Problem 2: (25 pts.) A student on the fifth floor of Hall "X" throws a water balloon out a window 15.0 m above the ground. Exactly 1.91 seconds later, the balloon hits a target on the ground 11.0 m away from the building.

a. (5 pts.) What was the initial x-component of the velocity of the balloon?

b. (5 pts.) What was the initial y-component of the velocity of the balloon?

c. (10 pts.) What is the *magnitude* of the velocity of the balloon just before it hits the ground?

d. (5 pts.) What is the *direction* of the velocity of the balloon just before it hits the ground?

Problem 2: (25 pts.) A student on the fifth floor of Hall "X" throws a water balloon out a window 15.0 m above the ground. Exactly 1.91 seconds later, the balloon hits a target on the ground 11.0 m away from the building.

a. (5 pts.) What was the initial x-component of the velocity of the balloon?

$x_0 = 0$ $\quad x = 11\,m$

$y_0 = 15.0\,m$ $\quad y = 0\,m$

$v_{0x} = ?$ $\quad v_x = ?$

$v_{0y} = ?$ $\quad v_y = ?$

$$v_x = v_{0x} + a_x t = v_{0x}$$

$$x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2 \quad (a_x = 0)$$

$$11.0\,m = 0 + (v_{0x})(1.91\,s)$$

$$v_{0x} = \frac{11.0\,m}{1.91\,s} = \boxed{5.76\,m/s}$$

b. (5 pts.) What was the initial y-component of the velocity of the balloon?

$$y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2$$

$$v_{0y} = \frac{y - y_0 - \frac{1}{2} a_y t^2}{t} = \frac{0 - 15 - \frac{1}{2}(-9.8)(1.91)^2}{1.91} \frac{m}{s}$$

$$\boxed{v_{0y} = +1.51\,m/s}$$

c. (10 pts.) What is the *magnitude* of the velocity of the balloon just before it hits the ground?

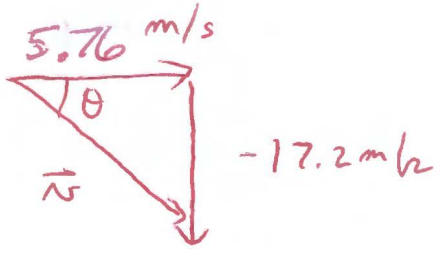
$v_x = v_{0x} = 5.76\ m/s$

$v_y = v_{0y} + a_y t = v_{0y} - gt = 1.51\frac{m}{s} - \left(9.8\frac{m}{s^2}\right)(1.91s)$

$v_y = -17.2\ m/s$

$v = \sqrt{v_x^2 + v_y^2} = \boxed{18.2\ m/s}$

d. (5 pts.) What is the *direction* of the velocity of the balloon just before it hits the ground?



$\theta = \tan^{-1}\left(\frac{-17.2}{5.76}\right)$

$\boxed{\theta = -71.5^\circ}$

Check: Yes, this is the correct quadrant.