1) (15 points) Determine whether the following series converge or diverge. Explain your answers.

(a) $\sum \frac{\sqrt{n^2+1}}{n^3}$ (b) $\sum (-1)^n \frac{n+1}{n}$ (c) $\sum \frac{10^n}{n!}$

2)

Decide, giving reasons, whether the following series converge absolutely, converge but *not* absolutely, or diverge.

a) $\sum_{n=2}^{\infty} \frac{1}{n + \ln n}$

b) $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n+1}}$

c) $\sum_{n=1}^{\infty} \frac{(-1)^n 2^n}{n!}$

d) $\sum_{n=1}^{\infty} \frac{\sin n}{n^2}$

3) (18 points—6 points each) Determine whether the series is convergent or divergent. If it is convergent, determine whether it is absolutely convergent.

(a) $1 - \frac{1}{3} + \frac{1}{5} - \ldots + \frac{(-1)^{n-1}}{2n-1} + \ldots$

(b) $\frac{3^2}{1 \cdot 2} - \frac{5^2}{2 \cdot 3} + \frac{7^2}{3 \cdot 4} - \ldots + (-1)^{n-1} \frac{(2n+1)^2}{n \cdot (n+1)} + \ldots$

(c) For what values of x does the series $\sum_{n=1}^{\infty} \ln(x^n)$ converge?

4) (20 points)

(a) (10 points) Does the series $\sum_{n=1}^{\infty} \frac{1}{n^{\pi}}$ converge or does it diverge? Explain your reasons for your answer. Be sure to indicate what theorem(s) you use and why you think they apply.

(b) (10 points) If you said in part (a) that the series converged, use integrals to compute both an upper and a lower bound for the sum of the series. If you claimed that the series diverged, use an integral to show that it diverges.