Section 9.5

Alternating Series Test: Let $a_n > 0$. The alternating series

$$\sum_{n=1}^{\infty} (-1)^n a_n \quad \text{and} \quad \sum_{n=1}^{\infty} (-1)^{n+1} a_n$$

converge if the following two conditions are met.

1. $\lim_{x\to\infty} a_n = 0$ **2.** $a_{n+1} \le a_n$ for all n

Absolute Convergence: If the series $\sum |a_n|$ converges, then the series $\sum a_n$ also converges.

Definitions of Absolute and Conditional Convergence:

1. $\sum a_n$ is **absolutely convergent** if $\sum |a_n|$ converges.
2. $\sum a_n$ is **conditionally convergent** if $\sum a_n$ converges but $\sum |a_n|$ diverges.

1) Determine the convergence or divergence of

$$\sum_{n=2}^{\infty} \frac{(-1)^n}{\ln n}$$

2) Determine the convergence or divergence of

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

3) Determine the convergence or divergence of

$$\sum_{n=1}^{\infty} (-1)^n 2^{1/n}$$

4) Determine whether the following series are absolutely or conditionally convergent, or divergent.

a) $\sum_{n=1}^{\infty} \frac{\cos n\pi}{n}$

b) $\sum_{n=1}^{\infty} \frac{(-1)^n \ln n}{n}$

Homework for 9.5: #5, 9, 10, 15, 19, 21, 37, 43, 45, 51

Section 9.6

Ratio Test: Let $\sum a_n$ be a series with nonzero terms.

1. $\sum a_n$ converges absolutely if $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| < 1.$
2. $\sum a_n$ diverges if $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| > 1$ or $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| = \infty.$
3. The ratio test is inconclusive if $\lim_{n\to\infty}\left|\frac{a_{n+1}}{a_n}\right| = 1.$

1) Determine the convergence or divergence of

$$\sum_{n=1}^{\infty}\frac{n!}{5^n}$$

2) Determine whether each of the following series converges or diverges.

a) $\sum_{n=1}^{\infty}\frac{n^6}{3^{3n+2}}$

b) $\sum_{n=0}^{\infty}\frac{7^n}{3^n+4^n}$

c) $\sum_{n=0}^{\infty} ne^{-n}$

3) Determine the convergence or divergence of

$$\sum_{n=1}^{\infty}\left(\frac{3n}{n+1}\right)^n$$

4) Determine if the following series converge or diverge using an appropriate test. Identify which test you use.

a) $\sum_{n=1}^{\infty}\frac{n}{3n^2+4}$

b) $\sum_{n=1}^{\infty}\frac{(-1)^n 2^n}{n!}$

Homework for 9.6: #15, 19, 23, 25, 29, 30, 37, 45, 53, 59, 63, 65