1. Suppose $f(n) = n^x + an^y$, where a, x, and y are positive integers such that $x > y$.
   Given this, it follows that $n^x + an^y \leq n^x + an^x$, since $x > y$. By factoring the right side of the equality, we find that $n^x + an^y \leq (a + 1) \cdot n^x$. Thus, given that $a + 1$ may be represented by some constant c, this equality may be represented as $n^x + an^y \leq c \cdot n^x$ where $c = a + 1$, for all $n \geq 1$. This proves that $f(n) = O(n^x)$.
2. <u>B/C</u>: When $n = 1$, this equation is equivalent to $(1!)^2 \leq (2 \cdot 1)! \rightarrow 1 \leq 2$, which is true.
   <u>I/S</u>: Let $n = k$; suppose $(k!)^2 \leq (2k)!$ for $n = 1,2, \ldots, k, and\ that\ c = 1\ and\ n_0 = 1$.

$$[(k+1)!]^2 \leq [2 \cdot (k+1)]!$$
$$(k+1)! \cdot (k+1)! \leq (2k+2)!$$
$$(k+1) \cdot k! \cdot (k+1) \cdot k! \leq (2k+2) \cdot (2k+1) \cdot (2k)!$$
$$k^2 + 2k + 1 \cdot (k!)^2 \leq 4k^2 + 6k + 2 \cdot (2k)!$$

Since $k^2 + 2k + 1 \leq 4k^2 + 6k + 2$ is true and, by our induction hypothesis, $(k!)^2 \leq (2k)!$, this final statement must also be true.