# Teacher Solutions – Section 5.1.2: The Principle of Mathematical Induction

SWOSU Discrete Structures

## Solution: Sum of Odd Integers Equals $n^2$

**Base Case:** For $n = 1$, LHS $= 1$, RHS $= 1^2 = 1$. True.

**Inductive Hypothesis:** Assume for $n = k$,

$$1 + 3 + 5 + \cdots + (2k - 1) = k^2.$$

**Inductive Step:** Then for $n = k + 1$:

$$1 + 3 + 5 + \cdots + (2k - 1) + (2(k + 1) - 1) = k^2 + (2k + 1) = (k + 1)^2.$$

Therefore, by induction, the statement holds for all positive integers $n$.

## Instructor Notes:

- Reinforce that $P(k)$ is *assumed true only for one integer* $k$, not all integers. - Emphasize that this is not circular reasoning. - The domino and ladder metaphors are helpful mental models—keep them visual. - Let students explain the process in their own metaphors (stairs, cookies, chain reactions, etc.)