# Math 1A Worksheet 16

March 10th, 2008

1. Solve the following:
   a) $\ln(x-1) - \ln x = 1$,
   b) $\ln(x^2 - 2x - 2) \leq 0$.

2. (A simple example of logarithmic differentiation.) If $y = (x+2)^5$, we obviously know how to find $y'$ using the power rule and chain rule. For practice, let's do this by logarithmic differentiation instead:
   a) Take ln of both sides of this equation, and differentiate with respect to $x$.
   b) Now do algebra to get an equation for $y'$ in terms of $x$. Does this look like the usual formula for the derivative of $(x+2)^5$?
   c) Now, we almost certainly cheated twice in this computation, and these two cheats cancelled out each others' effects. Explain why the above calculation is actually only valid for $x > -2$.
   d) We can fix the problem in c) by instead taking $\ln|y| = \ln(|x+2|^5)$ and going through steps a) and b). This still fails to give us information about one point. Which one?

3. Oftentimes a function is *not* one-to-one, but we can restrict the domain of the function to make it one-to-one and define an inverse to this restricted function. We have seen an example: $\sqrt{x}$ is the inverse of $x^2$ *restricted to* $[0, \infty)$. Let's look at another good example:
   a) The function $\sin x$ is *not* one-to-one. How can we restrict its domain to get a function which is one-to-one?
   b) Explain how we use part a) to define the well-known function $\sin^{-1}(x)$.

4. Without using a calculator, determine which of the numbers $\log_{10} 99$ or $\log_9 82$ is larger.

5. Suppose that $f$ is a differentiable function, $g$ is the inverse of $f$, and let $G(x) = 1/g(x)$. If $f(3) = 2$ and $f'(3) = \frac{1}{9}$, find $G'(2)$.