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 \( m + 1 \).

\[
1 + 3 + 5 + \ldots + (2m + 1) + (2(m + 1) + 1) = (m + 1)^2
\]

\[
(m + 1)^2 + (2(m + 1) + 1) = (m + 2)^2
\]

\[
m^2 + 2m + 1 + 2m + 3 = M^2 + 4m + 4
\]

\[
m^2 + 4m + 4 = m^2 + 4m + 4 \quad \text{So the statement is true for } m + 1. \; …
\]

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 works towards 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.