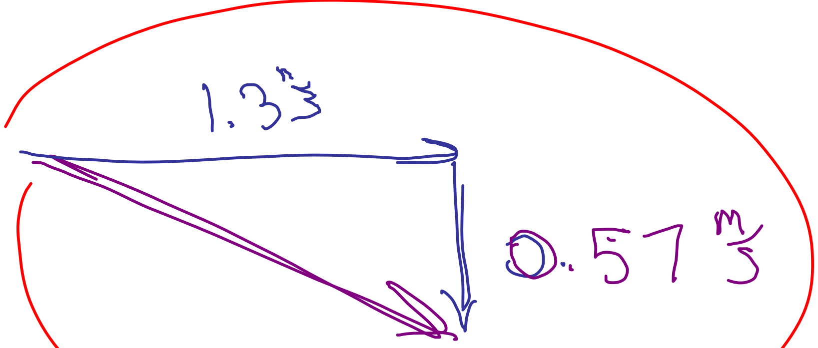
Phys 2110-4 2/6/13

Note Title 2/6/2013

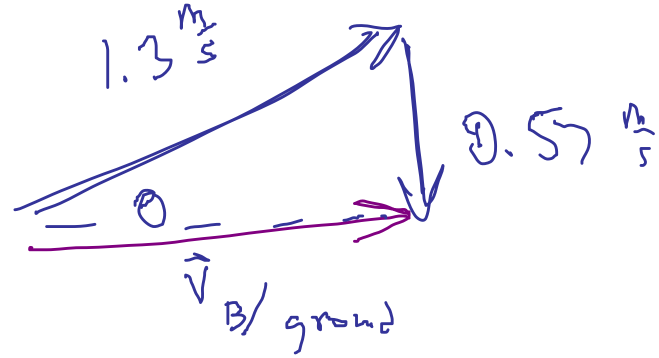
Relative motion:

$$\vec{V}_{A/C} = \vec{V}_{A/B} + \vec{V}_{B/C}$$

3.27 .. row str acr. 63-m wide river. You can row at steady speed $1.3\ \frac{m}{s}$ relative to water & river flows at $0.57\ \frac{m}{s}$. a) What dir you head? b) How long it take cross river?



Don't do this;



a) 26.0°

b) $V_{B/gr} = 1.17\ \frac{m}{s}$

time it takes, $d = vt$ $\quad t = d/v = \frac{63\ m}{1.17\ \frac{m}{s}}$

$= 53.9\ s$

3.26 You're a pilot ... 1500 km flight

Plane's speed is 1000 km/h. You are told to head 15° west of south, to maintain southward course. If flight takes 100 min, what's wind velocity.

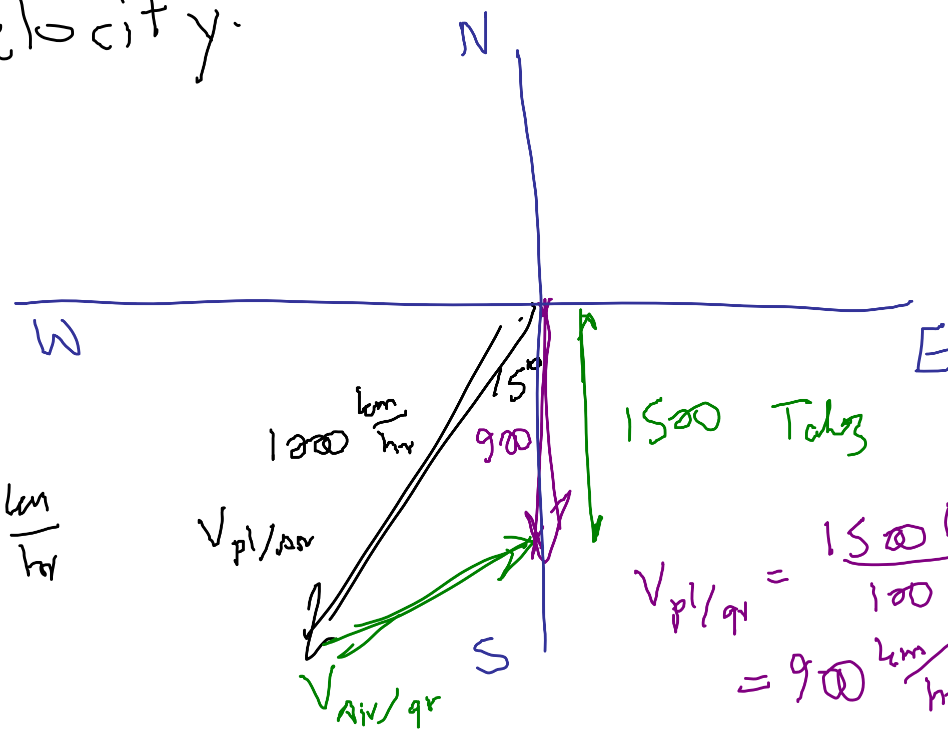
Draw vectors as shown

Find $\tilde{V}_{air/gr}$

$= +259\,\hat{i}\,\frac{km}{h} + 65.9\,\hat{j}\,\frac{km}{hr}$

etc.

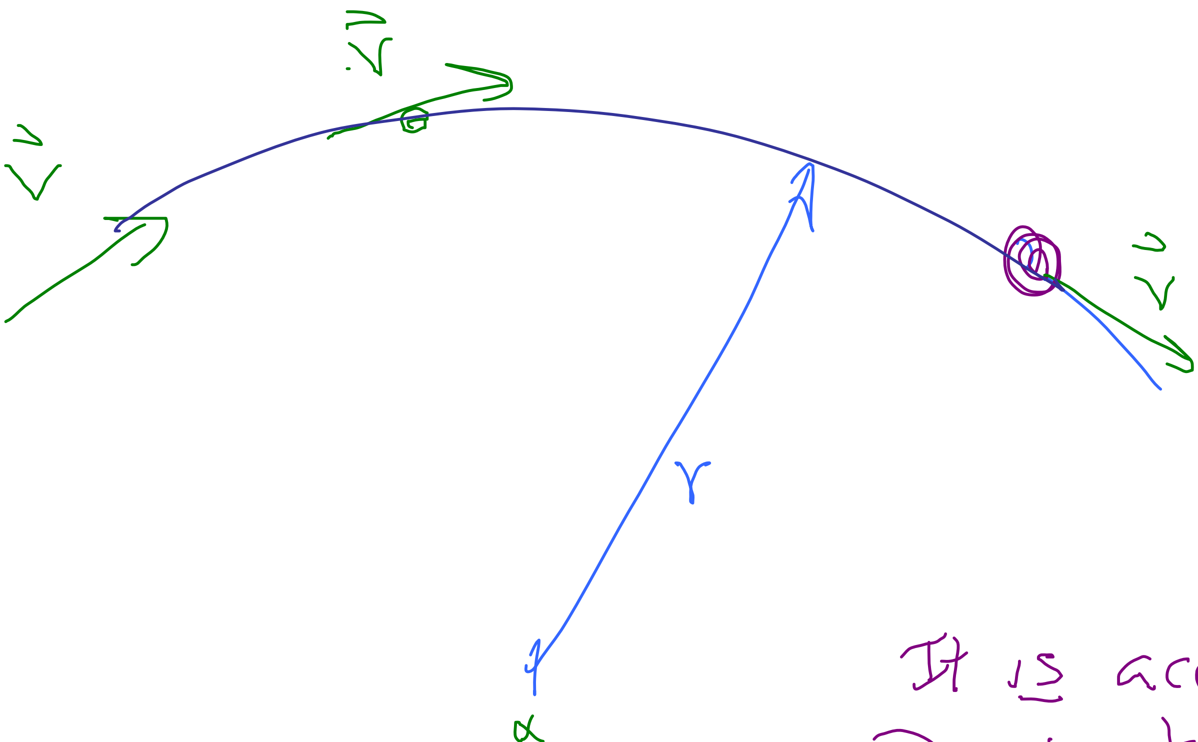
~~components~~

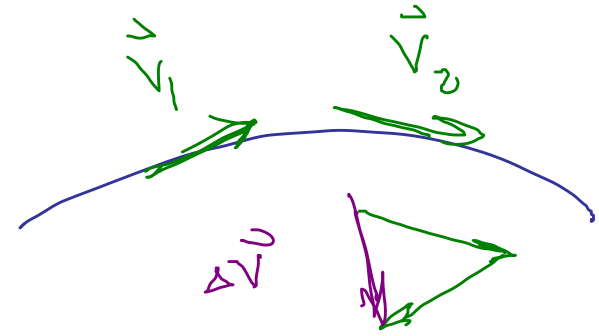


$V_{pl/gr} = \frac{1500\ km}{100\ min}$

$= 900\ km/hr$

Uniform cir motion



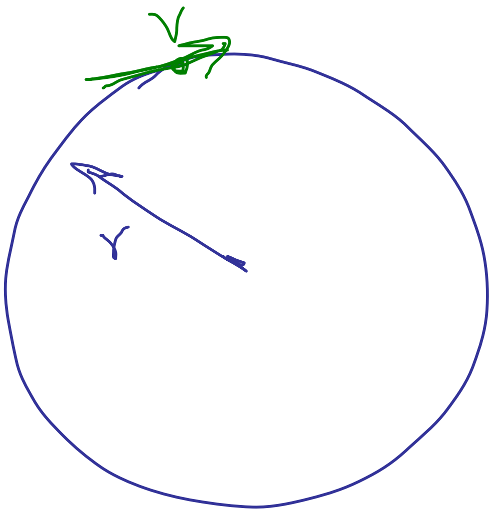


$\bar{a} = \dfrac{\Delta \vec{v}}{\Delta t}$ same inward

It is acc'ing.

Dir is toward center.

What's the magnitude.



v is constant

T = period of motion

= time for one orbit

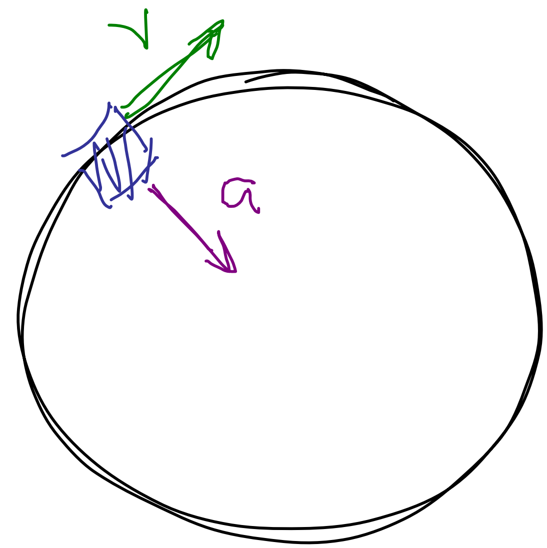
$v = \frac{2\pi r}{T}$ $\qquad$ $T = \frac{2\pi r}{v}$

f = frequency = $1/T$ $\qquad$ $\omega = 2\pi/T$ later.

$a = \frac{v^2}{r}$ $\qquad$ Toward center

Centripetal acceleration.

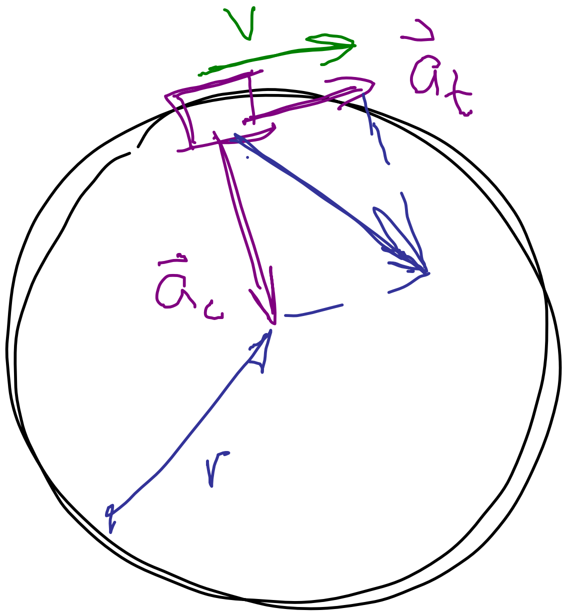
3.38 How fast would a car have to round 75-m-radius turn for its acceleration to be numerically equal to that of gravity?



$a = 9.8 \frac{m}{s^2}$

$= \frac{v^2}{r}$ $\quad r = 75\,m$

Fnd $\boxed{v = 27.1 \frac{m}{s}}$

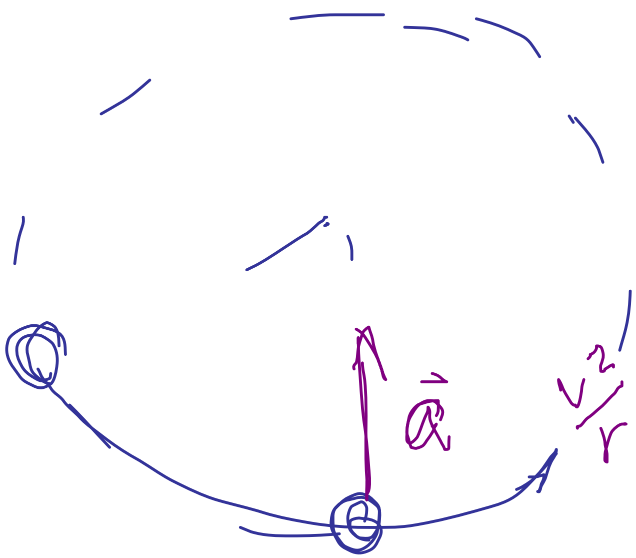


Suppose v is changing

$\vec{a}_c$ to center $\quad a_c = \frac{v^2}{r}$

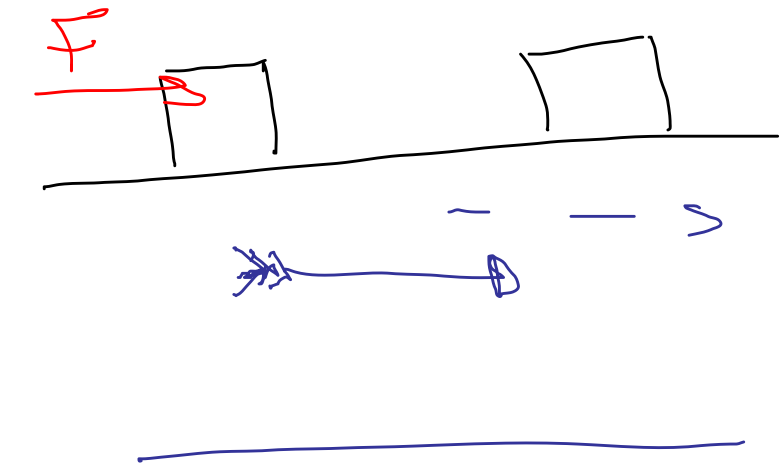
$\vec{a}_t$ is tangential,

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

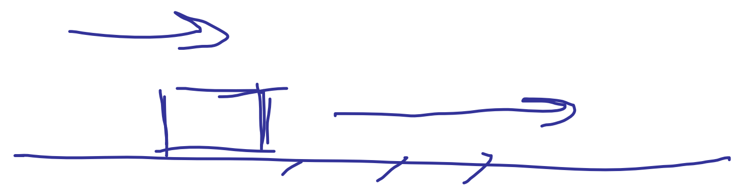


Chap 4 Reasons for motion

Old days, Aristotle



Force necessary to maintain motion

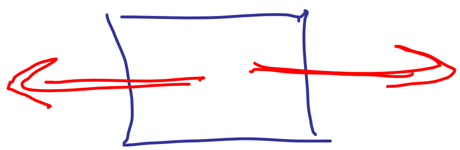


Nothing is necessary to maintain motion.
Must exert force to **change** motion.

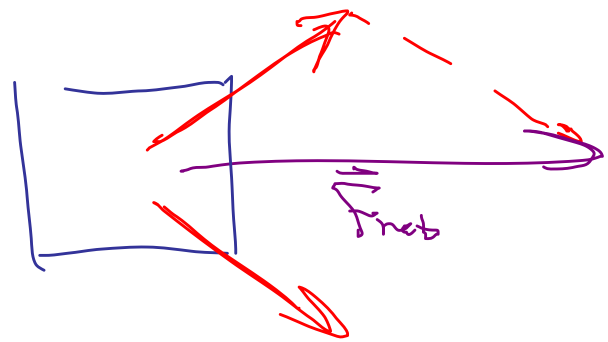
Isaac Newton   3 Laws of Motion

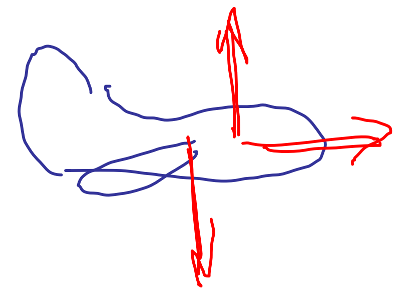
1st Law   A body in uniform motion remains in uniform motion **unless** a (net) force acts on it.

"Net" = total.

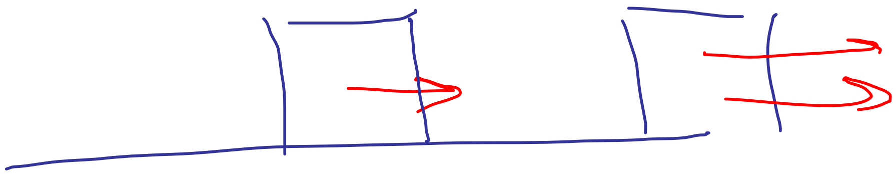


$F_{net} = 0$, no accel.





Relation between $\vec{F}$ and $\vec{a}$?



More force, more accel.

$$a \propto F_{net}$$