Need to Know $\boxed{\dfrac{1}{1-x} = \sum_{n=0}^{\infty} x^n,}$ (geo series)

whenever $|x|<1$.

From this we can prove two more results.

Integrate both sides:

$$-\ln(1-x) = c + \sum_{n=0}^{\infty} \frac{x^{n+1}}{n+1}$$

$$= c + \sum_{n=1}^{\infty} \frac{x^n}{n}$$

$$\ln(1-x) = c_0 - \sum_{n=1}^{\infty} \frac{x^n}{n}$$

Substitute $x=0$ to see $c_0 = 0$.

So $\boxed{\ln(1-x) = -\sum_{n=1}^{\infty} \frac{x^n}{n}.}$

Differentiate both sides:

$$\frac{1}{(1-x)^2} = \sum_{n=0}^{\infty} n x^{n-1}$$

$$= \sum_{n=1}^{\infty} n x^{n-1}.$$

$$\boxed{\frac{1}{(1-x)^2} = \sum_{n=0}^{\infty} (n+1) x^n}$$

Also Know $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$