Math 112
Dr. Sarah Raynor
Due: September 22, 2009

Homework #4: Sections 6.5 and 7.1

Complete each question below. Answers should be carefully written up, showing all necessary work for each step to complete each problem. Your turned-in work should be neat and legible. If I cannot understand or follow your work you will not get credit for it. You may discuss these problems with myself, the TAs and Math Center tutors, and your classmates, but once you start writing up the problem to turn in, you must complete the write-up on your own. This assignment is out of **33 points**. It is due at the **start of class** on **Tuesday, September 22**.

1. A turtle is racing against a hare. The race starts at time $t = 0$s. The hare's speed during the race as a function of time is $\frac{5\pi}{4}\sin(\frac{\pi t}{400})$m/s, while the turtle's speed as a function of time is 3 m/s.
   (a) (7 points) The race is 1000m long. Who will win?
   (b) (5 points) What is the hare's maximum speed during the race? What is the hare's average speed over the race? If the hare had run steadily at its maximum speed, would it have won or lost?
   (c) (3 points) At what time(s) during the race will the hare achieve its average speed?
2. (3 points) Is the function $f(x) = 2 + x^3 + \sin(x)$ one-to-one? Why or why not?
3. Consider the function $f(x) = \sqrt{x^3 + 8}$.
   (a) (4 points) Find the domain and range of $f^{-1}(x)$.
   (b) (2 points) Find $f^{-1}(4)$.
   (c) (4 points) Find $(f^{-1})'(3)$.
4. (5 points) Explain what an inverse function is. How can you tell whether a given function has an inverse or not? How can you find the values of the inverse function?