Theorem 1.

$$\sum_{k=1}^{n} k = \frac{n\,(n+1)}{2}$$

Proof. Base Case ($n = 1$)

$$\sum_{k=1}^{1} k = \frac{1\,(1+1)}{2} = 1$$

Inductive Step ($n \longrightarrow n+1$)

$$\sum_{k=1}^{n+1} k = \sum_{k=1}^{n} k + (n+1) = \frac{n\,(n+1)}{2} + (n+1) = \frac{(n+1)\,((n+1)+1)}{2}$$

□