1. Determine whether each of the following series converges or diverges.

5 pts (a) \( \sum_{n=2}^{\infty} \sqrt{\frac{4n+1}{n^3-1}} \)

5 pts (b) \( \sum_{n=1}^{\infty} \frac{(n+1)^5}{3^n} \)

Determine whether each of the following series converges or diverges.

5 pts (c) \( \sum_{n=1}^{\infty} \frac{\sin(n)}{n^e + 1} \)

5 pts (d) \( \sum_{n=1}^{\infty} (-1)^n \sqrt{n + 4} \)

10 pts 2. Let \( S = \sum_{n=2}^{\infty} \frac{3^n + 3^{-n}}{4^n} \). If \( S \) converges, find its sum. If \( S \) diverges, prove that it diverges.

10 pts 3. Find the value of \( \sum_{n=2}^{\infty} \frac{1}{(n+2)(n+3)} \).

10 pts 4. Let \( S = \sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n+3}} \). Find the minimum value of \( N \), such that \( S_N \) (the \( N \)th partial sum of \( S \)) is guaranteed to approximate \( S \) with an error no greater than 1/7.

10 pts 5. Determine whether the series \( \sum_{n=1}^{\infty} \frac{(-1)^{n+1}(n + 2)^2}{n^3} \) converges absolutely, converges conditionally, or diverges.

10 pts 6. Find the interval of convergence of \( \sum_{n=1}^{\infty} \frac{n(x+3)^n}{3^n} \).

7. Let \( f(x) = \frac{1}{3 - x^2} \) and let \( g(x) = \frac{x}{(3 - x^2)^2} \).

Note: For each part, you must give your answer in summation (\( \Sigma \)) notation for full credit, but for partial credit you may write the first four nonzero terms of the series.

5 pts (a) Use a geometric series expansion to find a power series for \( f(x) \) with center \( c = 0 \).

5 pts (b) Use your answer from part (a) to find a power series for \( g(x) \).

10 pts 8. Find the first four nonzero terms of the Maclaurin series of \( (1 + x)^{2/3} \).

10 pts 9. Evaluate \( \int_{3}^{\infty} \frac{2x}{(x^2 + 3)^2} \, dx \).