Problem 1: (20 points) Does the series converge or diverge? Identify which test you used and show all of your work.

a) \[ \sum_{n=1}^{\infty} \frac{2^n}{(n+6)!} \]

b) \[ \sum_{n=1}^{\infty} \left( \frac{2n-1}{3n+5} \right)^n \]

Problem 2: (20 points) Let \( f(x) = e^x \)

a) Find the 3rd degree Maclaurin polynomial for \( f \). Show all of your work.

b) Use \( P_3(x) \) to approximate the value of \( e^{0.2} \).

c) Use Taylor’s Theorem to determine the error in your approximation.

Problem 3: (20 points) Consider the following series \( \sum_{n=1}^{\infty} \frac{(x-2)^n}{n3^n} \).

a) Where is the series centered?

b) Determine the interval of convergence and radius of convergence. Show all of your work and name any tests used.

Problem 4: (20 points) Let \( f(x) = \frac{1}{1-x} \).

a) Find a power series for \( f(x) \). Show your work here. Find the interval of convergence.

b) Find a power series for \( g(x) = \frac{3}{3-x} \). Find the interval of convergence.

Problem 5: (20 points) Find the Maclaurin Series for \( f(x) = \ln(x+1) \). Write your final answer in summation notation, simplified.