1. Suppose that $a$ and $b$ are roots of unity. Suppose that $o(a) = m$, $o(b) = n$, and $(m, n) = 1$. Prove that $o(ab) = mn$.

2. Find an explicit numerical example in which $a$ and $b$ are roots of unity with $o(a) = m$, $o(b) = n$, $(m, n) \neq 1$, and the order of $ab$ is less than both $m$ and $n$.

3. Prove that $A \cap B = B$ if and only if $B \subseteq A$. 