**Workshop Problems–September 14**

1. Let $f(x) = \sin^{-1}\sqrt{\frac{2x}{1-2x}}$.

   (a) Find the domain and the range of this function. Plot the graph.

   (b) Is $f$ one to one in its domain? Explain this by solving $y = f(x)$ for $x$.

   (c) Write down the inverse function of $f$. What is its domain and range? Can you graph it using the graph of $f(x)$?

2. 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 walks 40 feet farther 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 farther away from the building, what will the angle from the horizontal ground to the top of the building be?

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 $\pi$ and $e$.

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

4. **You need a calculator for this problem.**

   Let

$$f(x) = x^{1/10}, \quad g(x) = e^{x/100}, \quad \text{and} \quad h(x) = \ln x.$$

   (a) Find an interval of positive numbers where the graph of $f$ lies above the graphs of both $g$ and $h$.

   (b) Find an interval of positive numbers where the graph of $g$ lies above the graphs of both $f$ and $h$.

   (c) Find an interval of positive numbers where the graph of $h$ lies above the graphs of both $f$ and $g$.

   (d) Consider a very short interval of positive numbers very close to 0, such as $\left[10^{-10}, 10^{-11}\right]$. Which graph will be on top? Which graph will be on the bottom?

   (e) Consider an interval of positive numbers which are very large, such as $\left[10^{100}, 10^{101}\right]$. Which graph will be on top? Which graph will be on the bottom?