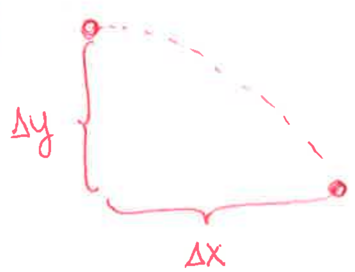
Projectile Homework

1. A rescue pilot drops a survival kit while her plane is flying at an altitude of 2000 m with a forward velocity of 100 m/s. If air friction is disregarded, how far in advance of the starving explorers' drop zone should she release the package? What was the velocity of the survival kit when it strikes the ground?

2. A rifle is fired horizontally. The bullet is found to have traveled 200 m. The rifle barrel is 1.90 meters from the ground. Disregarding air friction, at what speed must the bullet have been traveling as it left the barrel?

3. A skier leaves the horizontal end of the ramp with a velocity of 25 m/s and lands 70 meters from the base of the ramp. How high is the end of the ramp above the landing area?

(1)



$\Delta x = ?$

$V_x = 100\ \frac{m}{s}$

$\Delta t =$

$\Delta y = -2000\ m$

$V_{iy} = 0\ \frac{m}{s}$

$V_{fy} =$

$a_y = -9.8\ \frac{m}{s}$

Δt

$$\Delta y = V_{iy}\Delta t + \frac{1}{2}a_y \Delta t^2$$

$$-2000\ m = 0 + \frac{1}{2}(-9.8\ \frac{m}{s^2})\Delta t^2$$

$$-2000\ m = -4.9\ \frac{m}{s^2}\ \Delta t^2$$

$$\Delta t = \sqrt{\frac{-2000\ m}{-4.9\ \frac{m}{s^2}}} = \boxed{20.2 s}$$

$$V_x = \frac{\Delta x}{\Delta t}$$

$$100\ \frac{m}{s} = \frac{\Delta x}{20.2 s}$$

$$\boxed{2020\ m = \Delta x}$$

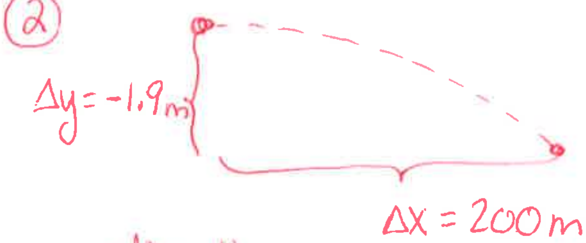
$$V_{yf}^2 = V_{yi}^2 + 2a\Delta y$$

$$V_{yf}^2 = 0 + 2(-9.8\ \frac{m}{s^2})(-2000\ m)$$

$$\sqrt{V_{yf}^2} = \pm\sqrt{39,200}\ \frac{m}{s}$$

$$V_{yf} = \boxed{-198\ \frac{m}{s}}$$

(2)



x-direction	y-direction	
$V_x = ?$	$\vec{V}_{iy} = 0\frac{m}{s}$	Δt
$\Delta x = 200m$	$\vec{V}_{fy} =$	$\Delta y = -1.9m$
$\Delta t =$	$a_y = -9.8\frac{m}{s^2}$	

$$\Delta y = V_{iy}\Delta t + \frac{1}{2}a_y\Delta t^2$$

$$-1.9m = 0 + \frac{1}{2}(-9.8\frac{m}{s^2})\Delta t^2$$

$$\frac{-1.9m}{-4.9\frac{m}{s^2}} = \Delta t^2$$

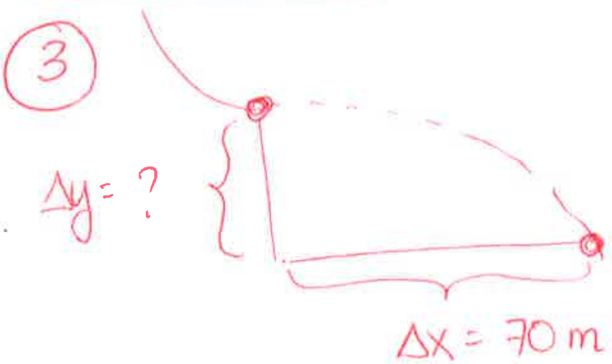
$$\boxed{\Delta t = 0.62s}$$

$$V_x = \frac{\Delta x}{\Delta t}$$

$$V_x = \frac{200m}{0.62s}$$

$$\boxed{V_x = 323\frac{m}{s}}$$

(3)



x-direction	y-direction	
$\vec{V}_x = 25\frac{m}{s}$	$\vec{V}_{iy} = 0\frac{m}{s}$	$a_y = -9.8\frac{m}{s^2}$
$\Delta\vec{x} = 70m$	$\vec{V}_{fy} =$	$\Delta t = 2.8s$
$\Delta t =$	$\Delta\vec{y} =$	

$$\vec{V}_x = \frac{\Delta x}{\Delta t} =$$

$$25\frac{m}{s} = \frac{70m}{\Delta t} \quad \Delta t = 2.8s$$

$$\Delta y = V_{iy}\Delta t + \frac{1}{2}a_y\Delta t^2 \quad (V_{iy}\Delta t = 0)$$

$$\Delta y = \frac{1}{2}(-9.8\frac{m}{s^2})(2.8s)^2$$

$$\Delta y = -38.4m \quad \boxed{38.4m}$$