Important Summation Formulas:

① $\sum_{i=l}^{u} 1 = u - l + 1$

② $\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \simeq \frac{1}{2} n^2$

③ $\sum_{i=1}^{n} i^2 = 1^2 + 2^2 + \cdots n^2 = \frac{n(n+1)(2n+1)}{6} \simeq \frac{1}{3} n^3$

④ $\sum_{i=1}^{n} i^k = 1^k + 2^k + \cdots n^k \simeq \frac{n^{k+1}}{k+1}$

⑤ $\sum_{i=0}^{n} a^i = 1 + a + a^2 + \cdots a^n = \frac{a^{n+1} - 1}{a - 1} \quad (a \neq 1)$

⑥ $\sum_{i=0}^{n} 2^i = 2^{n+1} - 1$

⑦ $\sum_{i=1}^{n} i \cdot 2^i = 1 \times 2^1 + 2 \cdot 2^2 + \cdots + n \cdot 2^n = (n-1) 2^{n+1} + 2$

⑧ $\sum_{i=1}^{n} \frac{1}{i} = 1 + \frac{1}{2} + \cdots + \frac{1}{n} \simeq \ln n + \gamma$ where $\gamma = 0.5772$ Euler's const.

⑨ $\sum_{i=1}^{n} \lg i \simeq n \cdot \lg n$.