21-118 **Calculus of Approximation** **D. Handron**

Exam #2
March 3, 2000 **Name:**____________________________________

1. **(20 points)** Consider the series
$$\sum_{n=0}^{\infty} \frac{n2^n}{n!}.$$
Can any of the following series may be used to show this series converges using the comparison test? Why or why not?

   (a) $\sum_{n=1}^{\infty} \frac{e^n}{(n-1)!}$

   (b) $\sum_{n=0}^{\infty} \frac{n^n}{n!}$

   (c) $\sum_{n=0}^{\infty} \frac{2^n}{n^n}$

2. **(20 points)** Determine whether the following series converge absolutely, converge conditionally, or diverge.

   (a) $\sum_{n=0}^{\infty}(-1)^n \frac{2n}{\sqrt{n^3+1}}$

   (b) $\sum_{n=0}^{\infty} \frac{n^n}{(2n)!}$

3. **(20 points)** Determine the interval of convergence and the radius of convergence for the power series $\sum_{n=1}^{\infty}(-1)^n \frac{(2x+3)^n}{n\ln(n)}$.

4. **(20 points)**

   (a) Find the Taylor series for $f(x) = \ln(x)$ around $x = 2$.

   (b) Find the Taylor series for $g(x) = (x-2)^2 \ln(x)$ around $x = 2$.

5. **(20 points)** Recall that $\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n$ for $|x| < 1$.

   (a) Use this MacLauren series to find the Taylor series for $-\ln(1-x)$.

   (b) Find the first five terms in the MacLauren series for $-\frac{\ln(1-x)}{1-x}$.