

The Geometric Series Test: If a series is of the form $\sum_{n=1}^{\infty} a \cdot r^{n-1}$, then the series converges
 (to $\frac{a}{1-r}$) if and only if $|r| < 1$

The Integral Test: Suppose $f(x)$ is a continuous, positive, decreasing function on $[c, \infty)$ for some $c \geq 0$, with $a_n = f(n)$ for all n ,

- If $\int_c^{\infty} f(x) dx$ converges, then $\sum a_n$ converges also.
- If $\int_c^{\infty} f(x) dx$ diverges, then $\sum a_n$ diverges also.

The Comparison Test: If $\sum a_n$ and $\sum b_n$ are both series with their terms all positive, and

- $a_n \leq b_n$ with $\sum b_n$ convergent, then $\sum a_n$ converges also.
- $a_n \geq b_n$ with $\sum b_n$ divergent, then $\sum a_n$ diverges also.

The Limit Comparison Test: If $\sum a_n$ and $\sum b_n$ are both series with their terms all positive, and

$$\lim_{n \rightarrow \infty} \frac{a_n}{b_n} = L$$

for some finite, positive number L , then either both series converge or both series diverge.

The Alternating Series Test: If $\sum (-1)^{n+1} a_n$, with $a_n \geq 0$ for all n , is a series for which

- the sequence $\{a_n\}$ tends to zero, i.e. $\lim_{n \rightarrow \infty} a_n = 0$
- the sequence $\{a_n\}$ is decreasing, i.e. $a_{n+1} \leq a_n$ for all n

then the series converges.

The Ratio Test: If $\sum a_n$ is a series for which

$$\lim_{n \rightarrow \infty} \left| \frac{a_{n+1}}{a_n} \right| = L$$

then

- if $L < 1$ then the series converges absolutely.
- if $L > 1$ (or if the limit diverges to $+\infty$) then the series diverges.

