1. Consider the function 
\[ 3n^2 + 10n \log n + 5n \]
(a) What is the high order term?
(b) What is the second order term?
(c) What is the third order term?
(d) Write the function in Theta notation (in the simplest way).

2. For each of the following say TRUE or FALSE. No justification needed.
(a) \[ e^{\pi x} = \Theta(\pi^x) \]
(b) \[ e^{\pi x} = O(\pi^x) \]
(c) \[ e^{\pi x} = o(\pi^x) \]
(d) \[ e^{\pi x} = \Omega(\pi^x) \]
(e) \[ e^{\pi x} = \omega(\pi^x) \]

3. Bubble Sort can be thought of as a recursive algorithm as follows: Bubble the largest element to the bottom of the list (to be sorted). Recursively sort the remaining elements.
(a) Write down the recursive version of Bubble Sort in pseudo code.
(b) Derive a recurrence for the exact number of comparisons the algorithm uses.
(c) Solve the recurrence using the tree method. Simplify as much as possible. NOTE: The tree is very, very narrow.

4. We can multiply two three-digit numbers using nine atomic multiplications and some constant number of atomic additions.
(a) Using this fact, write a recurrence for an algorithm that recursively multiplies two \( n \)-digit numbers. Note that you do not have to describe the algorithm itself. To keep things simple assume that for size \( n \) it takes \( cn \) time to do the additions for some constant \( c \) (after the recursive calls), and that each atomic multiplication takes time \( \mu \). You can also assume that \( n \) is a power of 3.
(b) Solve the recurrence using the tree method. Simplify as much as possible.