

In this 1936 cartoon, Popeye and Bruno both try out to be a lifeguard when they see Olive in the pool. There are lots of great problems regarding one- and two-dimensional motion to consider in this clip.

First, at about 0:20, Popeye opens a can of spinach and, squeezing the can, causes it to go into his mouth. However, when he applies the force, the can is completely upright, so the spinach should go straight up and return to its starting point. Have your students make some assumptions about the vertical and horizontal ranges of the spinach and calculate the necessary angle. Also, have them try this with a plastic squeeze bottle. The problem, assuming a vertical range of $y = 0.5 \text{ m}$ and a horizontal range of $x = 0.3 \text{ m}$, would work like this:

Take these 3 equations:

$$x = 0.3 \text{ m} = v_0 \cos \theta (t)$$

$$y = 0.5 \text{ m} = v_0 \sin \theta \left(\frac{t}{2}\right) + \frac{1}{2} a_y \left(\frac{t}{2}\right)^2$$

$$v_{top} = 0 = v_0 \sin \theta + a_y \frac{t}{2}$$

Now, solving the second and third equations for $v_0 \sin \theta$, and setting them equal, we find the time of flight to be 0.6 seconds. Then, by dividing equations 1 and 3, we find the angle to be 70° . Finally, the initial velocity is 15 m/s.

Next, at about 0:28, Popeye hits Bruno and knocks him across the pool. From the timer, it appears that Bruno is in the air for about 1.5 seconds. Assume a distance of 25 meters (for a standard pool) and an angle of 45° , what is Bruno's initial velocity?

$$x = v_0 \cos \theta (t)$$

$$25 \text{ m} = v_0 \cos 45^\circ (1.5 \text{ s})$$

Then, his initial velocity is 20 m/s (or about 50 mph).

Finally, after a great show from Popeye the octopus, Popeye knocks Bruno straight up in the sky. Bruno is in the air for about 6 seconds. What is his y-displacement and velocity when he returns to Popeye's arms?

First, find his initial velocity,

$$v_{top} = 0 = v_0 + a_y \frac{t}{2}$$

$$v_{top} = 0 = v_0 + \left(-9.8 \frac{\text{m}}{\text{s}^2}\right)(3\text{s})$$

$$v_0 = 29 \frac{m}{s}$$

Now, the y-displacement:

$$y = v_0 \left(\frac{t}{2} \right) + \frac{1}{2} a_y (t/2)^2 = 43 \text{ m}$$

Finally, Bruno's final velocity is the same as his initial: $v_f = 29 \frac{m}{s} \sim 64 \text{ mph}$