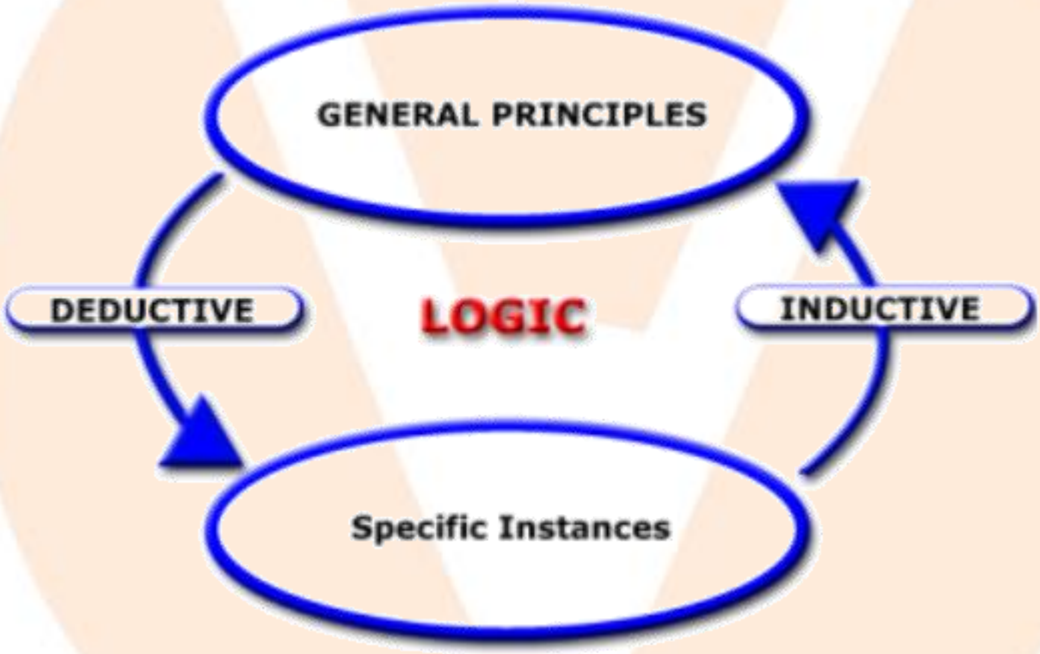
Revision Notes

Class 11 Maths

Chapter 4 - The Principle of Mathematical Induction

1.Deduction: Generalization of Specific Instance
Example: Rohit is a man, and all men consume food, hence Rohit eats food.

2.Induction: Specific Instances to Generalization
Rohit, for example, eats. Vikash consumes food. Vikash and Rohit are both males. The statement All men consume food is true for $n=1$, $n=k$, and $n=k+1$, and it is also true for all natural integers n.



3.Steps of Principle of Mathematical Induction:
Allow $P(n)$ to be a result or statement expressed in terms of n. (given question).

Step 2: Demonstrate that $P(1)$ is correct.

Step 3: Assume $P(k)$ is correct.

Step 4: Using Step 3 as a guide, show that $P(k+1)$ is correct.

Step 5: As a result, whenever $P(k)$ is true, $P(1)$ is true and $P(k+1)$ is true.

As a result, $P(n)$ is true for all natural integers n, according to the Principle of Mathematical Induction.

Example: Prove that $2^n > n$ for all positive integers n

Solution: Step 1: Let $P(n): 2^n > n$

Step 2: When $n = 1, 2^1 > 1$. Hence $P(1)$ is true.

Step 3: Assume that $P(k)$ is true for any positive integer k, i.e., $2^k > k \ldots (1)$

Step 4: We shall now prove that $P(k+1)$ is true whenever $P(k)$ is true.

Multiplying both sides of (1) by 2, we get

$2 \times 2^k > 2 \times k$

i.e., $2^{k} + 1 > 2k$

or, $2^{k+1} > k + k$

or, $2^{k+1} > k + 1$ $(\text{since } k > 1)$

Therefore, $P(k+1)$ is true when $P(k)$ is true. Hence, by principle of mathematical induction, $P(n)$ is true for every positive integer n.