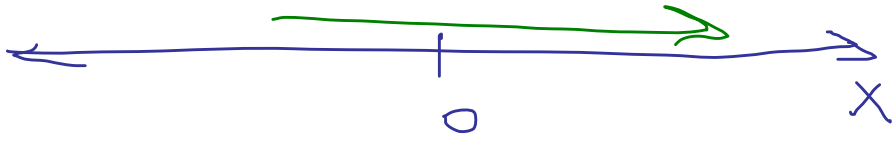
Phys 2110-5 9/5/12

Note Title 9/5/2012

1D Motion Chap 2



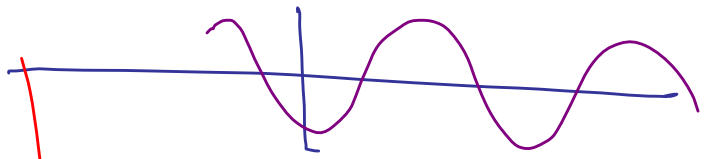
x, v, a

Constant acceleration, a

$$v = v_0 + at$$

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

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



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

2.32 Starting from rest a car accelerates at constant rate reaching 88 $\frac{km}{h}$ in 12s. Find

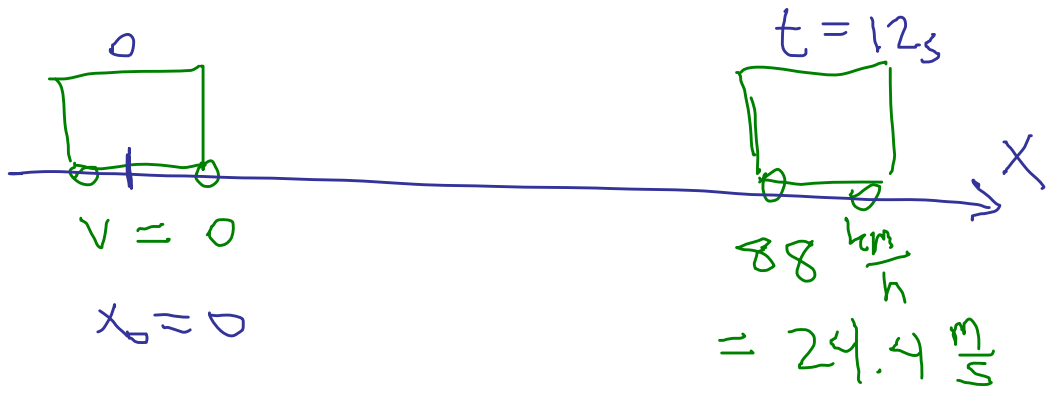
a) Acceleration

b) How far it go in that time?

a) $a = \frac{v - v_0}{t}$

$= \frac{24.4 \frac{m}{s} - 0}{12s}$

$= 2.0 \frac{m}{s^2}$



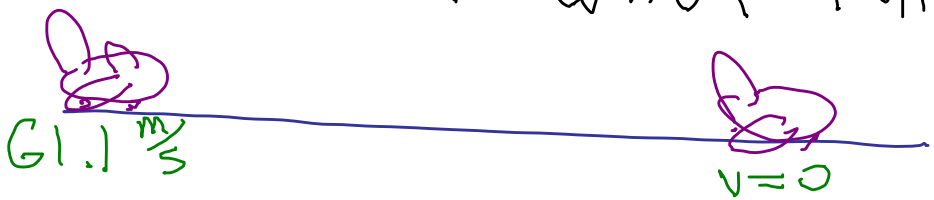
$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$= 0 + 0 + \frac{1}{2}\left(2.0 \frac{m}{s^2}\right)(12 s)^2$$

$$= 140 \text{ m}$$

$$\left(220 \frac{km}{hr}\right)\left(\frac{10^3 m}{1 km}\right)\left(\frac{1 hr}{3600 s}\right) = 61.1 \frac{m}{s}$$

2.57 A jetliner touches down at $220 \frac{km}{h}$ & comes to a halt 29 s later. What's the shortest runway on which this aircraft can land?



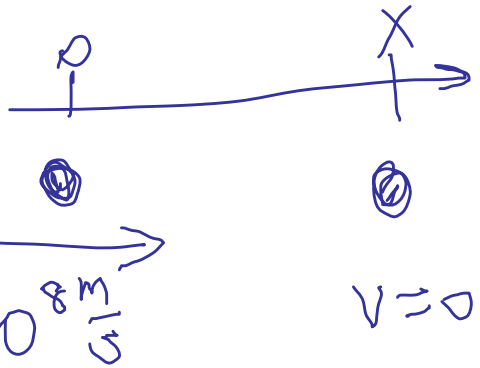
$t = 29 s$ a!!

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

$$890_m = 0 + \frac{1}{2}\left(0 + 61.1\frac{m}{s}\right)29\ s$$

$$= \boxed{0.890\ km}$$

2.34 In medical X-ray tube electrons accl to a vel. of $10^8 \frac{m}{s}$ slammed into target. As they stop, X rays produced Time for stopping is 10^{-9} s. How far do they move?

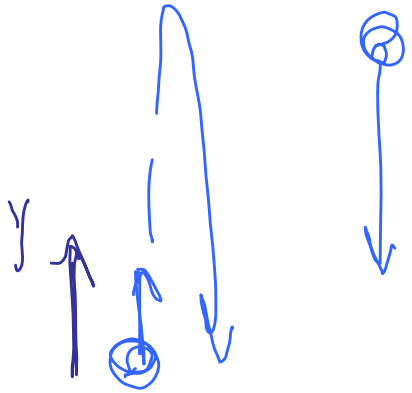


$$X = X_0 + \frac{1}{2}(V + V_0)t$$

$$= 0 + \frac{1}{2}(0 + 10^8 \tfrac{m}{s})\, 10^{-9} s$$

$$= 0.05 \text{ m}$$

Free Fall

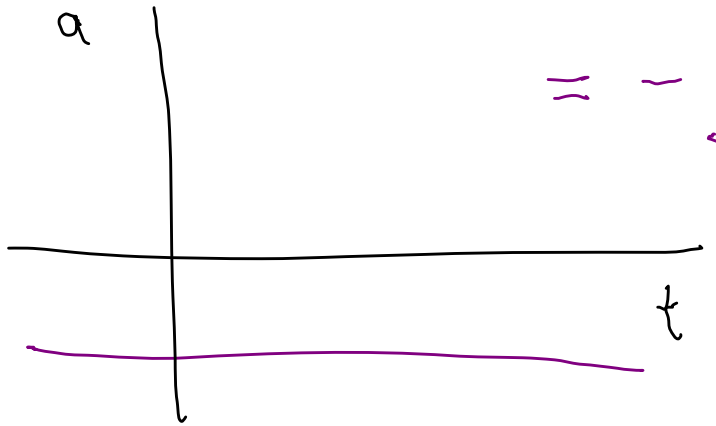


When object moves up & down "through the air"

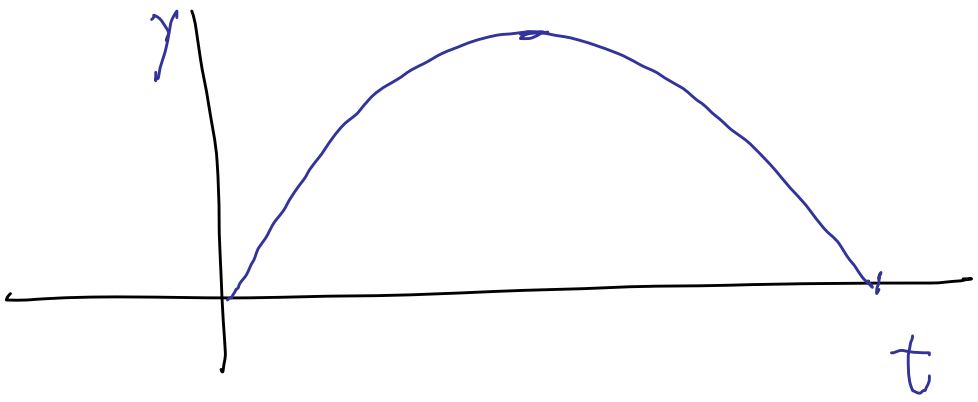
Velocity is <u>decreasing</u>

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

$= -g$



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



$a = -g$

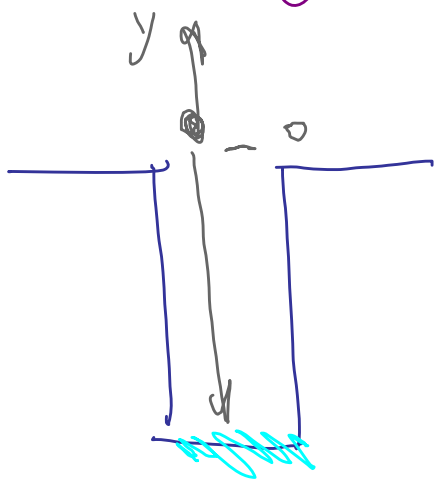
$v = v_0 - gt$

$v = v_0 + at$

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

2.37 You drop a rock into a deep well and 4.4 s later hear splash. How far down is water?

What is y at $t = 4.4$ s?



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

$$= 0 + 0 + \frac{1}{2}(-g) t^2$$

At $t = 4.4_5$

$$= \frac{1}{2}\left(-9.8 \frac{m}{s^2}\right)(4.4_5)^2$$

$$= \boxed{-94.9\ m}$$

$$y = -\frac{1}{2} g t^2$$

2.38 Your friend is sitting 6.8 m above you on branch. How fast you throw apple so that so it just reaches her.

$a^2 = b^2$

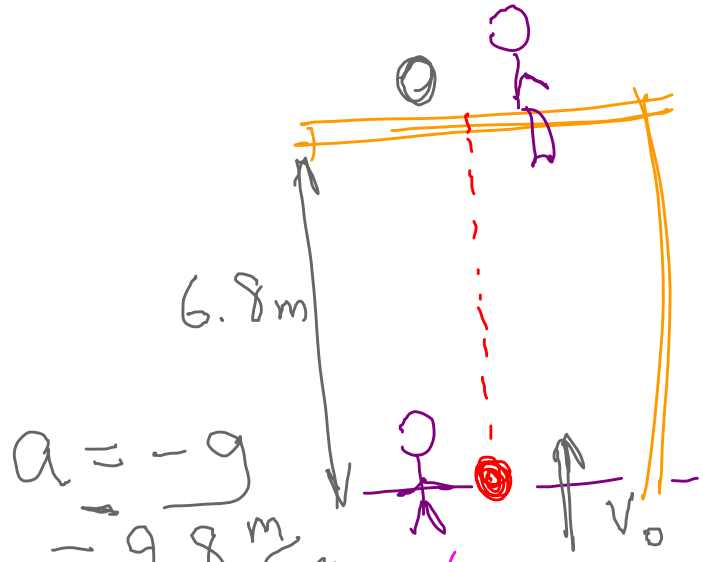
$a = \pm b$

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

$0 = v_0^2 + 2\left(-9.8 \frac{m}{s^2}\right)(6.8 m)$

$v_0^2 = 2\left(9.8 \frac{m}{s^2}\right)(6.8 m)$

6.8 m



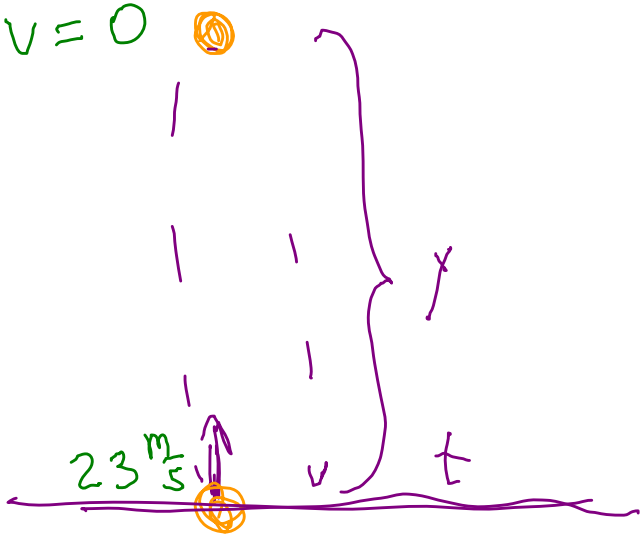
$v_0 = 11 \frac{m}{s}$

2.40 A foul ball leaves the bat going str. up at $23 \frac{m}{s}$. How high does it rise? How long is it in air?

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

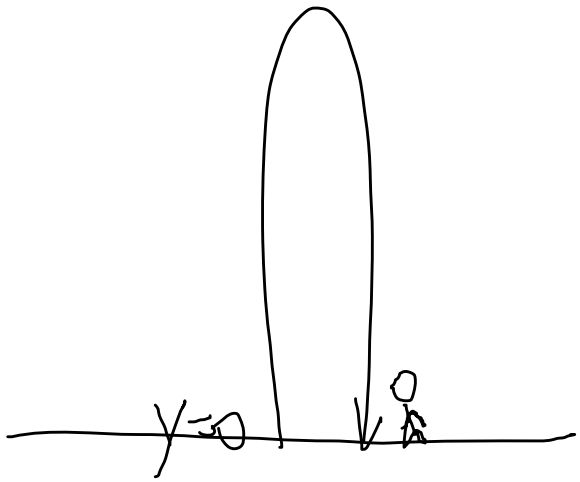
$$0 = \left(23 \frac{m}{s}\right)^2 + 2\left(-9.8 \frac{m}{s^2}\right) y$$

$$y = 27\ m$$



How long is it in air?

When does $y = 0$?



$$y = \cancel{y_0} + v_0 t - \frac{1}{2} g t^2$$

$$0 = v_0 t - \frac{1}{2} g t^2$$

$$= t\left(v_0 - \frac{g}{2} t\right)$$

$v_0 = 23 \frac{m}{s}$

$t = 0$

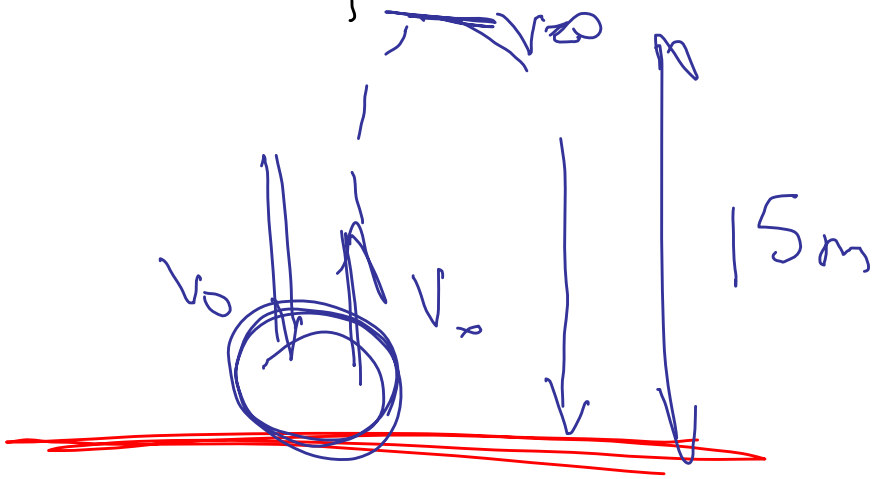
$v_0 - \frac{g}{2} t = 0$

$t = \frac{2 v_0}{g} = 4.69 s$

When does it get to max ht?

$v = v_0 - gt = 0$ $\quad t = \frac{v_0}{g} = 2.3 s$

2.63 Airbags cushioned Mars rover, it bounced some 15 m vertically after first impact. Assuming no loss of speed at contact, find speed of impact.



$v_0 = 10.59 \frac{m}{s}$

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

etc.