

$$S_n = \sum_{i=0}^{n-1} a^i x$$

$$S_n = a^0 x + a^1 x + a^2 x + \cdots + a^{n-1} x$$

$$aS_n = a^1 x + a^2 x + a^3 x + \cdots + a^n x$$

$$S_n - aS_n = x - a^n x$$

$$S_n - aS_n = x(1 - a^n)$$

$$S_n(1 - a) = x(1 - a^n)$$

$$S_n = x \frac{(1 - a^n)}{1 - a}$$