Phys 2110 - 5 9/7/12

Note Title 9/7/2012

1D motion

Const accel.

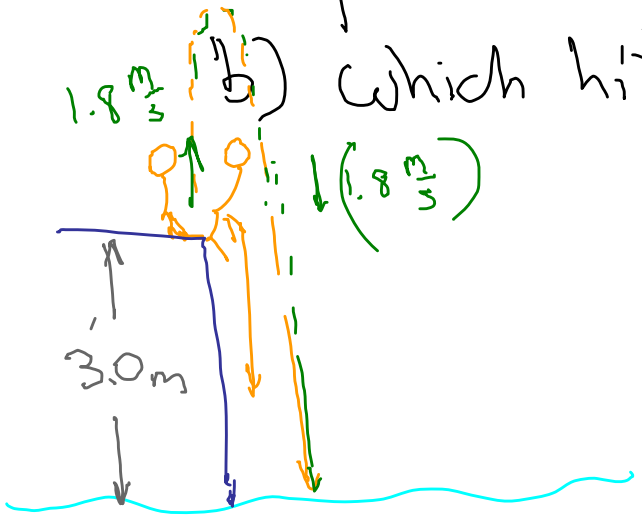
$$v = v_0 + at$$

$$y = y_0 + v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2a(y - y_0)$$

$$y = y_0 + \frac{1}{2}(v + v_0) t$$

2.69 Two divers jump from 3.0-m platform. One jumps upward at 1.80 $\frac{m}{s}$ & second steps off as the first passes one the way. a) What are their speeds as they hit the water? b) Which hits first, & by how much?



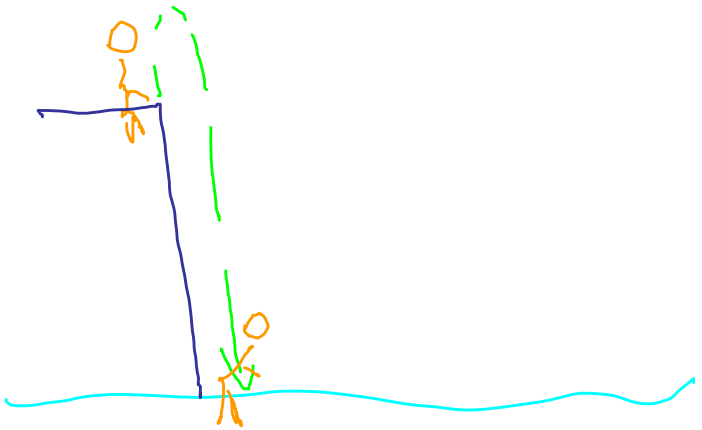
a) Steps off $v_0 = 0$ $y - y_0 = -3m$

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

$v^2 = v_0^2 + 2a(y - y_0)$

$v^2 = 0 + 2(-9.8 \frac{m}{s})(-3m)$

$v = 7.67 \frac{m}{s}$



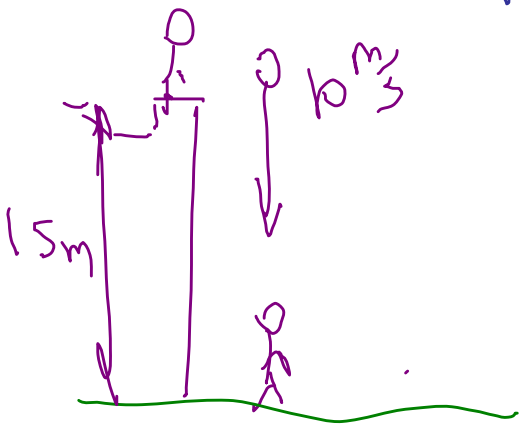
$v_0 = 1.8 \frac{m}{s}$ $a = -9.8 \frac{m}{s^2}$

$y - y_0 = -3m$

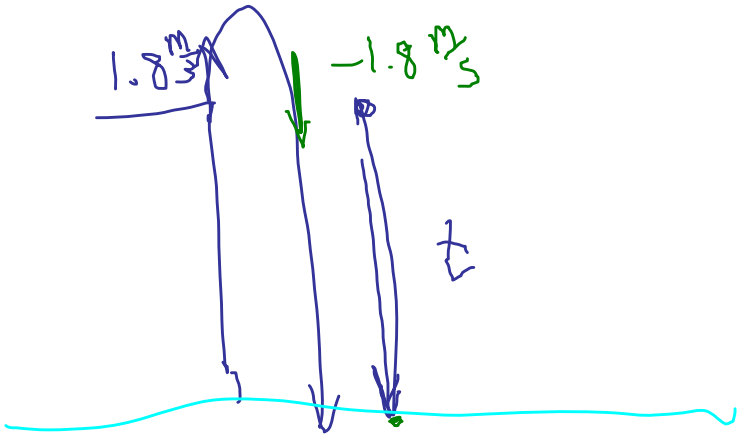
$v^2 = v_0^2 + 2a(y - y_0)$

$v^2 = (1.8 \frac{m}{s})^2 + 2(-9.8 \frac{m}{s})(-3m)$

$v = -7.88 \frac{m}{s}$ $v = 7.88 \frac{m}{s}$



b)



$$V = V_0 + at$$

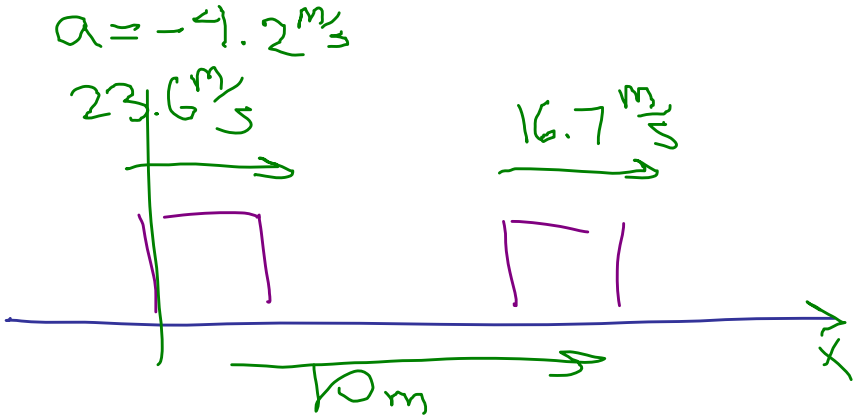
$V = -7.88 \frac{m}{s}$

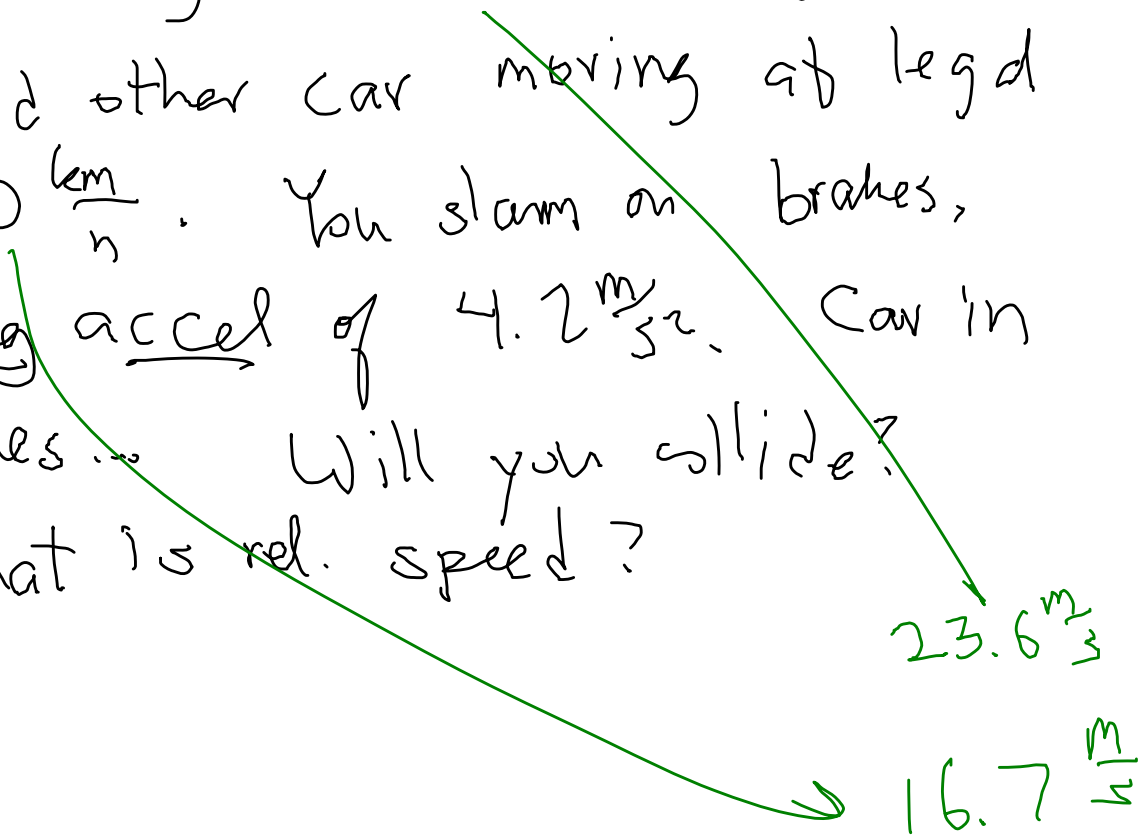
$V_0 = -1.8 \frac{m}{s}$ $\quad a = (-9.8 \frac{m}{s^2})$

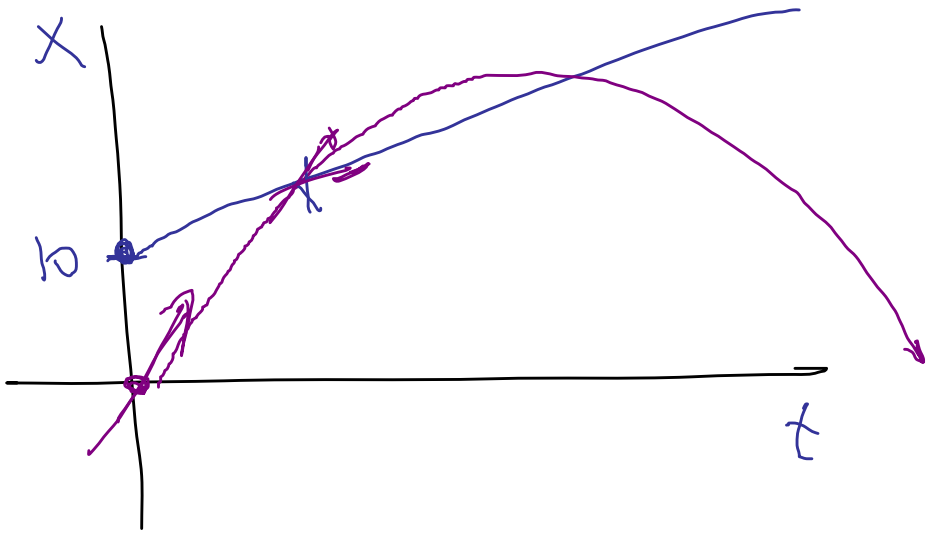
$-7.88 = -1.8 - 9.8t$ $\quad t = \frac{-7.88 + 1.8}{-9.8}$

Find other time, take diff $\quad = 0.62\,s$

2.62 You're speeding at $85 \frac{km}{h}$ when you notice 10 m behind other car moving at legal speed of $60 \frac{km}{h}$. You slam on brakes, gives car neg accel of $4.2 \frac{m}{s^2}$. Car in front continues... Will you collide? If so, what is rel. speed?







You: x_1

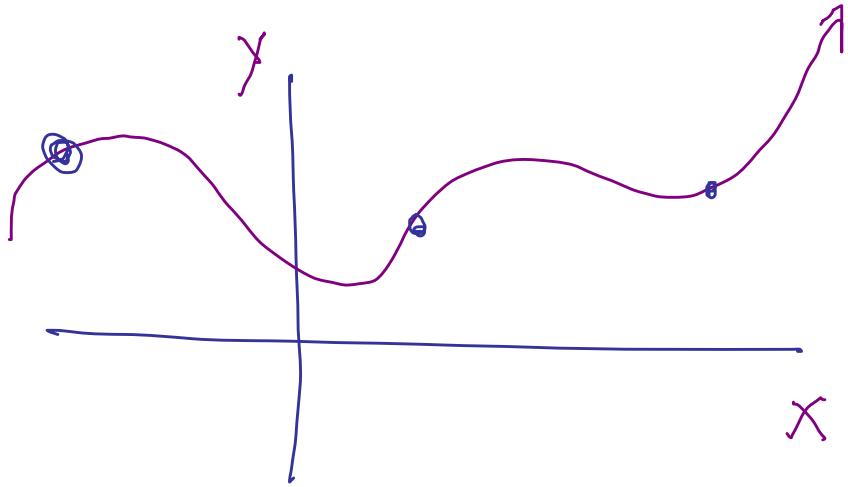
$$x_1 = 0 + 23.6\frac{m}{s}t - \frac{1}{2}4.2\frac{m}{s^2}t^2$$

$$x_2 = 10\,m + \left(6.7\frac{m}{s}\right)t$$

$$23.6t - 2.1t^2 = 10\,m + (16.7\tfrac{m}{s})\,t$$

Solve for t? No. Don't collide

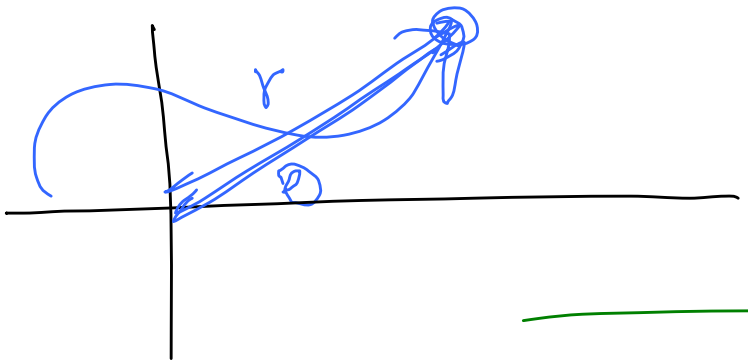
Chap 3 2D Motion



Chap 2 $x(t)$ Now $x(t), y(t)$ $z(t)$

Vectors

Many quantities in physics
Amount (Magnitude) and direction



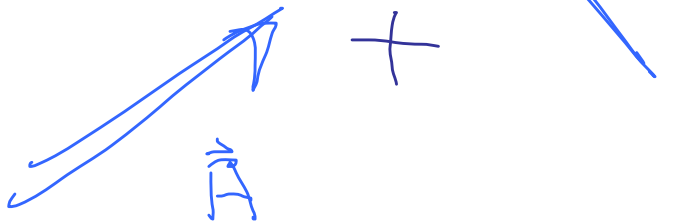
Location,
Velocity,
Acceleration

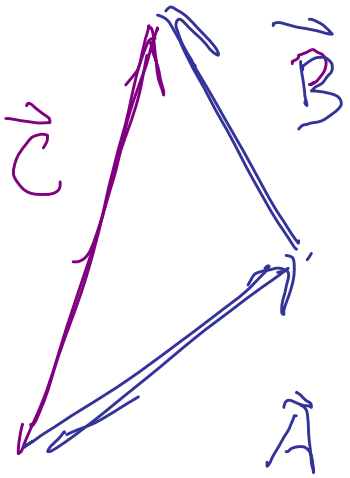
Forces
Momentum
∈ Fields, B fields ...

Vector: Represented by arrow, in a certain. Where it is drawn (for now) doesn't matter

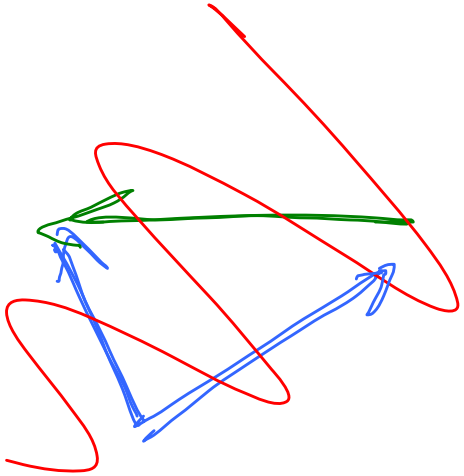
Vectors can be added:

$\vec{A} + \vec{B} = \vec{C}$

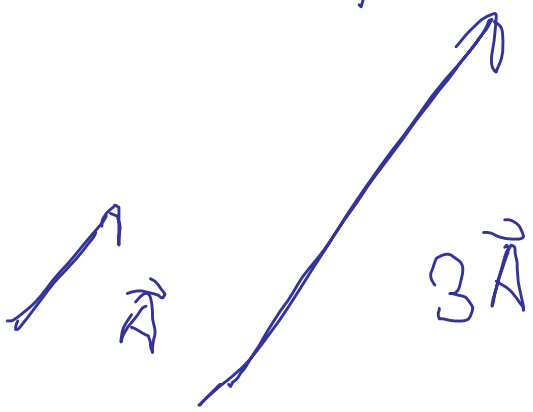


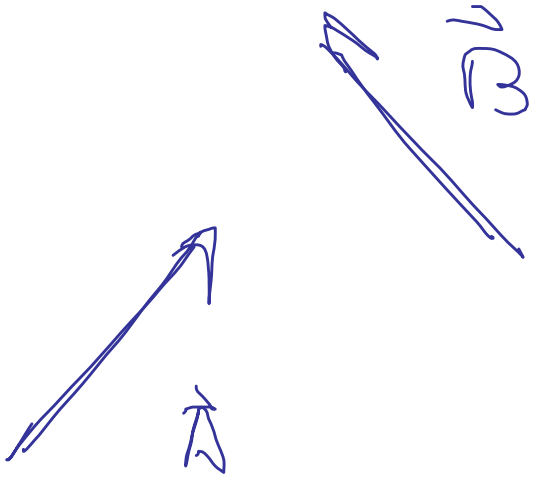


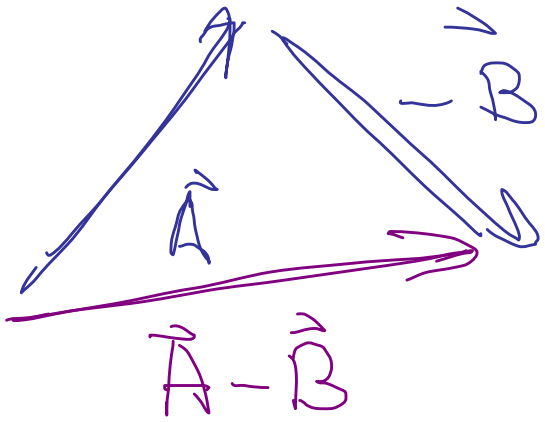
Multiply vector by number



$3\vec{A}$

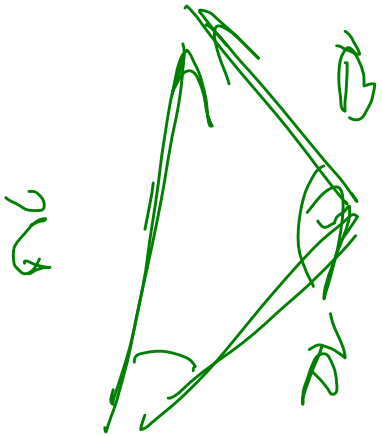






Vectors: Magnitude & Dir

Scalars: Just number.



Vector Components

$$A_x = A\cos\theta$$

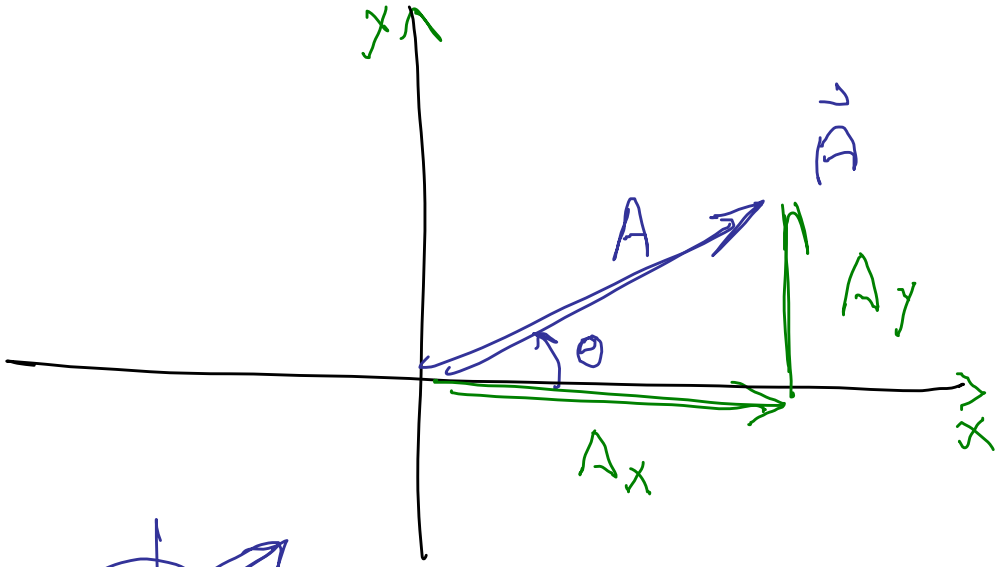
$$A_y = A\sin\theta$$

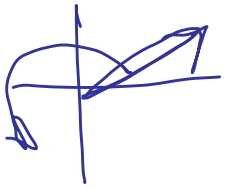
$$A = \sqrt{A_x^2 + A_y^2}$$

$$\tan\theta = \frac{A_y}{A_x}$$

$$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

+ brain engagement



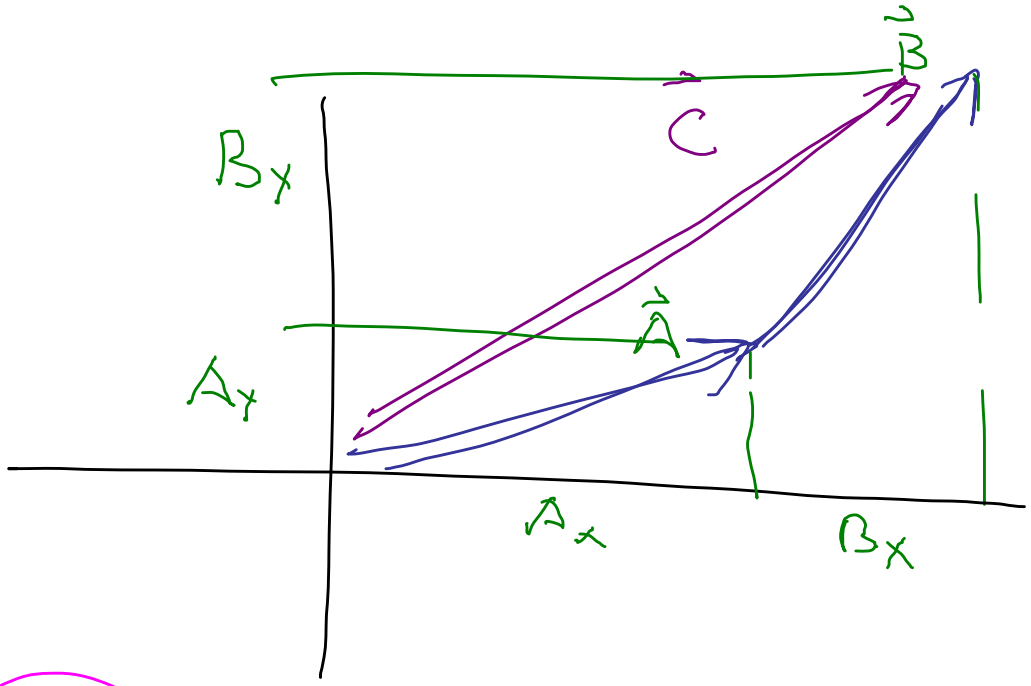


could give wrong answer

A = Magnitude

$= |\vec{A}|$

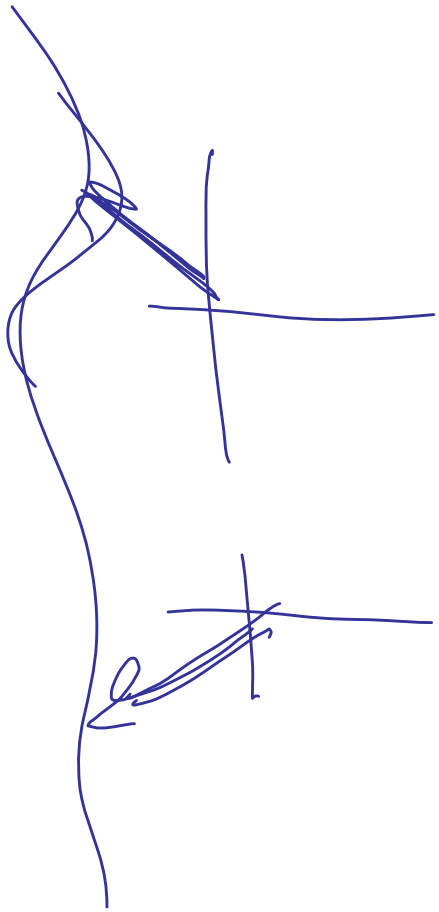
θ, direction



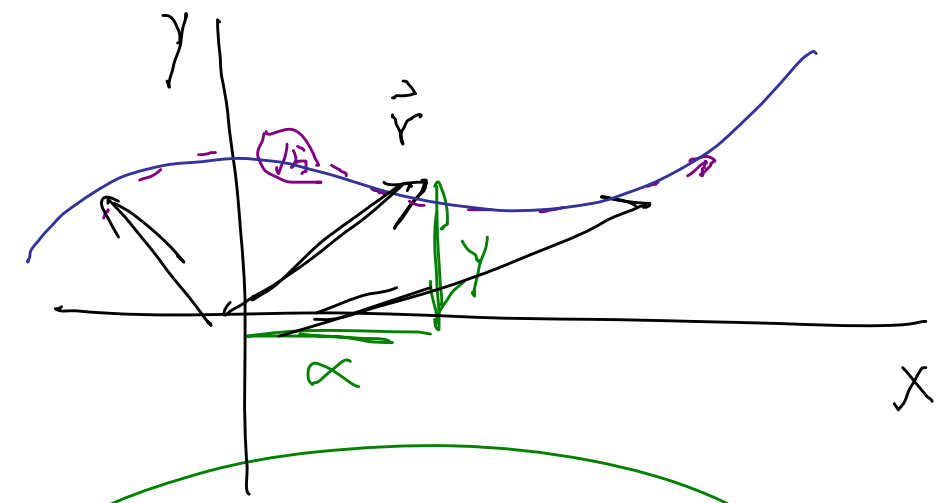
$$C_x = A_x + B_x$$
$$C_y = A_y + B_y$$

→ Find C, θ_C

To add vectors
find components
Add respective
components



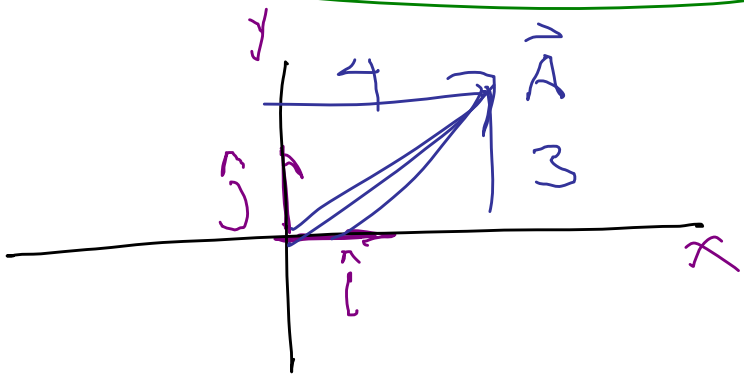
Motion



$\vec{a} \cdot \vec{b}$

$\vec{a} \times \vec{b}$

$x(t)$, $y(t)$ $\rightarrow$ $\vec{r}(t)$



$\vec{A} = 4\hat{i} + 3\hat{j}$