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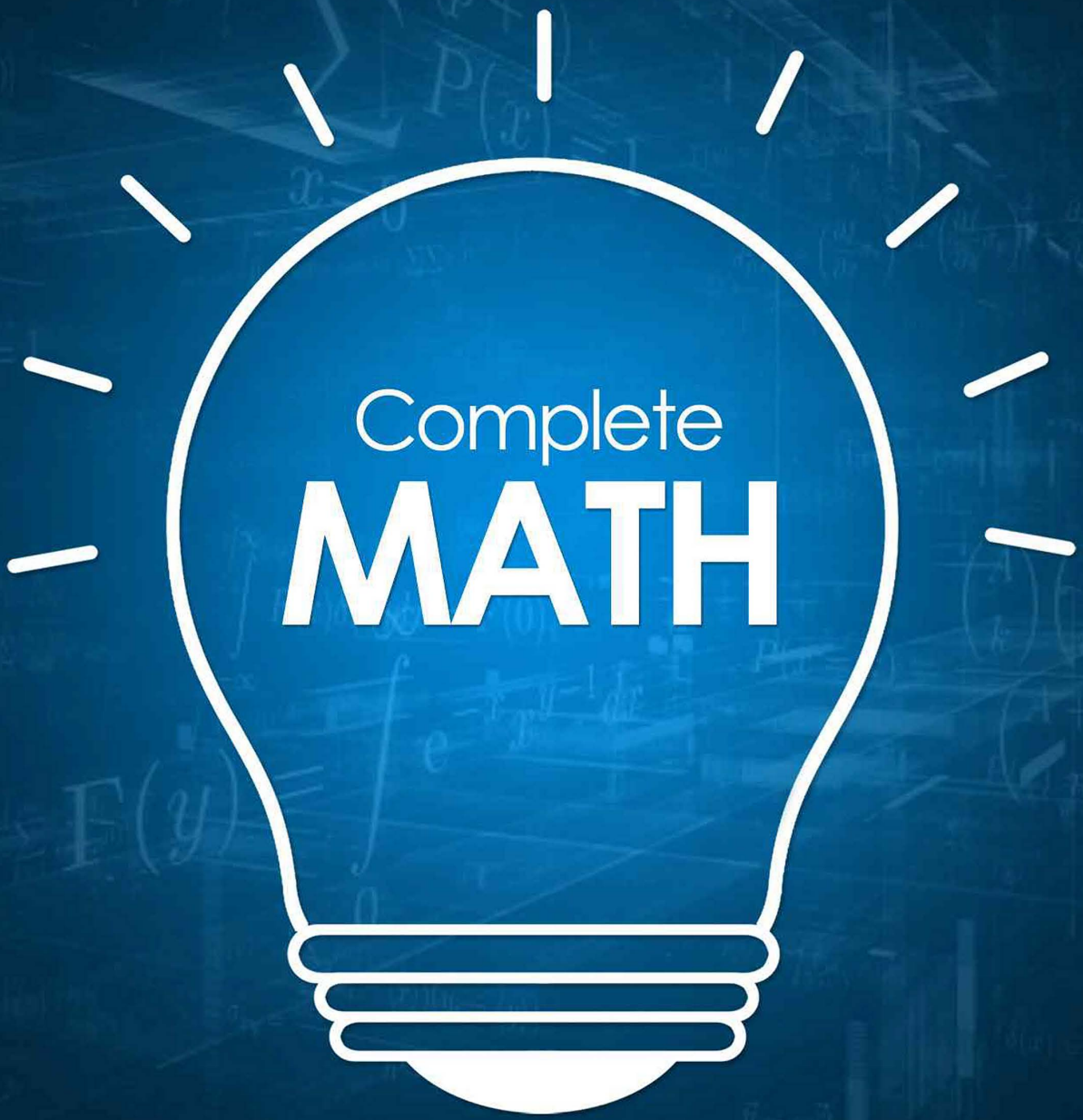

Complete MATH

IIT-JEE · CBSE eBOOKS

CLASS 11&12th

CLASS 11th

Mathematical Induction

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01. Statements

A sentence or description which can be judged to be true or false is called a statement.

Mathematical Statements : *Statements involving mathematical relations are known as the mathematical statements.*

We shall be using notations $P(n)$ or $P_1(n)$ or $P_2(n)$ etc. to denote such statements.

02. The Principles of Mathematical Induction

First Principle of Mathematical Induction

Let $P(n)$ be a statement involving the natural number n such that

(I) $P(1)$ is true i.e. $P(n)$ is true for $n = 1$

and (II) $P(m + 1)$ is true, whenever $P(m)$ is true i.e. $P(m)$ is true $\Rightarrow P(m + 1)$ is true.

Then, $P(n)$ is true for all natural numbers n.

Second Principle of Mathematical Induction

Let $P(n)$ be a statement involving the natural number n such that

(I) $P(1)$ is true i.e. $P(n)$ is true for $n = 1$

and (II) $P(m + 1)$ is true, whenever $P(n)$ is true for all n, where $1 \leq n \leq m$.

Then, $P(n)$ is true for all natural numbers.

In order to prove that a statement is true for all natural numbers using first principle of mathematical induction, we may use the following algorithm:

Algorithm

Step I *Obtain P(n) and understand its meaning.*

Step II *Prove that the statement $P(1)$ is true i.e. $P(n)$ is true for $n = 1$.*

Step III *Assume that the statement $P(n)$ is true for $n = m$ (say) i.e. $P(m)$ is true.*

Step IV *Using assumption in step III prove that $P(m + 1)$ is true.*

Step V *Combining the results of step II and step IV, conclude by the first principle of mathematical induction that $P(n)$ is true for all $n \in N$.*