Phys 2110-4 9/9/11

Note Title 9/9/2011

Chap 2 1-D motion

constant acceleration

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

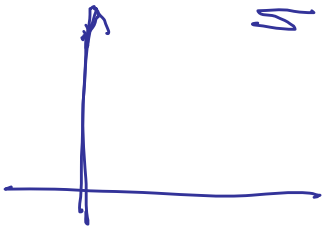
$$v^2 = v_0^2 + 2a(x - x_0)$$

$$x = x_0 + \frac{1}{2}(v + v_0) t$$

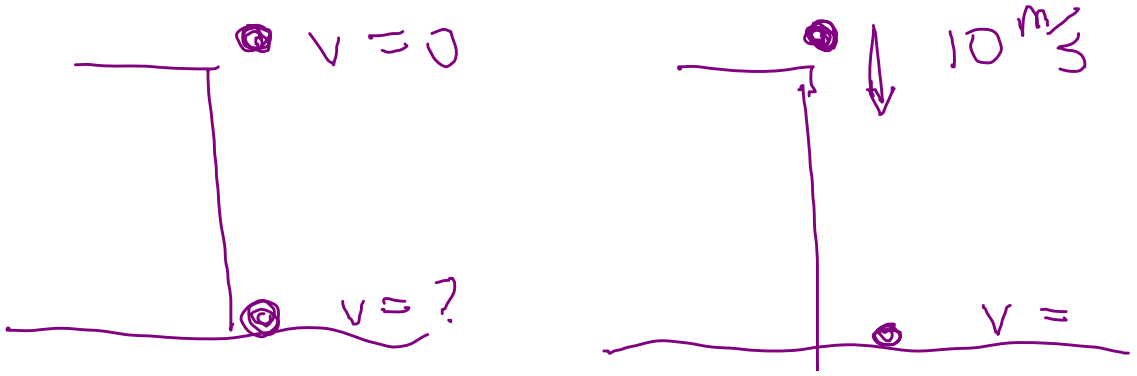
Free fall

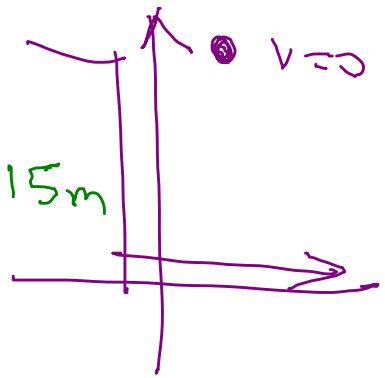
$$a = -9.8 \ \frac{m}{s^2}$$

$$= -g$$



2.68 A castle's defenders throw rocks down on attackers from 15 m wall w/ init speed 10 m/s. How much faster are the rocks moving when they hit ground than if they simply dropped rocks?

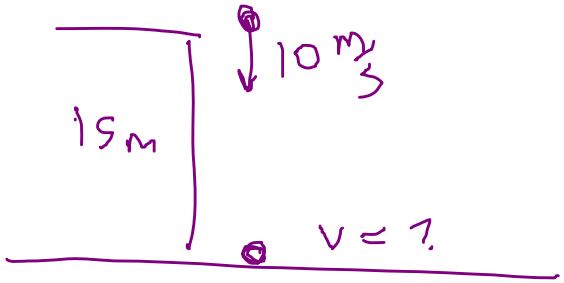




$$v^2 = v_0^2 + 2a(y - y_0)$$

$$v^2 = 0 + 2\left(-9.8\frac{m}{s^2}\right)(-15m)$$

$$v = 17.1\frac{m}{s}$$



$$v^2 = \left(-10\frac{m}{s}\right)^2 + 2\left(-9.8\frac{m}{s^2}\right)(-15m)$$

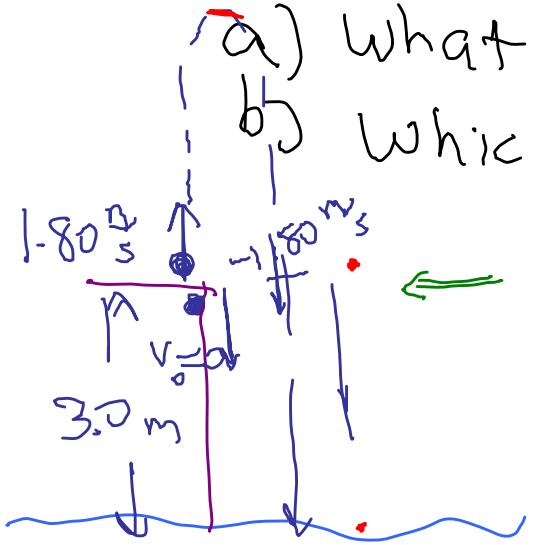
$$v = -19.8\frac{m}{s}$$

2.69 Two divers jump from 3.00 m platform

One jump upward at $1.80 \frac{m}{s}$ & second one steps off platform as the first passes one the way down.

a) What are their speeds as they hit water?

b) Which hits water first?



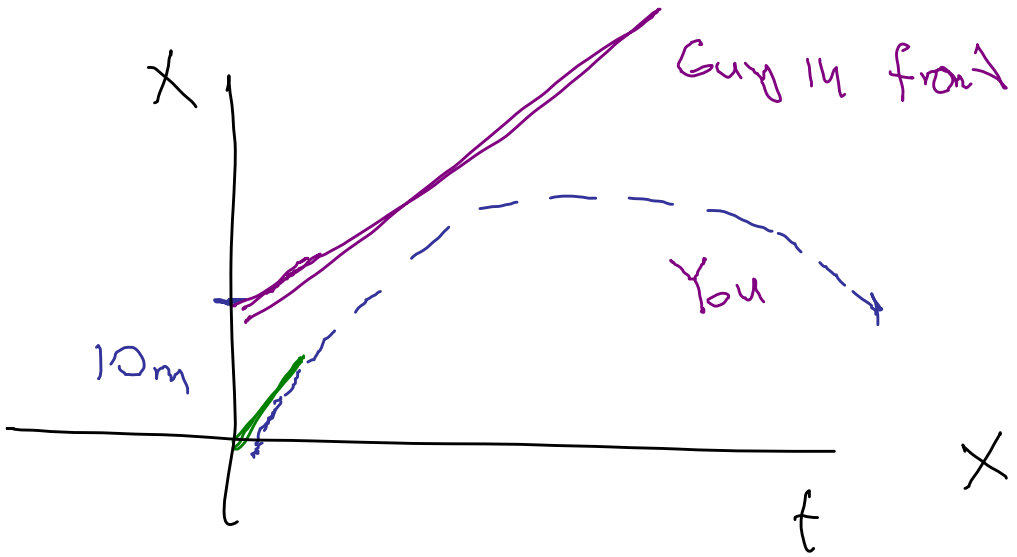
$$v^2 = v_0^2 + 2a(y - y_0)$$

$$v^2 = (+1.80 \tfrac{m}{s})^2 + 2(-9.8 \tfrac{m}{s^2})(-3.0\ m)$$

etc.

2.62 You're speeding at $85 \frac{km}{h}$ when you notice that you're only 10 m behind car in front, moving at $60 \frac{km}{h}$. Slam on brakes (immed) and your car negatively accel's at $< 4.2 \frac{m}{s^2}$. Other car contin's at same speed.

Will you collide? If so at what relative speed? If not, what will be dist of closest approach?



$85 \frac{km}{h} = 23.6 \frac{m}{s}$

$60 \frac{km}{h} = 16.7 \frac{m}{s}$

$X_1 = (23.6 \frac{m}{s})t + \frac{1}{2}(-4.2 \frac{m}{s^2})t^2$

$X_2 = 10\,m + (16.7 \frac{m}{s})t$

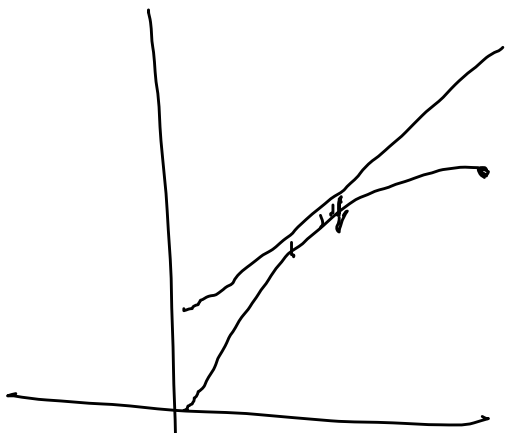
If we collide

$23.6t - 2.1t^2 = 10 + 16.7t$

$2.1t^2 - 6.9t + 10 = 0$

$$t = \frac{6.9 \pm \sqrt{-3.63}}{4.2}$$

No solution.



When is Δx smallest?

$$\Delta x = x_2 - x_1$$

$$= 2.1t^2 - 6.9t + 10$$

Smallest ≈ 4 m

Minimize $4.2t - 6.9 = 0$

$t = 1.64$ s

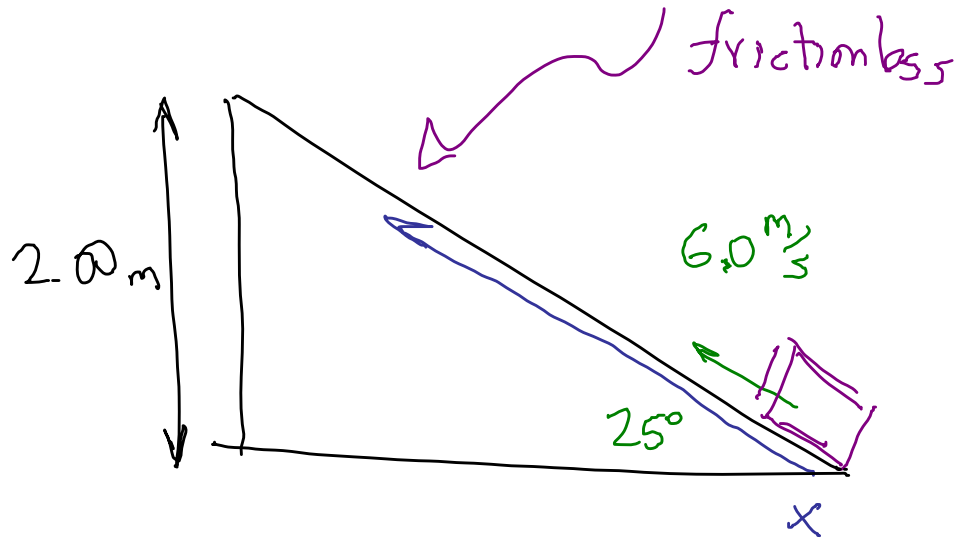
$x_1 = 37$

$x_2 = 33.05$

Example:

Block projected up inclined plane at speed $6.0 \frac{m}{s}$.

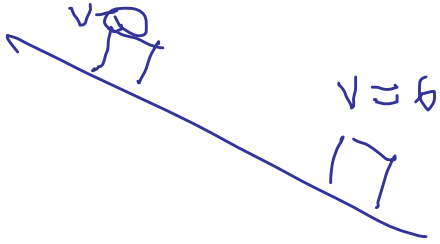
Does it get to top?



$$|a| = g \sin\theta \qquad a = -4.14 \frac{m}{s^2}$$

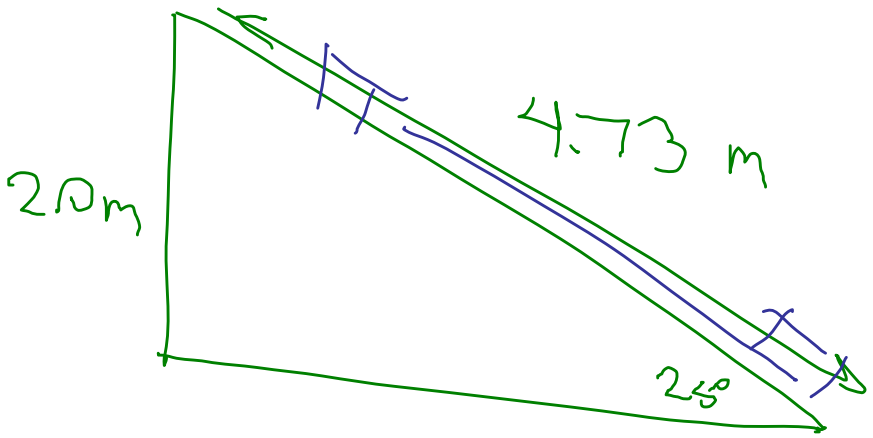
$$v^2 = v_0^2 + 2a(x - x_0)$$

$$0 = \left(6 \frac{m}{s}\right)^2 + 2\left(-4.14 \frac{m}{s^2}\right) x$$



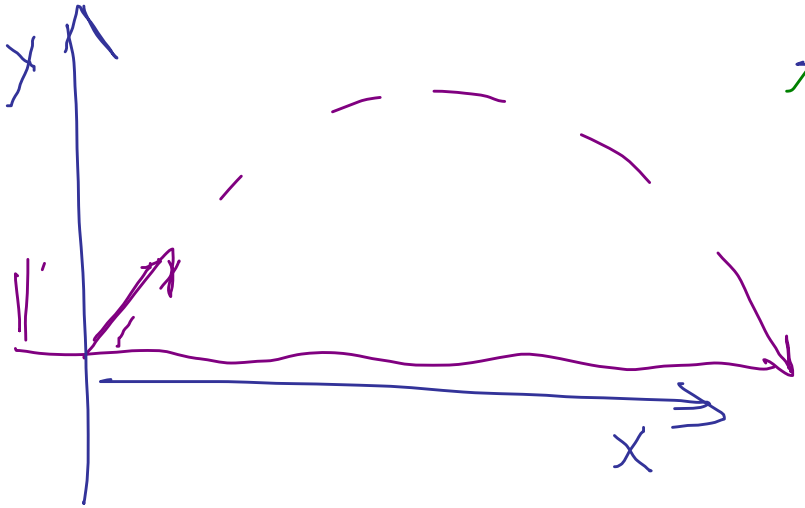
$X = 4.34\ m$

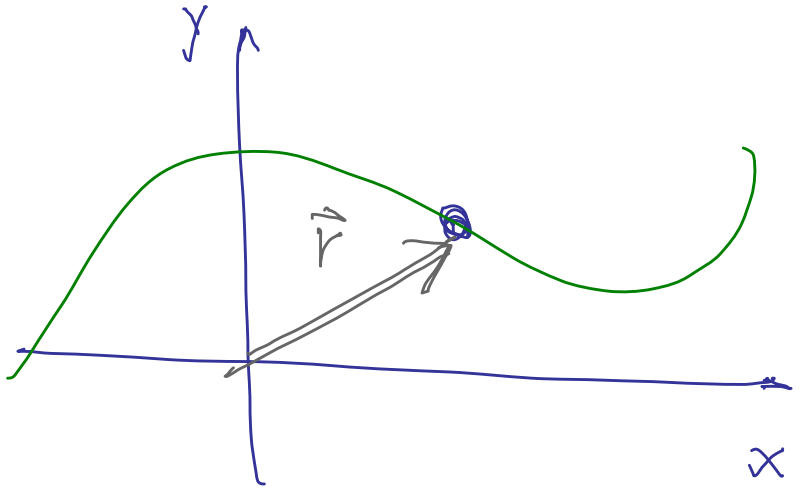
No, doesn't get to top



Chap 3 Motion in 2-Dimensions

$x(t)$ $y(t)$





Vectors.

Some quantities have direction & magnitude. **Vectors** Repr'd by arrow

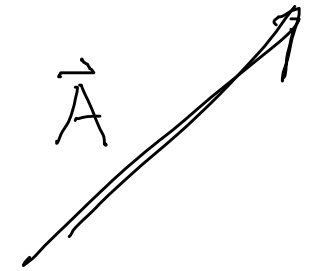
Some don't, **Scalar**

Energy
Temperature

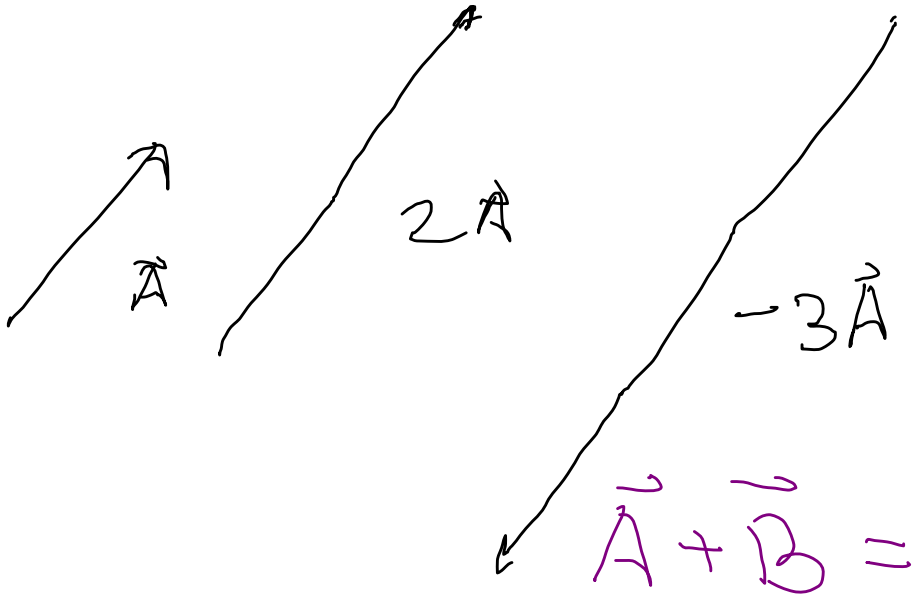
Forces
Momentum
$\vec{E}$, $\vec{B}$

Displacement
Velocity
Acceleration.

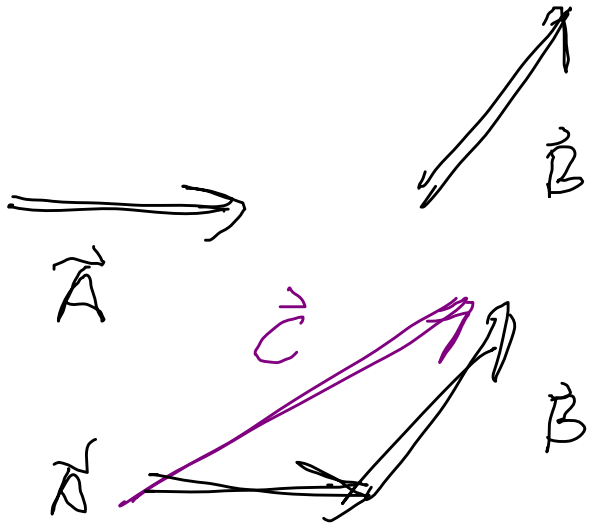
Vector rep'd by arrow



Mult vector by scalar

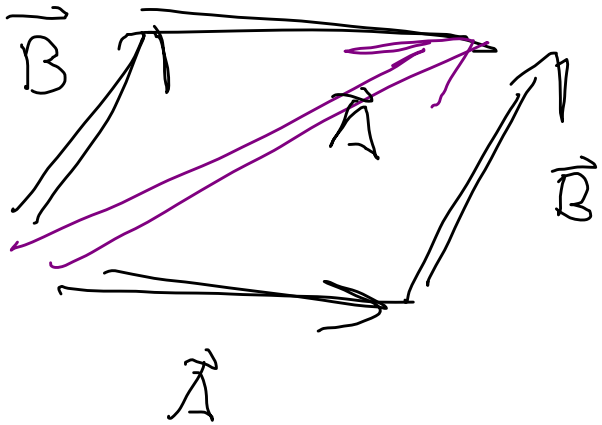


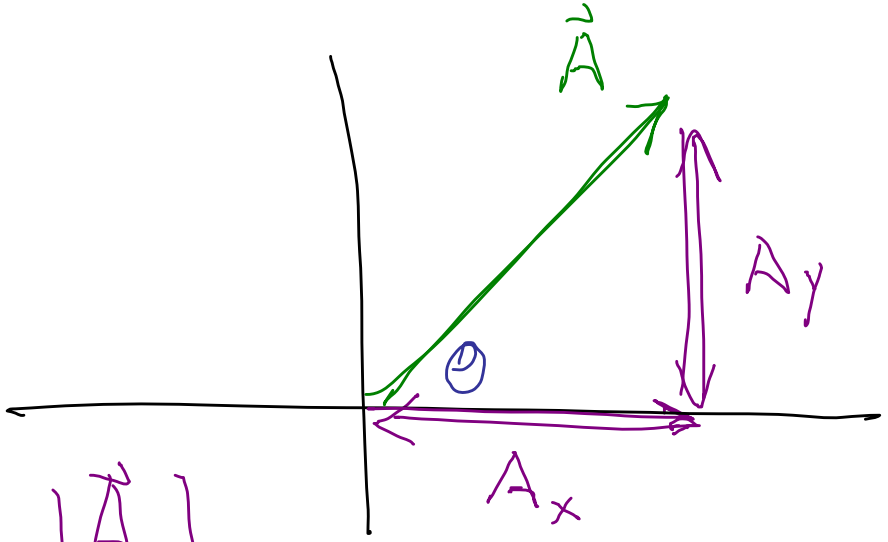
Add vectors:



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

Components :





Mag. of $|\vec{A}|$

$= A$

$A_x = A\cos\theta$

$A_y = A\sin\theta$