Class 6 - Sept 28/05

Finish §5.3

$a_y = -g$ Free Fall

"weightless"

$W_{app} = 0$

No expt

Einstein (1907):

text: weightless ≠ no weight

Einstein: weightless = no weight

CHAPT 6
2 DIM. DYNAMICS

§6.1
§6.2
} rehash

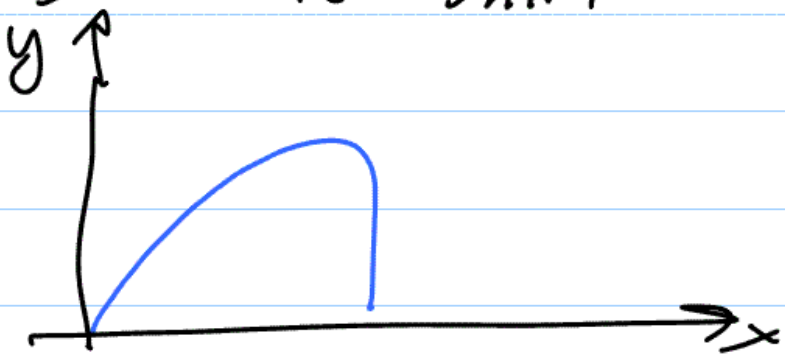
Cartesian Components'

motions are independent

$$x_f = x_i + v_{ix} t + \frac{1}{2} a_x t^2$$

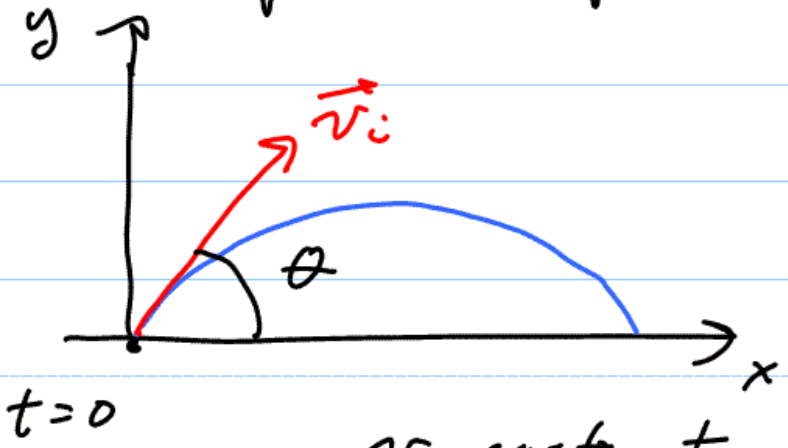
§6.3 Projectile

Shot tee shirt:



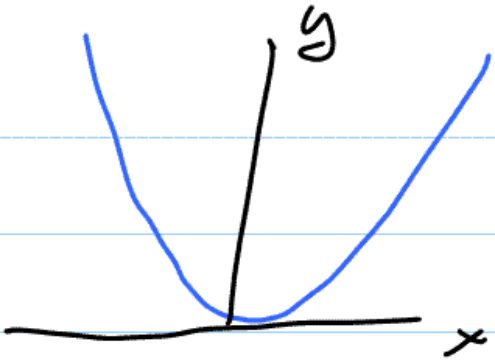
$a_y = -g$

prove a parabola

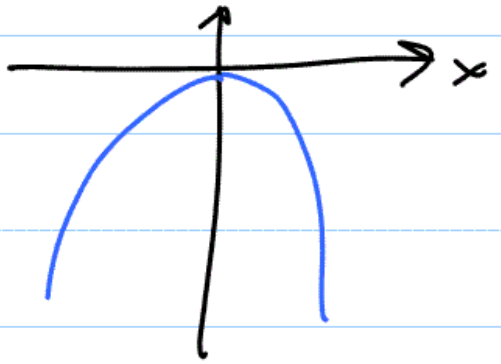


$x = v_i \cos\theta \; t$

$y = v_i \sin\theta \; t - \frac{1}{2} g t^2$

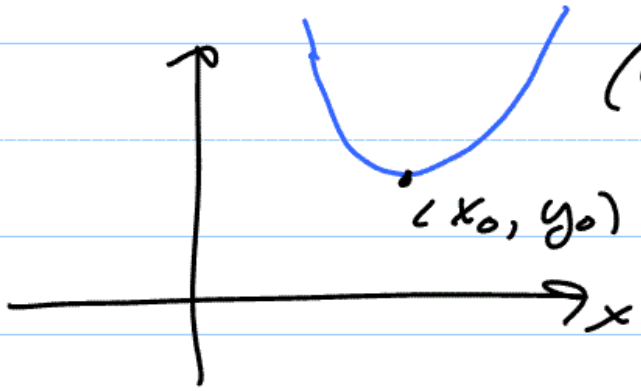


$y = cx^2$



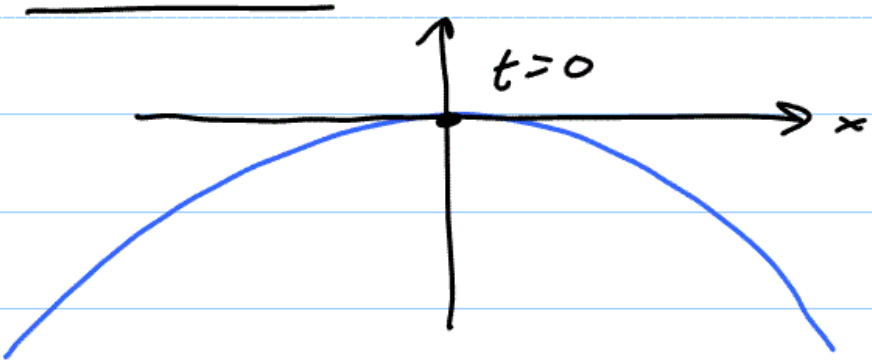
$c < 0$

Generic parabola:



$(y - y_0) = c(x - x_0)^2$

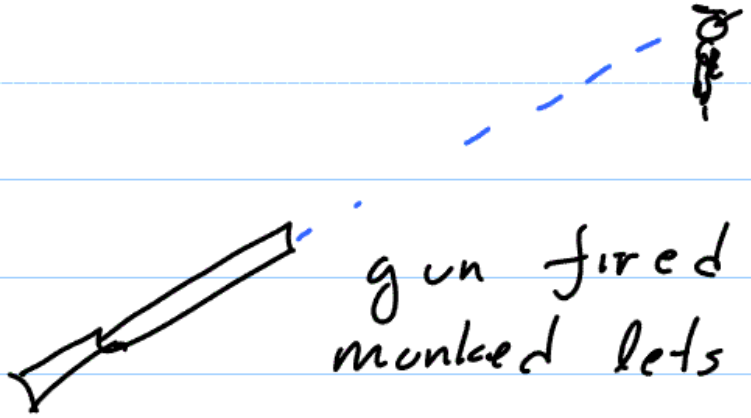
Clever choices!



$$x = v_i \cos\theta \; t \Rightarrow t = \frac{x}{v_i \cos\theta}$$

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

$$y = -\left(\frac{g}{2 v_i^2 \cos^2\theta}\right) x^2$$



max. height?

$\uparrow v_i \sin\theta$

Eqn 2.22:

$$v_f^2 = v_i^2 + 2 a_s \Delta s$$

($\Delta s = h$)

Solve from 1st Principles

$$\Delta v = g t_1$$

t_1 : from launch to highest point

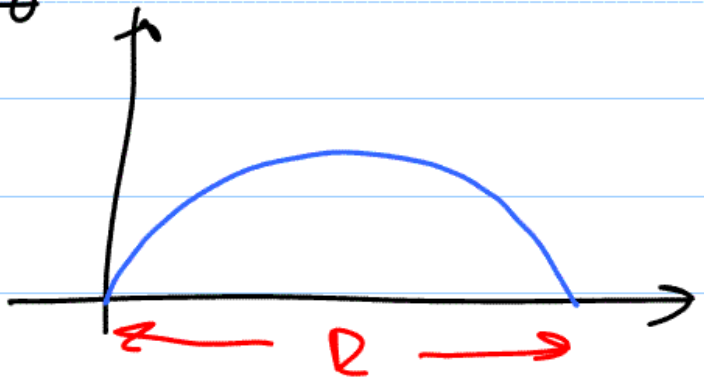
$$t_1 = \frac{\Delta v}{g} = \frac{v_i \sin\theta}{g}$$

t_2 : time from highest back to ground

$$h = \frac{1}{2} g t_2^2$$

$$\boxed{h = \frac{v_i^2 \sin^2\theta}{2g}}$$

Range R



$$R = (v_i \cos\theta)\, t_{tot}$$

$$= v_i \cos\theta \,(t_1 + t_2)$$

$$= 2 v_i \cos\theta \, \frac{v_i \sin\theta}{g}$$

$$= \frac{v_i^2 \sin 2\theta}{g}$$

maximum $\theta = \frac{\pi}{4}$ radians

$= 45^\circ$