You must show your work and give reasons for your answers!
Good luck.

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

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

(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?

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!]