

1. Prove by induction that  $\sum_{i=1}^n r^i = \frac{r^n - 1}{r - 1}$ .
2. Assuming the distributive property of multiplication over the addition of two numbers –  $a \cdot (b+c) = a \cdot b + a \cdot c$  – prove by induction that  $a \cdot (b_1 + b_2 + \dots + b_n) = a \cdot b_1 + a \cdot b_2 + \dots + a \cdot b_n$ .
3. Prove by induction that  $\sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$ .
4. Prove by induction that  $\sum_{i=1}^n (2i - 1) = n^2$ .
5. Prove by induction that  $\sum_{i=1}^n \frac{1}{(2i-1)(2i+1)} = \frac{n}{2n+1}$ .