Induction Group Work
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Here's a theorem that is very familiar from our work on binary notation.

Theorem 1 *Let n be a nonnegative integer. Then* $2^0 + 2^1 + 2^2 + \cdots + 2^n = 2^{n+1} - 1$.

Your questions:

1. Classify the statements as either statements of intent, definitions, assumptions or deductions. There might be more than one correct answer here.
2. Order the sentences to form a valid inductive proof.
3. Point to the sentence in which the inductive assumption is *stated* and to the sentence in which it is *used*.
4. True or false: $P(n) = 2^{n+1} - 1$.

The Proof, Jumbled Up:

1. $2^n - 1 + 2^n = 2(2^n) - 1 = 2^{n+1} - 1$.
2. We assume $P(n-1)$.
3. In other words, we want to prove that $2^0 = 2^1 - 1$.
4. This is obvious.
5. Inductive Step:
6. $2^0 + 2^1 + 2^2 + \cdots + 2^{n-1} + 2^n = 2^n - 1 + 2^n$.
7. Let $P(n)$ be the statement $2^0 + 2^1 + 2^2 + \cdots + 2^n = 2^{n+1} - 1$.
8. In other words, we want to prove that $2^0 + 2^1 + 2^2 + \cdots + 2^n = 2^{n+1} - 1$.
9. We want to prove $P(0)$.
10. In other words, we assume that $2^0 + 2^1 + 2^2 + \cdots + 2^{n-1} = 2^n - 1$.
11. $2^0 + 2^1 + 2^2 + \cdots + 2^n = 2^0 + 2^1 + 2^2 + \cdots + 2^{n-1} + 2^n$.
12. Therefore, $2^0 + 2^1 + 2^2 + \cdots + 2^n = 2^{n+1} - 1$.
13. We want to prove $P(n)$.
14. Basis Step:
15. We have proven that $P(n)$ holds,
16. This completes the proof.