Name: Key

BALLOON LAUNCH!

The equation $d = V_x t$ tells us the distance our balloon will travel through the air with no external forces other than gravity, so this should be easy...we just need to substitute in for V_x and t then solve for d. Right? Not so fast we have some "Algebra" to do ... ☺

FIND THE INITIAL VELOCITY OF THE BALLOON

V_x stand for horizontal velocity and we can't find that until we know V_i the initial velocity the balloon has when it leaves the launcher. To find V_i we will use the following equation $a = \frac{-2V_i}{t}$ Solve this equation for V_i below.

$$V_i = \frac{at}{-2}$$

In order to calculate V_i we must know a and t. a stands for acceleration of gravity and is equal to -9.8. t represents the average time in the air when the balloon is launched straight up. Let's go outside and time it!

Time 1: _____sec Time 2: _____sec Time 3: _____sec

Purple → 5th hr

Time 4: _____sec Time 5: _____sec Avg Time (t): 4.62 sec / 4.64 sec

Red → 6th hr

Now that we know a and t, substitute to find the initial velocity (V_i) of the balloon. The unit should be $\frac{m}{sec}$.

$V_i = \frac{(-9.8)(4.62)}{-2}$ | $V_i = \frac{(-9.8)(4.64)}{-2}$

Purple → 5th hr | Red → 6th hr

Initial Velocity (V_i) = 22.74 $\frac{m}{sec}$ / 22.64 $\frac{m}{sec}$

Your answer above is in meters per second $\frac{m}{sec}$. Just for FUN, convert that velocity to miles per hour $\frac{mi}{hr}$.

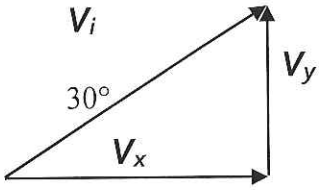
$\frac{1\ m}{sec} = \frac{2.24\ mi}{hr}$

$22.64 \cdot \frac{1m}{sec} = 22.64 \cdot \frac{2.24mi}{hr}$ | $22.74 \cdot \frac{1m}{sec} = 22.74 \cdot \frac{2.24mi}{hr}$

$\frac{22.64m}{sec} = \frac{50.7\ mi}{hr}$ | $\frac{22.74\ m}{sec} = \frac{50.9\ mi}{hr}$

FIND THE HORIZONTAL AND VERTICAL VELOCITIES

The equation used to find V_x (the horizontal velocity) is $.866 = \frac{V_x}{V_i}$. The equation used to find V_y (the vertical velocity) is $.5 = \frac{V_y}{V_i}$. Solve the two equations for V_x and V_y below.



$V_x = .866\,V_i$

$V_y = .5\,V_i$

Now substitute into the equations you just wrote to find the horizontal velocity (V_x) and the vertical velocity (V_y). Both units will be in $\frac{m}{sec}$

$V_x = .866(22.64)$ | $V_x = .866(22.74)$

$V_x = 19.6$ | $V_x = 19.69$

$V_y = .5(22.64)$ | $V_y = .5(22.74)$

$V_y = 11.32$ | $V_y = 11.37$

Horizontal Velocity (V_x) = 19.6 $\frac{m}{sec}$ ~~19.69 $\frac{m}{sec}$~~

Vertical Velocity (V_y) = 11.32 $\frac{m}{sec}$ ~~11.37 $\frac{m}{sec}$~~

FIND THE TIME BEFORE IMPACT

We need to know how long the balloon will be in the air. To find this, we use the equation $a = \frac{-2V_y}{t}$ and solve for t. This t represents the time your balloon will be in the air WHEN LAUNCHED AT AN ANGLE OF 30 DEGREES. It is different from the average t used earlier, which was the time your balloon was in the air when launched straight up. Solve for t below.

$t = \frac{-2V_y}{a} = \frac{-2(11.32)}{-9.8} = \frac{22.64}{9.8}$

Now substitute into the equation you just wrote to find the time the balloon is in the air when launched at 30 degrees (t). Remember, a = -9.8.

$t = \frac{-2V_y}{a} = \frac{-2(11.37)}{-9.8} = \frac{22.74}{9.8}$

2.31 sec

Time in air when launched at 30 degrees (t) = 2.32 sec

FIND THE DISTANCE TRAVELED

Like I said earlier, the equation $d = V_x t$ tells us the distance our balloon will travel through the air with no external forces other than gravity. Now we know V_x and t we can calculate that distance in meters! Show your work below:

$d = V_x t$

$d = \frac{19.6\ m}{sec} \cdot 2.31 sec$

$d = 45.3\ m$

$d = V_x t$

$d = \frac{19.68\ m}{sec} \cdot 2.32\ sec$

$d =$ m

Distance (d) = 45.3 m / ~~45.68 m~~

d is how far away your balloon will land in meters! The last thing we have to do is convert that to yards so we can test it on the football field! (1 m = 1.09 yds)

$45.3 \cdot 1m = 45.3 \cdot 1.09 yds$

$45.3m = 49.4 yds$

Distance (d) = 49.4 yds / ~~49.79 yds~~

$45.68 \cdot 1m = 45.68 \cdot 1.09 yds$

$45.68\ m = 49.79 yds$