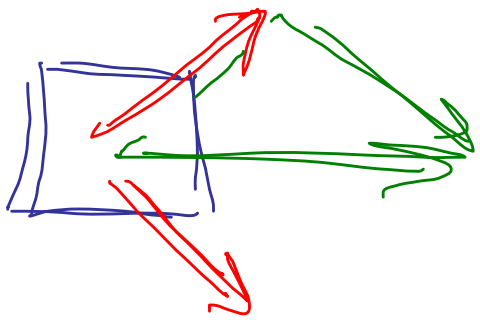
Newton 1st law

A body in uniform motion remains in uniform motion and body at rest remains at rest unless acted on by a nonzero net force.

Force causes change in motion

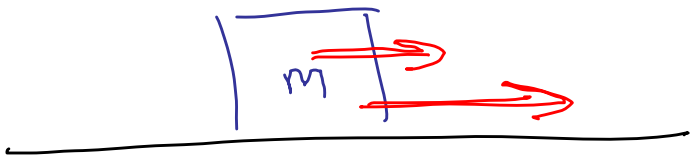


add to zero, no net force



Change in motion $\rightarrow \vec{a}$

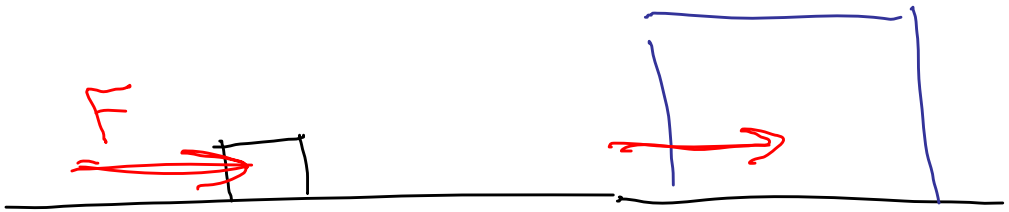
How do forces relate to accelerations



Acceleration is proportional to the net force

$a_x \propto \Sigma F_x$

Consider exerting same force on diff objects



Characteristic of object which makes them easy / hard to speed up.

Inertia.

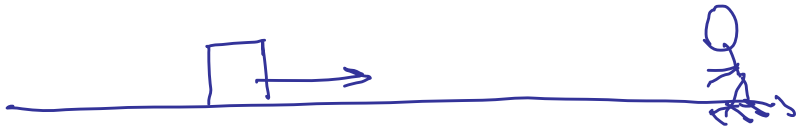
Mass, m

$a \propto \frac{1}{m}$

Same force

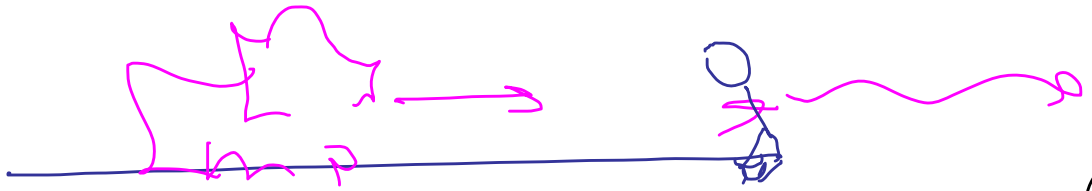
more mass ⟶ smaller a

small mass ⟶ larger a



$a \propto F$

$a \propto 1/m$



$a \propto F/m$

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

$$F = ma$$

m/s^2

Units!

Mass measured in kg

$$F = ma$$

Units:

$$[F] = ma$$

$[F] = [ma]$

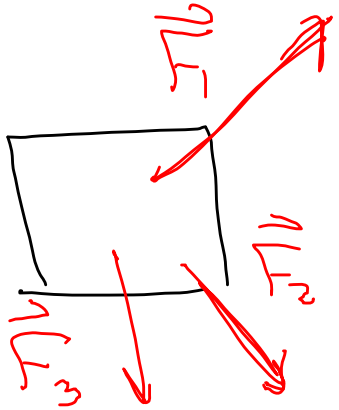
$kg \frac{m}{s^2}$

Units of force

$\frac{kg\ m}{s^2} = 1 \text{ newton}$

$= 1\ N$

Newton's 2nd law



Forces add like vectors to give net force.

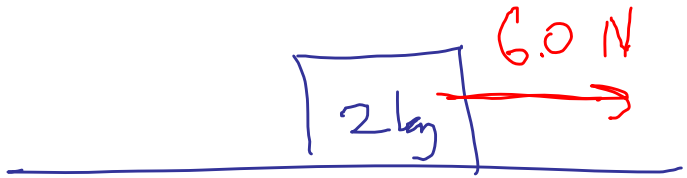
$$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3$$

Force is vector, so it acceleration.

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

x, y x, y.

Example:



Newton's 2nd law

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

$F_{net\,x} = ma_x$

$F_{net\,y} = ma_y$

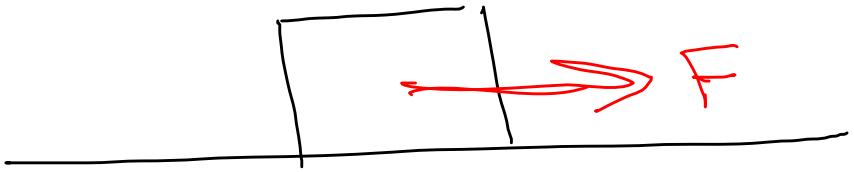
Find accel. $F_x = ma_x$

$$a_x = \frac{F_x}{m} = \frac{6.0\,N}{2.0\,kg}$$

$$= 3.0\,\frac{m}{s^2}$$

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

$\dashrightarrow 2.5 \frac{m}{s^2}$

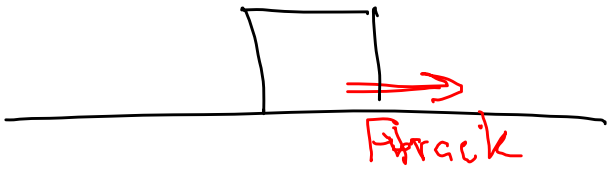


$F_x = m a_x$

Where does force comes from?

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

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



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

Not a definition