

Mathematical Induction 1

1. Prove that $2 + 2^2 + 2^3 + \cdots + 2^n = 2^{n+1} - 2$.
2. Prove by Mathematical Induction: $\sum_{i=1}^{n-1} i(i+1) = \frac{n(n-1)(n+1)}{3}$, for all integers $n \geq 2$.
3. Prove $1^3 + 3^3 + 5^3 + \cdots + (2n+1)^3 = (n+1)^2(2n^2 + 4n + 1)$ by mathematical induction.
4. Prove $1^2 + 3^2 + 5^2 + \cdots + (2n-1)^2 = \frac{1}{3}n(2n-1)(2n+1)$ by mathematical induction.
5. Prove $1^3 + 2^3 + 3^3 + \cdots + n^3 = \left[\frac{n(n+1)}{2} \right]^2$ by mathematical induction.