Mathematical Induction

Induction is a proof technique that is especially useful for proving statements about elements in a sequence

<u>The two components of an inductive proof</u>

<u>Base case</u>

establishes that the theorem is true for the first element in a sequence

<u>Inductive step</u>

establishes that if the theorem is true for K, then the theorem also holds for K+1

<u>Principle of mathematical induction</u> - states that if the base case (for n=1) is true and the inductive step is true, then the theorem holds for all positive integers

Let S(n) be a statement parameterized by a positive integer n. Then S(n) is true for all positive integers n if:

1.) S(1) is true (the base case)

2) For all $K \in \mathbb{Z}^+$, S(K) implies S(K+1) (inductive step)

i.e

$$\forall_K \in \mathbb{Z}^+ (S(K) \text{ implies } S(K+1)) \leftrightarrow [S(1) \text{ implies } S(2)] \wedge [S(2) \text{ implies } S(3)] \ldots$$

S(K) - <u>inductive hypotheses</u>