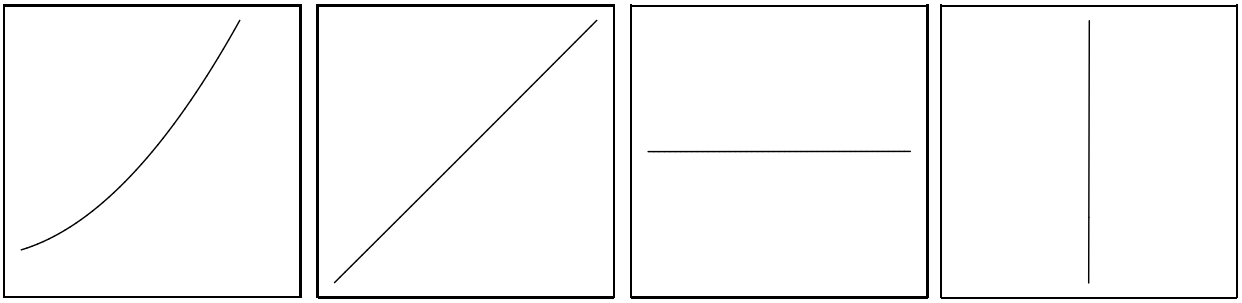
#2 **Problems for 151:07–09** **9/12/2007**

1. A surveyor stands on flat ground at an unknown distance from a tall building. She measures the angle from the horizontal ground to the top of the building; this angle is $\pi/3$. Next she paces 40 feet further away from the building. The angle from the ground to the top of the building is now measured to be $\pi/4$.

a) How tall is the building?

b) If the surveyor moves 20 feet further away from the building, what will be the angle from the horizontal ground to the top of the building?

2. Here are four graphs of $y = x^2$ all "drawn" by a computer. All of the windows are centered on the point $(2, 4)$. Find windows which could have produced the graphs shown, and explain your answers. Also, give one example of an approximately "straight line" graph which could *not* be produced by choosing a window centered around $(2, 4)$ and looking at $y = x^2$.



Graph #1 **Graph #2** **Graph #3** **Graph #4**

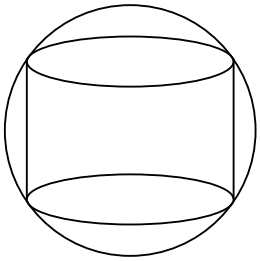
3. Suppose that f is the function defined by the formula

$$f(x) = \left(\arctan\Big(\ln\big(\sqrt{x} - 1\big)\Big)\right)^3.$$

a) What are the domain and range of f? Answers should *not* be numerical approximations, but should be written if needed in terms of traditional constants such as π and e.

b) If $y = f(x)$, write a formula for x in terms of y.

4. A cylinder is inscribed inside a sphere of radius R (an inscribed cylinder is shown in the picture to the right). Suppose the height of the cylinder is x. Write a formula for the volume, $V(x)$, of the cylinder as a function of x. (This formula will also include R in some way.) Information about the domain of $V(x)$ should be part of the explanation. Graph $V(x)$ when $R = 3$.



Comment Label the picture and analyze it carefully.

One problem will be selected for a writeup to be handed in at the next recitation meeting. Please see Professor Greenfield's Math 151 webpage to learn which problem to hand in.