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

converges if $|x| < 1$, diverges otherwise

Int. of conv. $(-1, 1)$; converges to $\frac{1}{1-x}$

$$\int \frac{1}{1-x}\,dx = -\ln(1-x) + C$$

$$F(x) = \int f x\,dx = x + \frac{x^2}{2} + \frac{x^3}{3} \cdots = \sum_{n=0}^{\infty} \frac{x^{n+1}}{n+1}$$

$$F(1) = -1 + \frac{1}{2} - \frac{1}{3} + \frac{1}{4} \cdots = -\ln(1-(-1)) = -\ln 2$$

$$\therefore \ln(2) = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} \cdots = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}$$