

Principle of Mathematical Induction

Theory

Let S_n be a statement about a positive integer n . Suppose that

1. S_1 is true,
2. S_{k+1} is true whenever S_k is true.

Then S_n is true for all positive integers n .

Mathematical Induction is used in all areas of mathematics. It can be used to prove summation formulas such as:

$$1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$$

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$$

$$1 + 3 + 5 + \dots + (2n-1) = n^2$$

It is also used to prove various number theory, algebraic, and geometric statements.