Math 250 Series Review: Ratio Test Name______________________

Consider $\sum_{1}^{\infty} a_n$. Let $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right|$ if

$r<1 \Rightarrow$ series is absolutely convergent
$r>1 \Rightarrow$ series diverges
$r=1 \Rightarrow$ wrong test

E.g., 1) $\sum_{1}^{\infty} \frac{1}{n!}$ $\lim_{n\to\infty}\left|\frac{\frac{1}{(n+1)!}}{\frac{1}{n!}}\right| = \lim_{n\to\infty}\frac{n!}{(n+1)!} = \frac{1}{n+1} = 0 < 1$

$\Rightarrow \sum_{1}^{\infty} \frac{1}{n}$ converges.

2) $\sum_{1}^{\infty} \frac{n}{2^n}$ $\lim_{n\to\infty}\left|\frac{\frac{n+1}{2^{n+1}}}{\frac{n}{2^n}}\right| = \lim_{n\to\infty}\left|\frac{n+1}{2^{n+1}}\cdot\frac{2^n}{n}\right|$

$= \lim_{n\to\infty}\left|\frac{n+1}{n}\right|\frac{1}{2} = \frac{1}{2} < 1 \Rightarrow \sum_{1}^{\infty}\frac{n}{2^n}$ converges.

Determine if the following series are absolutely convergent, conditionally convergent, or divergent:

$\sum_{1}^{\infty} \frac{(-2)^n}{n^2+1}$ $\sum_{1}^{\infty} ne^{-n}$

$\sum_{1}^{\infty} \frac{n!}{n^n}$ $\sum_{0}^{\infty} \frac{n!n!}{(2n)!}$

$\sum_{1}^{\infty} \frac{3^n}{n!}$ $\sum_{1}^{\infty} \frac{n!}{2^n}$