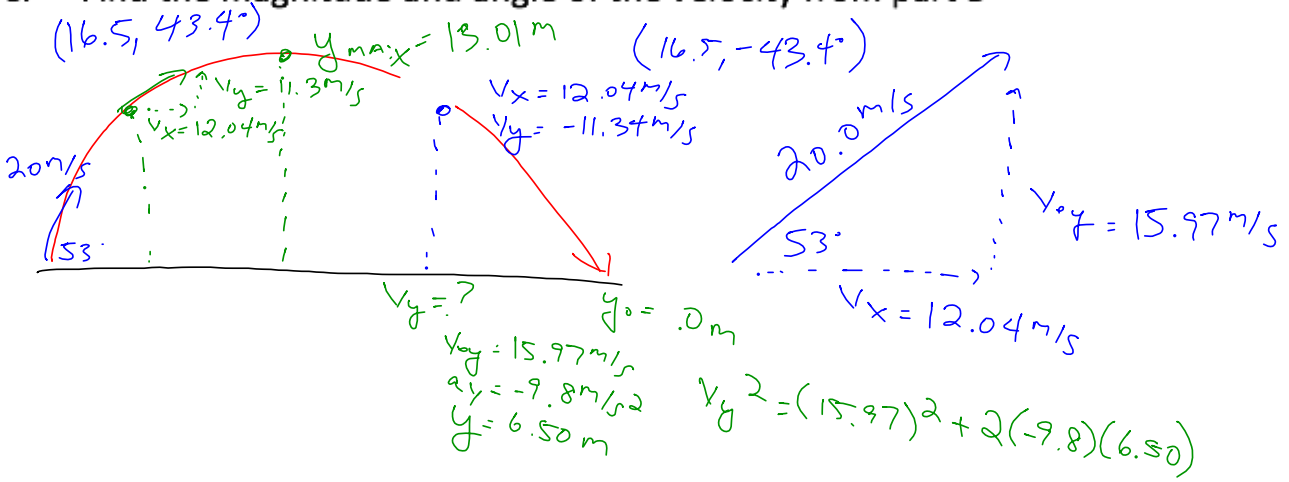
Projectile Motion – Warm Up

A kicker kicks a football with a velocity of 20.0 m/s and at an angle of 53.0 degrees.

A. What is the maximum height of the football?

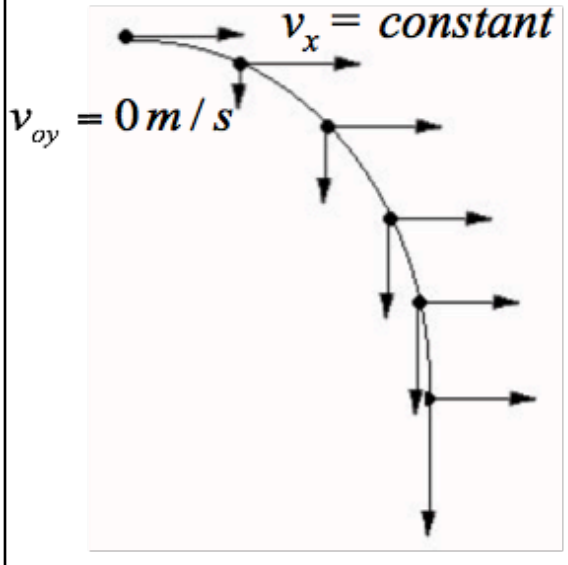
B. What are the x- and y-components of the velocity at a height of 6.50 m?

C. Find the magnitude and angle of the velocity from part B



½ Projectile

- Projectiles launched from an initially horizontal position



- No initial velocity in the y-direction (v_{oy} = 0 m/s)
- y-velocity increases negatively after that
- x-velocity remains constant

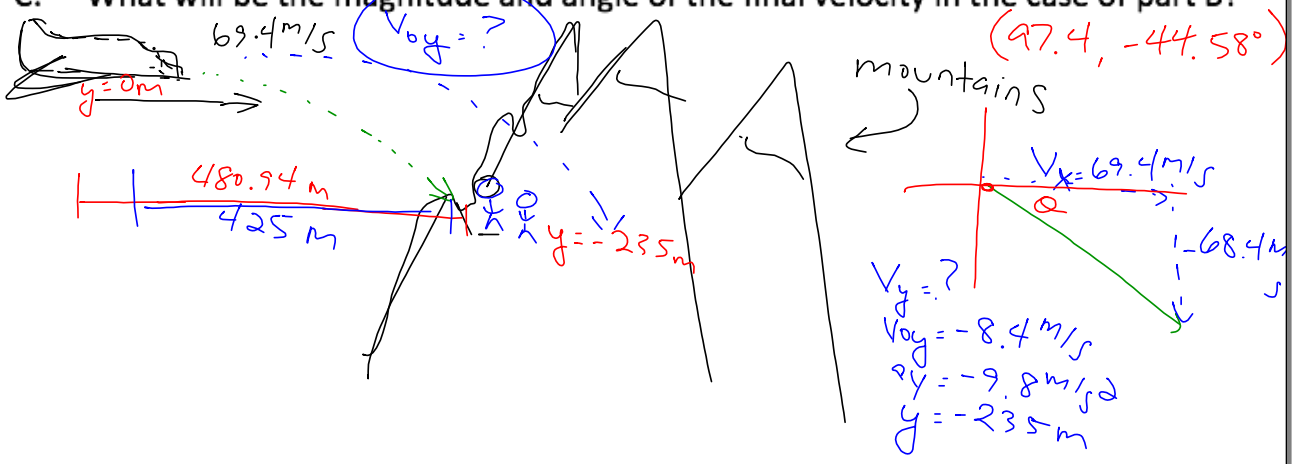
Example 11

A rescue plane is trying to drop supplies to isolated mountain climbers on a rocky ledge 235 m below the plane. If the plane is traveling with a velocity of 250.0 km/h (69.4 m/s)...

A. How far in advance must the supplies be released to reach the climbers?

B. Suppose the supplies were released at a horizontal distance of 425 m in advance of the mountain climbers. What vertical velocity needs to be given to the supplies to ensure they still reach the climbers?

C. What will be the magnitude and angle of the final velocity in the case of part B?



Example 12

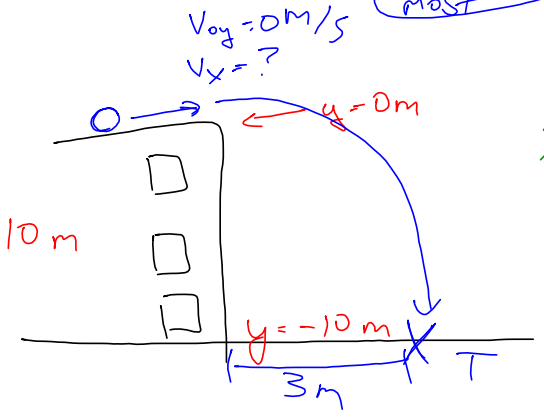
A target T lies flat on the ground 3.00 m from the side of a building that is 10.0 m tall. A student rolls a ball off the horizontal roof of the building in the direction of the target. Air resistance is negligible. The horizontal speed with which the ball must leave the roof if it is to strike the target is ~~move~~ most nearly:

A. $\frac{3}{10}$ m/s

B. $\sqrt{2}$ m/s

C. $\frac{3}{\sqrt{2}}$ m/s

D. 3 m/s



$a \approx -9.8 m/s^2$

$a \approx -10 m/s^2$

$x = V_x \cdot t$

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

$V_x = \frac{3}{t}$

$y = v_{oy} t + \frac{1}{2} a t^2$

$y = 0 + \frac{1}{2}(-10) t^2$

$-10 = -5 \cdot t^2$

$t = \sqrt{2}$

Example 13

During a recent snow-storm, bales of hay had to be dropped from an airplane to a herd of cattle below. Assume the airplane flew horizontally at an altitude of 180 m with a constant velocity of 50 m/s and dropped one bale of hay every two seconds. It is reasonable to assume that air resistance is negligible for this situation.

But for this situation, what will happen to the bales' vertical distance of separation as they fall?

A. The distance of separation will increase
B. The distance of separation will decrease
C. The distance of separation will remain constant
D. The distance of separation will depend on the mass of the bales

Example 13

During a recent snow-storm, bales of hay had to be dropped from an airplane to a herd of cattle below. Assume the airplane flew horizontally at an altitude of 180 m with a constant velocity of 50 m/s and dropped one bale of hay every two seconds. It is reasonable to assume that air resistance is negligible for this situation.

About how far apart from each other will the bales land on the ground?

A. 300 m
B. 180 m
C. 100 m
D. 50 m

$x = v_x \cdot t$

$x = (50)(2)$

Example 14

A rubber ball bounces on the ground as shown. After each bounce, the ball reaches one-half the height of the bounce before it. If the time the ball was in the air between the first and second bounce was 1 second, what would be the time between the second and third bounce?

A. 0.43 s
B. 0.50 s
C. 0.71 s
D. 1.00 s