A note on presenting induction arguments

I saw this a lot when reading submissions for Exercise 0.9.

Show the statement is true for $n = 1$. … [No real issues here]

Assume the statement is true for m. We want to show it's true for $m + 1$.

$1 + 3 + 5 + \ldots + (2m + 1) + (2(m + 1) + 1)) =? ((m + 1) + 1)^2$

$(m + 1)^2 + (2(m + 1) + 1)) =? (m + 2)^2$

$m^2 + 2m + 1 + 2m + 3 =? M^2 + 4m + 4$

$m^2 + 4m + 4 = m^2 + 4m + 4$ So the statement is true for $m + 1$. …

A better, more efficient approach would be:

Assume the statement is true for m. We want to show it's true for $m + 1$.

Now $1 + 3 + 5 + \ldots + (2m + 1) + (2(m + 1) + 1)) = (m + 1)^2 + (2m + 3)$

$= m^2 + 4m + 4 = (m + 2)^2 = ((m + 1) + 1)^2$.

Hence the statement is true for $m + 1$. …

The former approach is not technically incorrect. However, it keeps emphasizing what you're attempting to prove (=?), which can become a distraction (especially in longer arguments). The latter approach keeps the reader focused on what is known at any moment and <u>works towards</u> the desired conclusion.

The former is fine for 'sketching' the proof for yourself. But the latter cleans up the presentation considerably.

You should strive for the second presentation.