Geometric series - We say
\[
\sum_{n=0}^{\infty} z^n = \frac{1}{1 - z} \quad \text{whenever } |z| < 1
\]

Taylor series - Let \( f \) be analytic throughout \( |z - z_0| < R_0 \), centered at \( z_0 \) with radius \( R_0 \). Then \( f(z) \) has the power series representation
\[
f(z) = \sum_{n=0}^{\infty} a_n (z - z_0)^n \quad (|z - z_0| < R_0)
\]
where
\[
a_n = \frac{f^{(n)}(z_0)}{n!} \quad (n = 0, 1, 2, \ldots)
\]

Common Formulas
\[
e^z = \sum_{n=0}^{\infty} \frac{z^n}{n!}
\]
\[
\sin z = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} z^{2n+1}
\]
\[
\cos z = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} z^{2n}
\]

Laurent Series - Suppose that a function \( f \) is analytic throughout an annular domain \( R_1 < |z - z_0| < R_2 \), centered at \( z_0 \), and let \( C \) denote any positively oriented simple closed contour around \( z_0 \) and lying in that domain. Then, at each point in the domain, \( f(z) \) has the series representation
\[
f(z) = \sum_{n=0}^{\infty} a_n (z - z_0)^n + \sum_{n=1}^{\infty} \frac{b_n}{(z - z_0)^n} \quad (R_1 < |z - z_0| < R_2)
\]
where
\[
a_n = \frac{1}{2\pi i} \int_C \frac{f(z)}{(z - z_0)^{n+1}} dz \quad (n = 0, 1, 2, \ldots)
\]
\[
b_n = \frac{1}{2\pi i} \int_C \frac{f(z)}{(z - z_0)^{-n+1}} dz \quad (n = 1, 2, \ldots)
\]