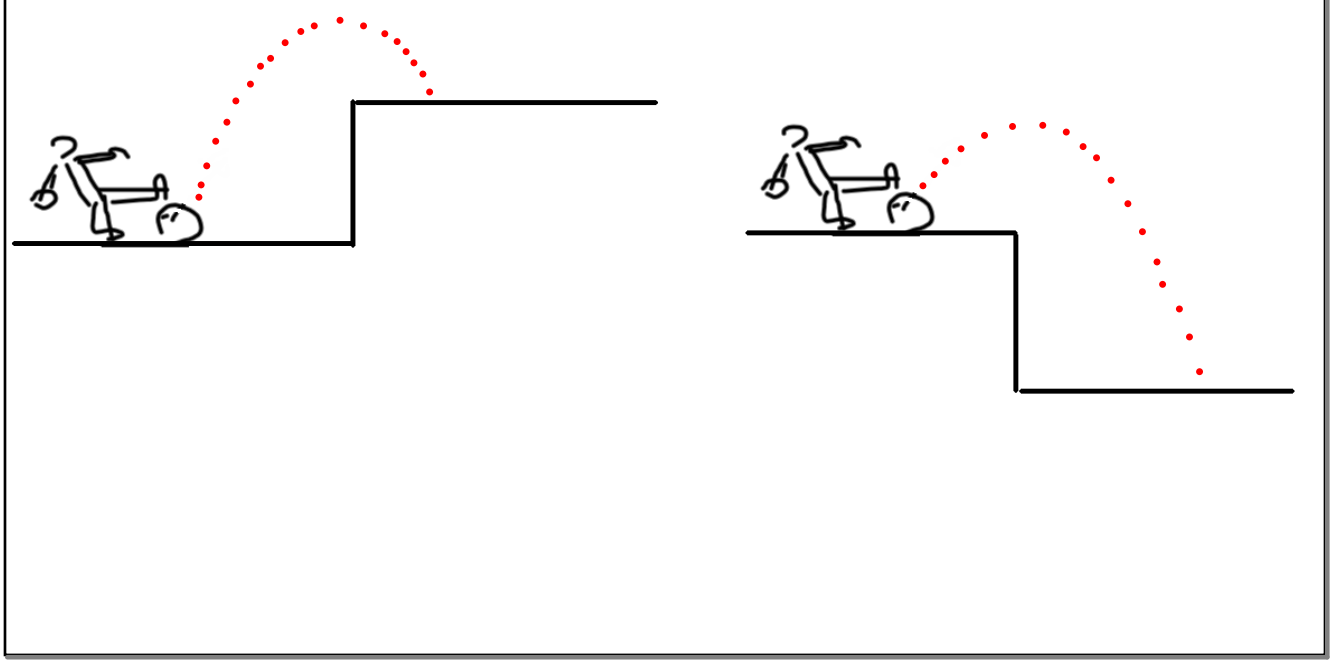
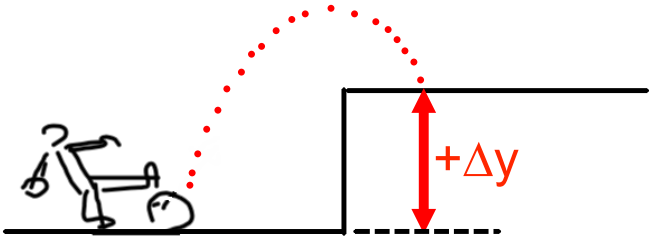
What if it doesn't land at the same height?

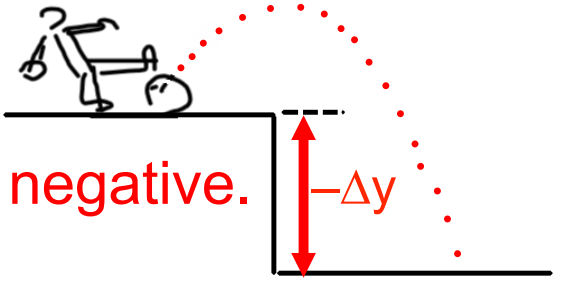


What if it doesn't land at the same height?

Δy isn't zero!

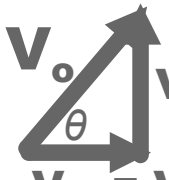


Δy is positive.



Δy is negative.

angled launch with elevation change



$V_{yo} = V_o \sin\theta$

$V_{xo} = V_o \cos\theta$

$\Delta x = V_{xo}t$

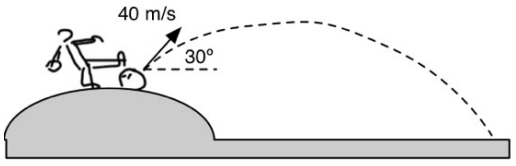
Use to get how far in the x (range).

$\Delta y = V_{yo}t + 1/2a_yt^2$

Set Δy = the change in height.

Quadratic!

(a_y is -10m/s^2)



The soccer ball is kicked and lands 5 m below its original height.
a) Resolve the initial velocity into components.
b) How long was the ball in flight?
c) What horizontal distance did the ball travel?

$40\ m/s$, $30°$: $v_{y0} = 40 \sin 30° = 20\ m/s$

$v_{x0} = 40 \cos 30° = 34.6\ m/s$

$\Delta x = v_{x0} t$

$\Delta x = 34.6t$

$\Delta x = (34.6)(4.24)$

$= 147\ m$

$\Delta y = v_{y0} t + \frac{1}{2} a_y t^2$

$-5 = 20t + \frac{1}{2}(-10)t^2$

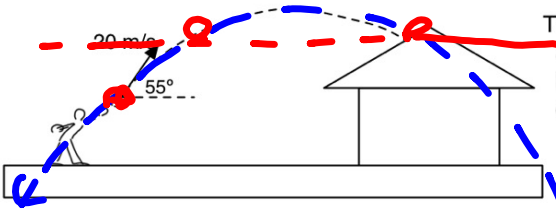
$-5 = 20t - 5t^2$

$+5 \quad +5$

$0 = 5 + 20t - 5t^2$

$c \quad b \quad a$

$t = -0.24\ s$ OR $4.24\ s$



The ball is thrown and hits the roof 6 m above its original height.
a) Resolve the initial velocity into components
b) How long was the ball in flight?
c) What horizontal distance did the ball travel?

$20\ m/s$, $55°$: $v_{y0} = 20 \sin 55° = 16.4\ m/s$

$v_{x0} = 20 \cos 55° = 11.5\ m/s$

$\Delta x = v_{x0} t$

$\Delta x = 11.5t$

$= 11.5(2.86)$

$= 32.9\ m$

$\Delta y = v_{y0} t + \frac{1}{2} a_y t^2$

$+6 = 16.4t + \frac{1}{2}(-10)t^2$

$-6 \quad -6$

$0 = -6 + 16.4t - 5t^2$

$t = 0.42\ s$ OR $2.86\ s$