2. (40 pts.) Romeo is trying to attract Juliet's attention by throwing a stone against her window. Romeo is a horizontal distance of 25 m away from the building and he releases the stone from shoulder height, which is 1m above the ground. Romeo releases the stone with an initial velocity of 20 m/s at an angle of 60° above the horizontal. Juliet's window sill is exactly 14 m above the ground.

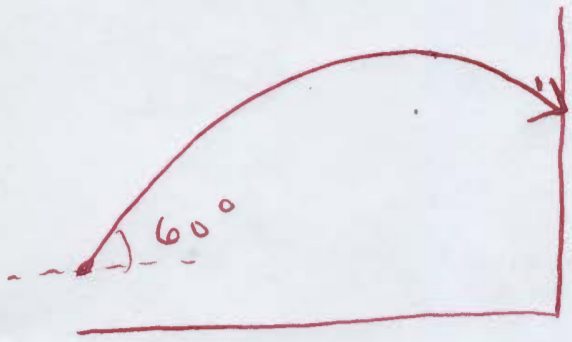
a. (25 pts.) Does the stone make it in the window? That is, how high above the ground is the stone when it hits the wall of the building?

b. (10 pts.) What is the *magnitude* of the velocity of the stone just before it hits the building?

c. (5 pts.) What is the *direction* of the velocity of the stone just before it hits the building?

2. (40 pts.) Romeo is trying to attract Juliet's attention by throwing a stone against her window. Romeo is a horizontal distance of 25 m away from the building and he releases the stone from shoulder height, which is 1m above the ground. Romeo releases the stone with an initial velocity of 20 m/s at an angle of 60° above the horizontal. Juliet's window sill is exactly 14 m above the ground. [See P.S. 2, problem # 1]

a. (25 pts.) Does the stone make it in the window? That is, how high above the ground is the stone when it hits the wall of the building?



$x_0 = 0$

$y_0 = 1$

$v_0 = 20\ m/s\ @\ 60°$

Find: $x = 25$

$y = ?$

$v_{0x} = v_0 \cos 60° = 10\ m/s$

$v_{0y} = v_0 \sin 60° = 17.32\ m/s$

Find time to reach wall:

$$x = x_0 + v_{0x} t$$

$$t = \frac{x - x_0}{v_{0x}} = \frac{25\ m}{10\ m/s} = 2.5\ s$$

then

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

$$y = 1 + (17.32)(2.5) - \frac{1}{2}(9.8)(2.5)^2$$

$y = 13.68\ m$ → doesn't reach the 14m window sill.

b. (10 pts.) What is the *magnitude* of the velocity of the stone just before it hits the ~~window~~ building? [See PS. 2, problem #6]

$v_x = v_{0x} = 10\ m/s$

$v_y = v_{0y} - gt = 17.32 - (9.8)(2.5)$

$v_y = -7.18\ m/s$

$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(10)^2 + (-7.18)^2}$

$v = 12.3\ m/s$

c. (5 pts.) What is the *direction* of the velocity of the stone just before it hits the ~~window~~ building? [See P.S. 2, problem # 7]

$\tan\theta = \frac{v_y}{v_x} = \frac{-7.18}{10}$

$\theta = -35.7°$