Recurrence & Summation Formulas:

If the formula matches $S(n) = cS(n-1) + g(n)$

$$S(n) = c^{n-1}S(1) + \sum_{i=2}^{n} c^{n-i} g(i)$$

Arithmetic Series
General term: $a_n = a + (n-1)d$
, where a; first term, n; number of terms, d; common difference

Sum: $S_n = \frac{n(2a+(n-1)d)}{2}$

Geometric Series
General Term: $a_n = ar^{n-1}$
, where a; first term, n: number of terms, r; common ratio

Sum: $S_n = \frac{a(r^n-1)}{r-1} = \frac{a(1-r^n)}{1-r}$

$$a + ar + ar^2 + \cdots + ar^{n-1} = \frac{a - ar^n}{1-r}$$

$$1 + 2 + 2^2 + \cdots + 2^n = 2^{n+1} - 1$$

$$1 + \frac{1}{2} + \frac{1}{4} + \cdots + \frac{1}{2^n} = 2 - \frac{1}{2^n}$$

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

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