Part I. All problems in part I count for 15 points.

(1) Is the following series Absolutely Convergent, Convergent, or Divergent?
\[ \sum_{n=0}^{\infty} \frac{(-1)^n}{2^n} \]

(2) Express the function \( f(x) = \frac{1}{2 + x} \) as a power series centered at 0. Also state the interval of convergence.
(3) Express \( f(x) = \sin(x^3) \) as a power series. Also include the interval of convergence.

(4) Find the radius and interval of convergence for the power series \( \sum_{n=1}^{\infty} \frac{2^n(x+5)^n}{n} \).
(5) Estimate the sum of the series \( \sum_{n=0}^{\infty} \frac{(-1)^n}{n!} \) with an error of at most \( 10^{-4} \). [You don’t need to add the terms in the approximation.]

**Bonus [5 points]:** Do you know the exact value of this sum?

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**Part II.** The problem in Part II counts for 25 points.

(6) Estimate

\[
\int_{0}^{2} e^{-x^3} \, dx
\]

with an error of at most \( 10^{-10} \). [You don’t need to add the terms in the approximation!]