Some Useful Summations

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Geometric Progression

$$\sum_{i=0}^{\infty} a^i = \frac{1}{1-a}$$

$$|a| < 1$$

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Finite Geometric Summation

$$\sum_{i=0}^{N} a^i = \begin{cases} 0 & if \quad a = 0 \\ N+1 & if \quad a = 1 \\ \dfrac{1-a^{N+1}}{1-a} & otherwise \end{cases}$$

Derive from #1

Note: no restriction on value of a

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$$\sum_{i=0}^{\infty} ia^i = \frac{a}{(1-a)^2}$$

$$|a| < 1$$

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$$\sum_{i=0}^{N} i = \frac{N(N+1)}{2}$$

$$e^x = \sum_{i=0}^{\infty} \frac{x^i}{i!}$$

Exponential series