

<https://GitHub.Com/Nazgand/NazgandMathBook>  
Geometric Series

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Consider

$$b * \left( \sum_{k=a}^n b^k \right) = \left( \sum_{k=a}^n b^k \right) - b^a + b^{n+1} \quad (0.1)$$

Rearranging:

$$\left( \sum_{k=a}^n b^k \right) = \frac{b^a + b^{n+1}}{1 - b} \quad (0.2)$$

Note if  $|b| < 1$  then as  $n \rightarrow \infty, b^{n+1} \rightarrow 0$

$$|b| < 1 \Rightarrow \left( \sum_{k=a}^{\infty} b^k \right) = \frac{b^a}{1 - b} \quad (0.3)$$

Note if  $|b| > 1$  then as  $n \rightarrow \infty, |b^{n+1}| \rightarrow \infty$  resulting in a diverging series.