Homework 2, Graded Problems.

1. A population grows exponentially. Write a formula (using a base $e$ exponential) for the population as a function of time assuming:
   
   (a) There are initially 100 (whatever), and  
   (b) The number doubles after 15 hours.

2. A population of foxes grows according to the function

\[ p(t) = \frac{1000}{1 + e^{-0.2t}} \]

where $t$ is measured in years.

   (a) Find a formula for the inverse of this function.  
   (b) What is the input to the inverse function? (Include units.)  
   (c) What is the output of the inverse function? (Include units.)

3. A ball is thrown directly upward from a 100 foot tall tower. Its height (in feet) after $t$ seconds is given by

\[ h(t) = 100 + 40t - 16t^2 \]

   (a) Compute the average velocity on the intervals  
   i. [0.9, 1]  
   ii. [0.99, 1]  
   iii. [1, 1.1]  
   iv. [1, 1.01]  
   (b) Guess the velocity at time $t = 1$.

4. Compute the limit

\[ \lim_{x \to 1} \frac{e^x - e^1}{x - 1} \]

Use any methods (approximate and guess, graph and zoom, whatever...) but SHOW ALL YOUR WORK!