MATH 162: HOMEWORK G

(due: Friday, 20th April)

1. For amusement, Mme Verdurin has been trying to evaluate the following indefinite integral:

$$\int_0^2 \sqrt{x + \sqrt{x + \sqrt{x + \cdots}}}\, dx$$

She finally asks her friend, Odette, to help her. What should Odette tell Mme Verdurin?

2. Robert de Saint-Loup is stuck on a calculus homework problem:

A cylindrical hole of radius 3 cm is bored through a sphere of radius 5 cm. The hole has been bored so that its main axis passes through the center of the sphere. (Of course, referring to the diagram below, h = 4 cm.)

Robert must compute the volume of the remainder of the sphere. His friends, Albertine and Marcel, offer to help him. Marcel soon solves the problem, much to Robert's delight. However, in an unexpected twist, Albertine claims that the answer *does not depend upon the radius of the sphere but only upon h* (of course, as long as the radius of the sphere is greater than the radius of the hole)! Robert and Marcel feel that Albertine has gone mad. Who is correct and why?
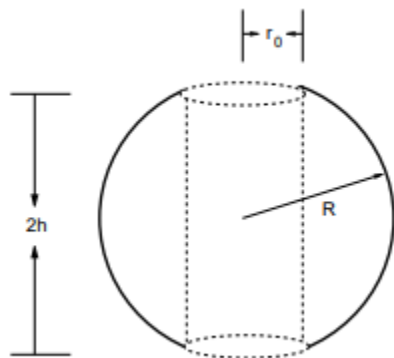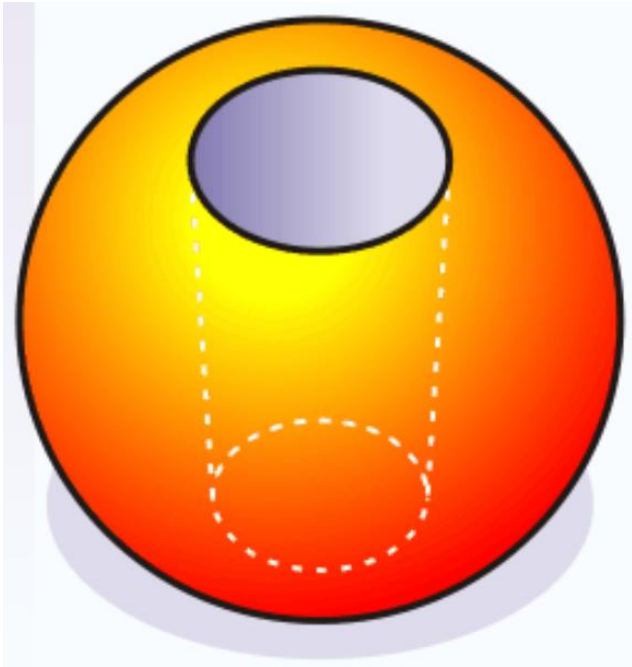
3. Jack and Jill decide to manufacture wine goblets. Their idea is to rotate the region shown below about the y-axis. Write an expression that represents the volume of material required to construct the drinking glass. (Your answer may contain the function f(y).) Assume that the units are inches.

$x = \left(\frac{y}{3}\right)^{1/5}$

$x = f(y)$

AND JILL

l went up the hill,
ail of water;
and broke his crown
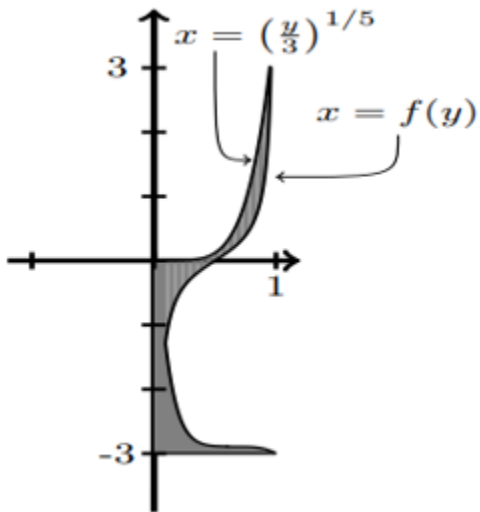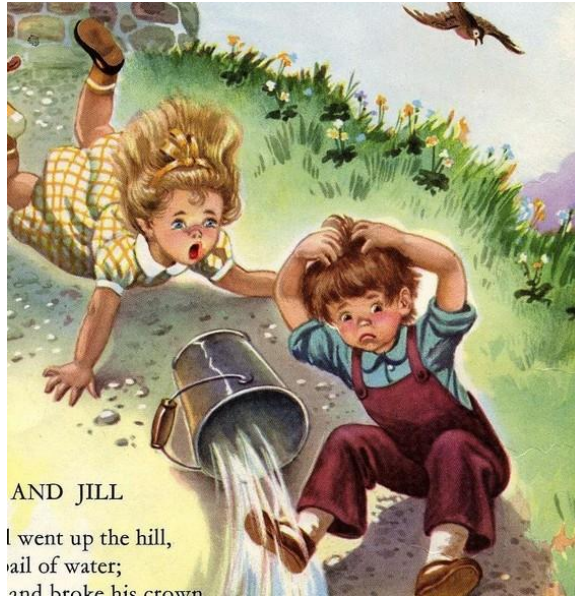
4. When a Space-X rocket takes off it does not travel in a straight line as it ascends. Instead, it turs slightly east, so that it gains speed by traveling with the rotation of the earth. From Space-X control's point of view, the rocket's path appears to follow the curve $y = \sqrt{1 + 10x^2} - 1$, $where\ y\ is\ the\ height\ in\ meters\ of\ the\ rocket$ off the ground and x is the horizontal movement in meters from the launch pad. After 20 seconds, the rocket appears to be 1 kilometer high.

    (a) Determine, to the nearest hundredth of a meter, the horizontal distance the rocket has traveled from the launch pad at 20 seconds.

    (b) From Space-X control's point of view, what is the total distance of the path the rocket appears to have traveled throughout the first 20 seconds of its trip? Give your answer to the nearest hundredth of a meter, and be certain to justify your answer.