You and your buddies have created a water balloon slingshot. Using a radar gun, you measure the velocity of the water balloon as it leaves the slingshot. Because you're taking physics, your friends want you to work out how far the balloon will go for a given launch angle.

a) Find an equation for the horizontal distance the balloon will travel in terms of the magnitude of it's initial velocity and the launch angle with respect to the horizontal.

b) Find the maximum height of the balloon in terms of the same variables.

c) Find the x displacement of the balloon at its maximum height.
(Don't assume that it's exactly halfway, PROVE that it is!)

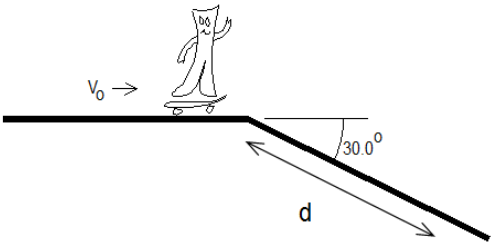
Imagine that you have thrown a ball toward a wall with a speed of 25.0 m/s and at an angle of 40.0º above the horizontal. The wall is 22.0 m from the release point of the ball.

(a) How far above the release point does the ball hit the wall?
(b) What are the horizontal and vertical components of its velocity as it hits the wall?
(c) When it hits, has it passed the highest point on its trajectory? How do you know?

You are sitting in the middle of a field listening to a concert when a water balloon hits you from behind at a speed of 14 m/s coming in at an angle of -60^{o} as measured off of the x axis. If the rows are separated by 1.5 m, how many rows behind you are the vandals sitting? Assume the initial and the final height of the balloon are the same.

a. Draw a sketch of the situation showing ALL relevant variables and define the coordinate system.
b. Using the kinematics equations, derive an expression for the number of rows in terms of GIVEN variables defined in part a.
c. Using your expression from part b and numbers given in the problem statement, calculate the number of rows.

Gumby has just purchased a new skateboard; but, unfortunately, he does not know how to stop. Traveling at 8.0 m/s, he reaches the top of a hill sloping down at 30.0^{o}. He flies through the air and lands a distance d down the slope.



Find the distance d where Gumby lands.

Having recovered from an earlier crash, Gumby is ready to try new and more exciting stunts on his skateboard. After some prodding from the Blockheads, he decides to jump across a river. Gumby knows that the far bank is 3.0 m below the top of the ramp. The ramp is inclined at 37.0^{o} above the x-axis. He is moving at 15 m/s when he leaves the ramp.

a. How wide of a river can Gumby jump if he puts the ramp on the edge of the riverbank?

b. If Gumby lands with $|\vec{v}| > 16 m/s$ his legs will break. Does Gumby need crutches?

An airplane is flying at a speed of V_0 and diving at an angle of θ degrees below the horizontal when it drops a radar decoy. The decoy strikes the ground a horizontal distance of d from where it was released.

Find an expression for the height of the airplane above the ground when the decoy was released.