CS 5300 Advanced Algorithms

1. Show that for any real constants a and b, where $b > 0$, $(n + a)^b = \Theta(n^b)$
2. Show that $\lg n! = O(n \lg n)$
3. Find a theta notation for the number of times the statement $x = x + 1$ is executed.

   i = 2
   while (i < n) {
     i = i * i
     x = x + 1
   }

4. Determine whether each statement is true or false. Justify your answer
a) $n^n = O(2^n)$
b) If $f(n) = O(g(n))$, then $g(n) = \Omega(f(n))$
5. Show that $7n - 2$ is $O(n)$
6. Express the function $\frac{n^3}{1000} - 100n^2 - 100n + 3$ in terms of Θ-notations.