1. Give an example of an absolutely convergent series.
   \[ \sum \frac{(-1)^n}{n^2} \]
   Give an example of a conditionally convergent series.
   \[ \sum \frac{(-1)^n}{n} \]

2. Determine whether the series is absolutely convergent, conditionally convergent, or divergent.
   \[ \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{\sqrt{n}} \]
   Conditionally convergent

3. Determine whether the series is absolutely convergent, conditionally convergent, or divergent.
   \[ \sum_{n=1}^{\infty} \frac{(-1)^n}{n^3 + 3} \]
   Absolutely convergent

4. For the Ratio Test, we compute \( \lim_{n \to \infty} \left| \frac{a_{n+1}}{a_n} \right| \).
   If the limit is \( L < 1 \), what can you say about \( \sum a_n \)?
   Convergent
   If the limit is \( L > 1 \), what can you say about \( \sum a_n \)?
   Divergent
   If the limit is \( L = 1 \), what can you say about \( \sum a_n \)?
   Nothing
   If the limit is \( \infty \), what can you say about \( \sum a_n \)?
   Divergent
   Use the Ratio Test to determine whether the series is convergent or divergent.

5. \[ \sum_{n=1}^{\infty} \frac{n}{5^n} \]
   Convergent

6. \[ \sum_{n=1}^{\infty} \frac{(-3)^n}{(2n + 1)!} \]
   Convergent
7. \[ \sum_{n=1}^{\infty} \frac{n!}{100^n} \]
   Divergent

8. \[ \sum_{n=1}^{\infty} \frac{100^n}{n!} \]
   Convergent

9. \[ \sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \cdot 7 \cdot \ldots \cdot (2n + 1)}{n!} \]
   Divergent

10. For the Root Test, we compute \( \lim_{n \to \infty} \sqrt[n]{|a_n|} \).
    If the limit is \( L < 1 \), what can you say about \( \sum a_n \)?
        Convergent
    If the limit is \( L > 1 \), what can you say about \( \sum a_n \)?
        Divergent
    If the limit is \( L = 1 \), what can you say about \( \sum a_n \)?
        Nothing
    If the limit is \( \infty \), what can you say about \( \sum a_n \)?
        Divergent
    Use the Root Test to determine whether the series is convergent or divergent.

11. \[ \sum_{n=1}^{\infty} \left( \frac{n^2 - 3}{3n^2 + 1} \right)^n \]
    Convergent

12. \[ \sum_{n=1}^{\infty} (\arctan n)^n \]
    Divergent

To determine whether a series is conditionally convergent, absolutely convergent, or divergent, we use one or more of the following tests:

\begin{align*}
\text{p-series} & \quad \text{Geometric series} & \text{Test for divergence} & \text{Comparison test} \\
\text{Alternating series test} & \quad \text{Ratio test} & \text{Root test} & \text{Integral test}
\end{align*}

For each of the following series, indicate which test(s) should be used. If you use the comparison test, indicate what series you would compare to. If you have time, apply the test to each series to determine convergence. Not all tests may be needed and some tests may be needed more than once.
\[ \sum_{n=1}^{\infty} \frac{n - 1}{n^2 + 1} \]  
CT with \( \sum \frac{1}{n} \); Divergent

\[ \sum_{n=1}^{\infty} \frac{n^2}{e^{-n^2}} \]  
Integral test; Convergent

\[ \sum_{n=1}^{\infty} \frac{2^{n-1}3^{n+1}}{n^n} \]  
Ratio test; Convergent

\[ \sum_{n=1}^{\infty} \frac{5 \cdot 3^{n+1}}{2 \cdot 4^{n-1}} \]  
Geometric series; Convergent

\[ \sum_{n=1}^{\infty} \frac{1}{2 + \sin n} \]  
TfD; Divergent

\[ \sum_{n=1}^{\infty} (-1)^n \frac{n - 1}{n^2 + 1} \]  
AST; Conditionally convergent

\[ \sum_{n=1}^{\infty} \left( \frac{1}{n^3} - \frac{1}{3^n} \right) \]  
\( p \)-series & Geometric series; Convergent

\[ \sum_{n=1}^{\infty} (-1)^{n+1} \frac{2n^2 + n}{3n^2 + 2n} \]  
AST/ TfD; Divergent

\[ \sum_{n=1}^{\infty} \left( \frac{3n^2}{5n^2 - 2n} \right)^n \]  
Root test; Convergent

\[ \sum_{n=1}^{\infty} \frac{\sin 2n}{1 + 2^n} \]  
CT with \( \sum \frac{1}{2^n} \); Convergent