

**Telescoping Series**

1. Find the sum of the series  $\sum_{n=1}^{\infty} (\arctan(n+1) - \arctan(n))$ .
2. Find the sum of the series  $\sum_{n=1}^{\infty} \frac{2}{x^2 + 6x + 8}$ .

**Integral Test**

Determine whether the series converges or diverges.

3.  $\sum_{n=0}^{\infty} \frac{n}{n^2 + 4}$
4.  $\sum_{n=1}^{\infty} \frac{\ln n}{n^2}$
5.  $\sum_{n=1}^{\infty} \frac{n}{n^4 + 1}$

Find the values of  $p$  for which the series is convergent

6.  $\sum_{n=3}^{\infty} \frac{(\ln n)^p}{n}$

**Comparison Tests**

Determine whether the series converges or diverges

7.  $\sum_{n=2}^{\infty} \frac{\sqrt{n}}{n-1}$
8.  $\sum_{n=0}^{\infty} \frac{1 + \cos n}{n^5}$
9.  $\sum_{n=1}^{\infty} \frac{n+5}{\sqrt[3]{n^7} + n^2}$
10.  $\sum_{n=1}^{\infty} \frac{n+2^n}{n+3^n}$

**Alternating Series Test**

Determine whether the series converges or diverges

11.  $\sum_{n=1}^{\infty} \frac{\cos(n\pi)}{n^{3/4}}$
12.  $\sum_{n=1}^{\infty} (-1)^n \frac{n!}{n^n}$
13.  $\sum_{n=2}^{\infty} (-1)^n \frac{n}{\ln n}$
14.  $\sum_{n=1}^{\infty} \left(-\frac{n}{5}\right)^n$

**Alternating Series Test** (continued)

Show that each of the following sequences are convergent, and answer the indicated questions.

15. Approximate  $\sum_{n=1}^{\infty} \frac{(-1)^n}{3^n n!}$  correct to four decimal places. ( $|\text{error}| < 0.0001$ )
16. How many terms of  $\sum_{n=1}^{\infty} \frac{(-1)^n n}{4^n}$  do we need to add in order to find the sum with  $|\text{error}| < 0.002$ ?

**Absolute Convergence and the Ratio and Root Tests**

Determine whether the series is absolutely convergent, conditionally convergent, or diverges

17.  $\sum_{n=1}^{\infty} \frac{n^n}{n!}$
18.  $\sum_{n=0}^{\infty} \frac{(-10)^n}{n!}$
19.  $\sum_{n=1}^{\infty} e^{-n} n!$
20.  $\sum_{n=2}^{\infty} \frac{(-1)^n}{n \ln n}$
21.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(\arctan n)^n}$
22.  $\sum_{n=1}^{\infty} \left( \frac{n^2 + 1}{2n^2 + 1} \right)^n$
23.  $1 - \frac{1 \cdot 3}{3!} + \frac{1 \cdot 3 \cdot 5}{5!} - \dots + (-1)^n \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{(2n-1)!}$

**Strategy for Testing Series**

Determine whether the series is absolutely convergent, conditionally convergent, or diverges

24.  $\sum_{n=1}^{\infty} \tan \left( \frac{1}{n} \right)$
25.  $\sum_{n=1}^{\infty} \frac{n!}{e^{n^2}}$
26.  $\sum_{n=1}^{\infty} \frac{n \ln n}{(n+1)^3}$
27.  $\sum_{n=2}^{\infty} \frac{(-1)^n}{\sqrt{n} - 1}$
28.  $\sum_{n=1}^{\infty} \frac{1 \cdot 2 \cdot 5 \cdots (2n-1)}{5^n n!}$
29.  $\sum_{n=1}^{\infty} \frac{7^n}{5^n + 6^n}$