Mathmetical Induction

(covers Sullivan 12.4)

To prove that a statement $P(n)$ is true for all natural numbers n, you can use a method called **mathematical induction**. This method of proof has two parts:

1. **Base case**: Show that $P(1)$ is true.
2. **Induction step**: Assume $P(k)$ is true, and show that $P(k+1)$ is true (for any natural number k).

Once you show the above two, you know $P(1)$ is true, $P(2)$ is true, $P(3)$ is true, $P(4)$ is true, etc. The induction step creates a "domino" effect, and the base case knocks the first domino down.

Ex 1.

Let $P(n)$ be the statement $1 + 3 + 5 + \cdots + (2n - 1) = n^2$. Use mathematical induction to prove that $P(n)$ is true for all natural numbers n.

Ex 2.

Use mathematical induction to prove that for every natural number n, $1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$