# Bathtub Problem

Assume that the number of liters of water remaining in the bathtub varies quadratically with the number of minutes which have elapsed since you pulled the plug.

a. If the tub has 38.4, 21.6 and 9.6 liters remaining at 1, 2 and 3 minutes respectively, since you pulled the plug, write an equation expressing liters in terms of time.

b. How much water was in the tub when you pulled the plug?

c. At what time will the tub be empty?

d. Draw a graph of the function in the appropriate domain.

Schlitterbahn Problem

Schlitterbahn is planning a new water ride and they have asked you for help. For the ride, they are planning to have tubers slide down a gigantic slide to gain speed. At the bottom of the slide, the tubers will be launched into the air where they will soar over the Comal River and splash down into a pool on the other side. The problem is that there is a large tree on the opposite bank that the tubers must clear to land safely. Since you know that objects in free fall follow a parabolic path, you decide to use a quadratic function to model this problem.
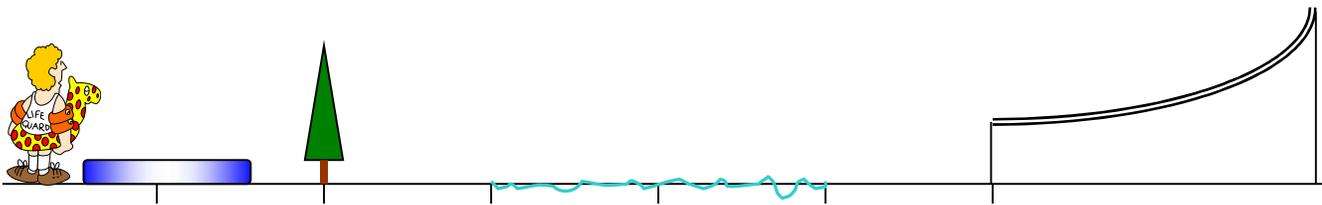
a. Write the particular equation of the parabolic path of the tuber based on the coordinates shown in the diagram above.

b. How high above the river will the tubers be when they fly over the right river bank at $x = 2$?

c. How high will they be when they fly over the left river bank at $x = 0$?

d. What is the maximum altitude they reach?

Gateway Arch Problem

On a trip to St. Louis you visit the Gateway Arch. Since you have plenty of time on your hands, you decide to estimate its altitude. You set up a Cartesian coordinate system with one end of the arch at the origin. The other end of the arch is at $x = 162$ meters. To find a third point on the arch, you measure a value of $y = 4.55$ meters when $x = 1$ meter. You assume the arch is parabolic.

a. Find the particular equation of the underside of the arch.

b. What is the x-coordinate of the vertex? By substituting this number into the equation, predict the height of the arch.

c. An airplane with a wingspan of 40 meters tries to fly through the arch at an altitude of 170 meters. Could the plane possibly make it?