CS200 Worksheet - Review

1. For each of the following, prove true or prove false:

   (a) $\lceil 2x \rceil = O(x)$

   (b) $2^x + 17 = O(3^x)$

   (c) $x \log(x) = O(x)$

2. Consider a game in which there are two players and two piles of tokens, and the piles both start out with the same number of tokens. The players alternate turns. On each player's turn, they choose a pile, and can remove as many tokens as they want from that pile. The player who removes the last token remaining wins. Prove that the player who goes second can always win.

3. Prove using a proof by contradiction that if $3n+2$ is odd, then n is odd. (Note that you can prove this statement using other approaches, but for practice, use contradiction.)

4. Prove $\log_2(3)$ is irrational.