Geometric Progression:

1	2	3	4	n
1	r	r^2	r^3	r^{n-1}

so $a_n = r^{n-1}$

$$S_n = \sum_{k=0}^{n-1} r^k = \frac{(1-r^n)}{1-r}, \quad S_\infty = \sum_{k=0}^{\infty} r^k = \frac{1}{1-r}, \ |r|<1$$

since

$$S = r^0 + r^1 + \ldots + r^{n-1} \text{ and}$$

$$rS = r + r^2 + \ldots + r^n$$

$$S - rS = 1 - r^n$$

$$S(1-r) = 1 - r^n$$

$$\therefore \ S = \frac{(1-r^n)}{1-r}, \ \lim_{n \to \infty} S = \frac{1}{1-r}, \ |r|<1$$