1. (18 pts) Determine whether the series is absolutely convergent, conditionally convergent, or divergent. Justify your answer and name any tests or theorems you use.

(a) \[
\sum_{n=1}^{\infty} \frac{(-1)^n}{n 3^n}
\]

(b) \[
\sum_{n=1}^{\infty} \frac{1}{\sqrt{5 + n^2}}
\]

2. (20 pts) Let \( f(x) = x^{3/2} \).

(a) Find the Taylor polynomial \( T_2(x) \) for \( f(x) \), centered at 1.

(b) Suppose \( T_2(x) \) from part (a) is used to approximate the value of \( \sqrt[3]{\frac{2}{3}} \). Use Taylor’s Formula to find an error bound for the approximation. You may leave your answer unsimplified.

3. (22 pts) The following problems are not related.

(a) Suppose \( g(x) = \sum_{n=2}^{\infty} (-1)^n \frac{(2x)^{n-2}}{3^n n!} \) and \( h(x) = x^2 g(x) \). Find a power series representation for \( h'(x) \). Simplify your answer.

(b) Find a power series centered at 0 for \( \frac{1}{6 + x^7} \) and use it to find a power series for \( \int \frac{1}{6 + x^7} \, dx \). Simplify your answer.

4. (20 pts) The following problems are not related.

(a) Use series to evaluate \( \lim_{x \to 0} \frac{3x^6 - x^8}{\arctan(x^2) - x^2} \).

(b) Find the sum of the series \( \frac{1}{2^3 3!} + \frac{1}{2^5 5!} - \frac{1}{2^7 7!} + \frac{1}{2^9 9!} - \cdots \).

5. (20 pts) The following two problems are not related.

(a) Suppose the series \( \sum_{n=0}^{\infty} c_n (x + 3)^n \) converges when \( x = -7 \) and diverges when \( x = -9 \). For each of the following write Convergent, Divergent, or Indeterminate. No justification is necessary.
   i. Series at \( x = 2 \)  
   ii. Series at \( x = 3 \)  
   iii. \( \sum_{n=0}^{\infty} (-1)^n c_n \)

(b) Use the graphs of \( f \) and \( g \) to sketch the parametric curve \( x = f(t), y = g(t) \), for \( 0 \leq t \leq 4 \). Indicate the direction of motion.