<u>9.6.19</u> Let $\sum a_n = \sum_{n=1}^{\infty} \frac{2^n}{n^2}$ ratio test:

$$L = \lim_{n\to\infty} \left| a_{n+1} \cdot \frac{1}{a_n} \right| = \lim_{n\to\infty} \frac{2^{n+1}}{(n+1)^2} \cdot \frac{n^2}{2^n}$$

$$= \lim_{n\to\infty} \frac{n^2}{(n+1)^2} \cdot \underbrace{\frac{2^{n+1}}{2^n}}_{\frac{2^1 \cdot 2^n}{2^n}} = 1 \cdot 2$$

Since $\lim_{n\to\infty} \left| \frac{a_{n+1}}{a_n} \right| > 1$ $\sum a_n$ diverges by ratio test.

Ratio test is <u>Inconclusive</u> for n^p type Gen. Functions such as Rational & Power functions (i.e. anything you would test by Lim. Comp.)

Ex $\sum_{n=1}^{\infty} \frac{1}{n^3}$ $L = \lim_{n\to\infty} \frac{1}{(n+1)^3} \cdot \frac{n^3}{1} = 1$, inconc.

$\sum a_n = \sum_{n=1}^{\infty} \frac{2n^2 - 5n + 4}{5n^4 + 2n^2 - 1}$ $L = \lim_{n\to\infty} a_{n+1} \cdot \frac{1}{a_n} = \frac{2}{5} \cdot \frac{5}{2} = 1$

$\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^2+1}}$ $L = \lim_{n\to\infty} \frac{1}{\sqrt{(n+1)^2+1}} \cdot \frac{\sqrt{n^2+1}}{1} = 1$

9.6.23 $\sum a_n = \sum_{n=1}^{\infty} \frac{n!}{n \cdot 3^n}$ ratio test

$$L = \lim_{n\to\infty} \frac{(n+1)!}{n!} \cdot \frac{n}{n+1} \cdot \frac{3^n}{3^{n+1}} = \lim_{n\to\infty} \frac{n+1}{1} \cdot 1 \cdot \frac{1}{3}$$

$L = \infty$. Diverges