Tips for solving projectile Motion Problems

1. Clearly, clearly Label your knowns & unknowns

Include x or y

i.e. horizontally → x only $y = 0$

height = Δy (falls $-\Delta y$)

range or distance from base = Δx

time is same for x and y

List ALL equations, figure out which ones you can use.

You'll usually have to use more than 1.

Draw picture.

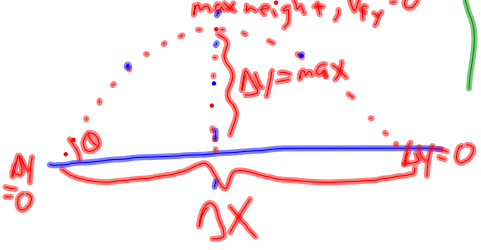
- only use $v_{fy} = 0$ for max height

It is ok to set $\Delta y = 0$

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

$$= t\left(v_{iy} + \frac{1}{2}(-g)t\right) \quad t = 0 \text{ or}$$

Use when initial & final altitude or height are same



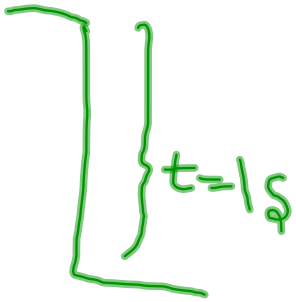
$$v_{iy} + \frac{1}{2}(-g)t = 0$$

$$v_{iy} - 4.9t = 0$$

$$\frac{v_{iy}}{4.9} = \frac{4.9t}{4.9}$$

$$t = \frac{v_{iy}}{4.9}$$

#1



$V_{ix} = 0$

$V_{iy} = 0$

$\Delta y = ?$

$\Delta y = v_{iy}t + \frac{1}{2}at^2$

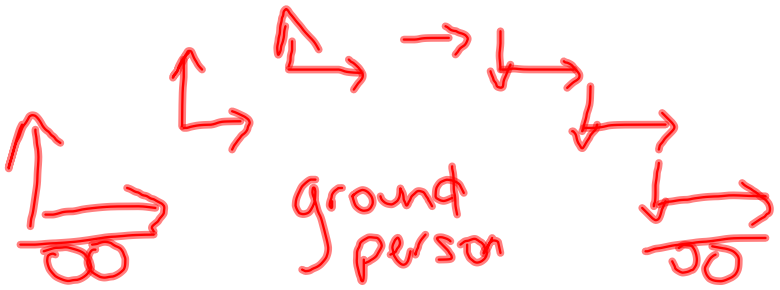
$= 0 + \frac{1}{2}(9.8)(1)$

a) $= 4.9\,m$

b) yes only if $V_{iy} = 0$

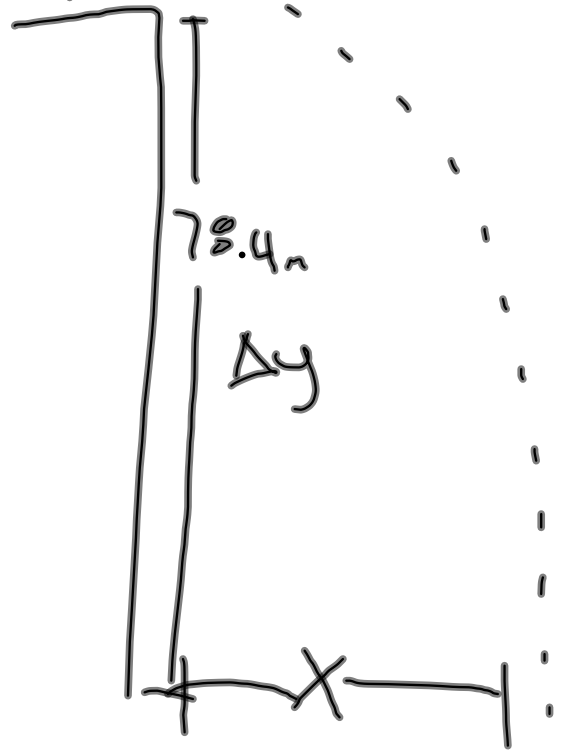
& know how far from edge

#2



rider

3.) 10 m/s: v_{ix}



$v_{iy} = 0$

$78.4 = \frac{1}{2}(9.81)(t^2)$

$78.4 = 4.905t^2$

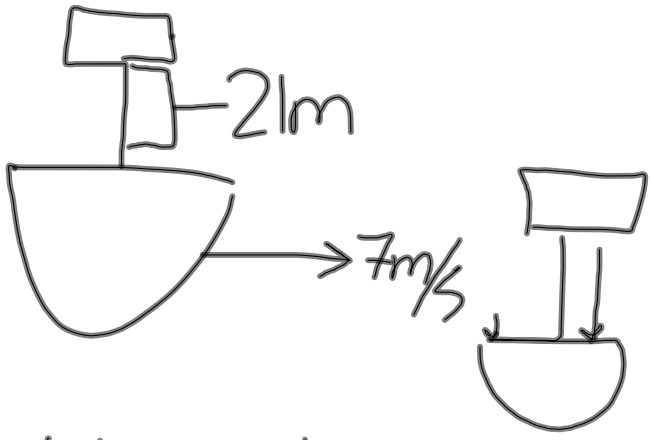
$\frac{4.905}{4.905}$

$15.984 = t^2$

$t = 3.998\,s$

$\Delta x = 10\,m/s(3.99\,s)$

$\Delta x = 40m$



$V_f = V_i + at$

$\Delta y = V_i t + \frac{1}{2} a t^2$

$\Delta y = 21$ $\quad 21 = 0t + \frac{1}{2} - 9.8 t^2$

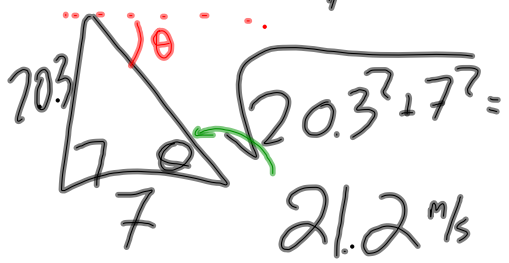
$V_{iy} = 0$

$a = -9.8$ $\quad \frac{21 = 0t - 4.9t^2}{-4.9}$

$\sqrt{4.28 = t^2}$

$V_{fy} = 0 + -9.8(2.07)t = 2.07$

$V_{fy} = 20.3 \text{ m/s}$ ↓



$\sqrt{20.3^2 + 7^2} =$

21.2 m/s

$\tan^{-1}\left(\frac{20.3}{7}\right) = 70.9°$

N of W

above - x axis

below the horizontal

V_{ix}: #5
30 m/s
V_{iy}: 0

764 | Δy

$\Delta y = V_y T + \frac{1}{2}(-g)T^2$

$764 = \frac{1}{2}(-9.81)T^2$

4.905

$159.84 = T^2$

$12.64 = T$ sec

$\Delta x = V_i x T$

$\Delta x = 30(12.64)$

$\Delta x = 379.2 m$

How fast are they going before they hit the ground

$V_{fy} = V_{iy} + (-g)t$

$V_{fy} = 0 + (-9.81)(12.64)$

$V_{fy} = 123.9 m/s$

$V_{fx} = 30 m/s$

123.9

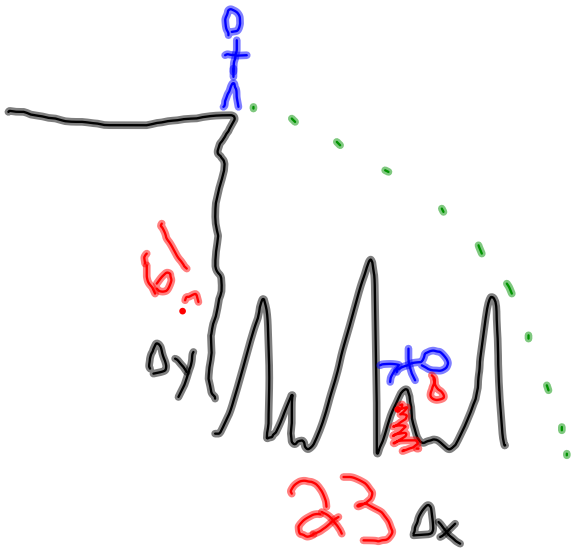
127.5 m/s

30

127.5 m/s | .6114 mph

.278 m/s

280.9 mph



$V_{iy} = 0$

$V_{ix} = ?$

$\Delta y = 0_y t + \frac{1}{2} - g t^2$

$61 = -4.9 t^2$

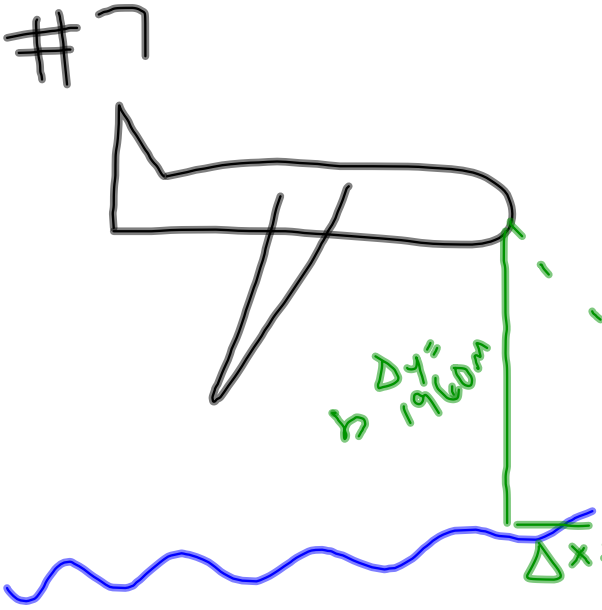
$t = 3.52$

$\Delta x = V_{ix} t$

$23 = V_{ix} 3.5$

$V_{ix} = 6.51 m/s$

#7



$1800^2 + 1960^2 = c^2$

$c = 2661.13m$

$v_{ix} = 90m/s$

$v_{iy} = 0m/s$

$\Delta y = v_i t + \frac{1}{2}(-9.8)t^2$

$1960 = 0 + \frac{1}{2}(-9.8)t^2$

$t = 20s$

$\Delta x = 90t$

$\Delta x = 90(20)$

$\Delta x = 1800m$

#8

$\Delta y = v_{iy}t + \frac{1}{2}(-g)t^2$

$122.5 = 0t + \frac{1}{2}(9.81)t^2$

$\frac{122.5}{4.9} = \frac{4.9t^2}{4.9}$

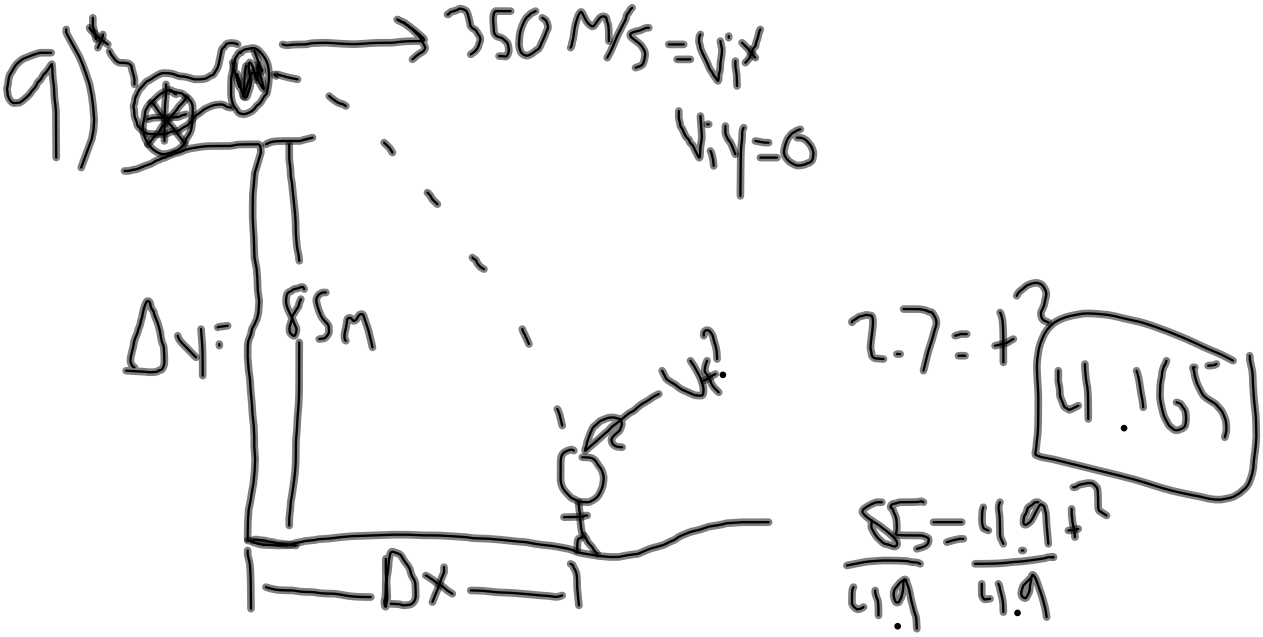
$t^2 = 25$

$t = 5$ sec.

$\Delta x = v_{ix}t$

$40 = v_{ix}(5)$

$v_{ix} = 8$ m/s

9) 

$2.7 = t^2$

$t = 1.65$ s

$\frac{85}{4.9} = \frac{4.9t^2}{4.9}$

$\Delta y = v_{iy}t + \frac{1}{2}(-g)t^2$

$85 = 0 + \frac{1}{2}(-9.8)t^2$