Math 202
Hour Exam 3

Name: _____ Date: _____

9 Problems. 100 Points. Follow directions carefully. Please do not leave any question blank, and turn off cell phones and other noisemakers to avoid disturbing your classmates.

I have verified that this exam contains 9 problems and 6 printed pages. Initial_____.

Print the name of the people sitting either side of you :- _____

Short Answer (8 points each) - no explanation or calculations necessary though where appropriate, answers should be exact. Print your answers to each question in the appropriate numbered box below.

1. Find a formula for the nth term of the sequence

$$\{\frac{1}{2}, -\frac{1}{4}, \frac{1}{8}, -\frac{1}{16}, \frac{1}{32} \dots\}.$$

2. The series

$$\sum_{n=1}^{\infty} ar^n$$

where r and a are constants is called a geometric series.

(a) For what values of r does it converge?

(b) When it converges, what does it converge to (in terms of a and r)?

3. The series

$$\sum_{i=1}^{\infty} \frac{1}{n^p}$$

where p is a constant is called a p-series. For what values of p does it converge?

4. **Briefly** explain the difference between the **limit comparison test** and the **ratio test** for convergence of series.

5. **Briefly** explain why any power series centered at 0,

$$\sum_{n=0}^{\infty} c_n x^n$$

always converges for at least one value of x.

6. Write down an alternating series which does not converge.

Long Answer (18 points each) - show work and provide explanations, an answer without supporting work is not worth much.

1. Test the following series for convergence or divergence and state which test you are using:

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

   (b)
   $$\sum_{n=2}^{\infty}\frac{\sqrt{n}}{n-1}$$

   (c)
   $$\sum_{n=0}^{\infty}\frac{1+\sin(n)}{10^n}$$

2. Find the radius of convergence and the interval of convergence of the series

$$\sum_{n=1}^{\infty}(-1)^n n4^n x^n.$$

3. (a) For which values of p does the integral

$$\int_0^\infty e^{px} dx$$

converge? Find a formula in terms of p for the values of the integral for which it converges.

(b) For which values of p does the sequence

$$a_n = e^{pn}$$

converge?

(c) For which values of p does the series

$$\sum_{k=1}^{\infty} e^{pk}$$

converge?