

# Problems of the Month

## November-December 2019

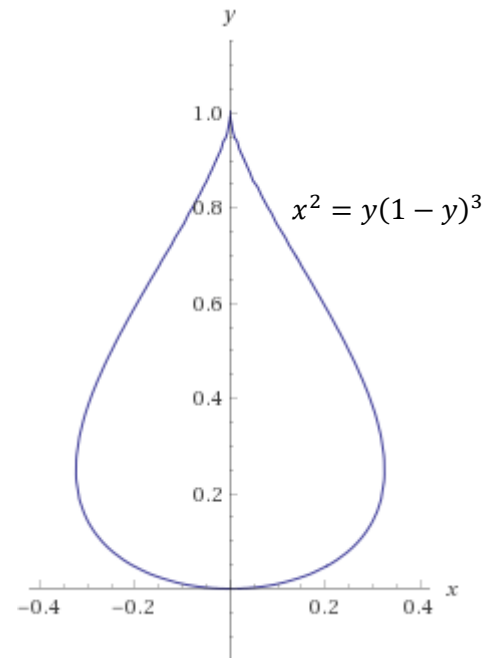
### General Problem:

To build the foundation of the new building across the street, they are digging holes for pilings as part of the foundation. Assume one of the holes is a cylinder 2 feet in diameter and 30 feet deep. If there are 50 such holes, how much concrete will they need to fill them all?

### Calculus Problem:

Suppose instead of cylindrical pilings, as above, the pilings instead have a teardrop shape. It can be described mathematically by taking the curve shown here and rotating it around the  $y$ -axis. Assume the total height is still 30 feet from tip to bottom. Find the volume of this piling.

(Engineering Disclaimer: this is rather unusual piling shape, but sometimes in permanently saturated environments, the base of a piling will take different shapes depending on the nature of the soil)



### Challenge Problem:

A wall and a fence meet at right angles, with the wall running north-south. Two spots are marked at a distance 1 meter east of the wall; they are 3 and 6 meters north of the fence. What is the length of the shortest path from one spot to the other, provided the path meets the wall and the fence (possibly at two different points)?