

Infinite sums:

$$\sum_{k=0}^{\infty} a^k \rightarrow \frac{-1}{(a-1)}$$

$$\sum_{k=0}^{\infty} k \cdot a^k \rightarrow \frac{a}{(a-1)^2}$$

$$\sum_{k=0}^{\infty} k^2 \cdot a^k \rightarrow \frac{-(a^2 + a)}{(a-1)^3}$$

$$\sum_{k=0}^{\infty} \frac{a^k}{k!} \rightarrow \exp(a)$$

Finite Sum:

$$\sum_{k=m}^n a^k \rightarrow \frac{a^{(n+1)}}{(a-1)} - \frac{a^m}{(a-1)} \text{ simplify } \rightarrow \frac{[a^{(n+1)} - a^m]}{(a-1)}$$

$$\sum_{k=m}^n k \cdot a^k \rightarrow a^{(n+1)} \cdot \frac{[(n+1) \cdot a - n - 1 - a]}{(a-1)^2} - a^m \cdot \frac{(m \cdot a - m - a)}{(a-1)^2} \text{ simplify } \rightarrow \frac{[-a^{(n+2)} \cdot n + a^{(n+1)} \cdot n + a^{(n+1)} + a^{(m+1)} \cdot m - a^m \cdot m - a^{(m+1)}]}{(a-1)^2}$$