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example of ratio test

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Consider the sequence given by $a_n = x^n$ (geometric progression) where $|x| < 1$. Then the series

$$\sum_{j=0}^{\infty} a_n$$

converges. To see this, we can use the ratio test. We need to consider the sequence $|a_{n+1}/a_n|$. But for any $n \geq 0$ we have (when $x \neq 0$)

$$\left| \frac{a_{n+1}}{a_n} \right| = \left| \frac{x^{n+1}}{x^n} \right| = |x| < 1,$$

and therefore the series converges. The ratio test and the previous argument shows that the geometric series diverges for $|x| > 1$.