

Math 202
Hour Exam 3

Name: _____

Date: _____

9 Problems. 150 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 10 printed pages.
Initial_____.

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

Question	Points Value	Points Awarded	Section Totals
Short Answer 1	12		
Short Answer 2	12		
Short Answer 3	12		
Short Answer 4	12		
Short Answer 5	12		
Short Answer 6	12		
Long Answer 1	26		
Long Answer 2	26		
Long Answer 3	26		
Total	150		

Short Answer (12 points each) - keep explanations and calculations brief and where appropriate, answers should be exact.

1. Determine the exact value of the series

$$\sum_{n=0}^{\infty} \left(\frac{1}{n+1} - \frac{1}{n+3} \right).$$

2. Determine the value of the series

$$\sum_{n=0}^{\infty} -3 \left(\frac{2}{3} \right)^n.$$

3. Explain why the alternating series test does not apply to the series

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

State another test you could use which would determine whether or not this series converges (you do not need to determine whether it converges).

4. Determine a power series representation for the function

$$f(x) = \ln(1+x)$$

(you may assume you know the power series representation for the function $1/(1-x)$).

5. Use the ratio test to show that for any number k , the series

$$\sum_{n=1}^{\infty} \frac{n^k}{e^n}$$

converges.

6. Determine the radius of convergence of the series

$$1 + 2x + 3x^2 + 4x^3 + 5x^4 + \dots$$

Long Answer (26 points each) - show work and provide explanations, an answer without supporting work is not worth much.

1. (This question continues over the page) Determine whether or not the following series converge and state the test you use.

(a)

$$\sum_{n=1}^{\infty} \frac{1}{n \ln(n)}$$

(b)

$$\sum_{n=1}^{\infty} 2^{-n} \frac{n+1}{n+2}$$

(c)

$$\sum_{n=0}^{\infty} \frac{1}{2 + \sin(n)}$$

(d)

$$\sum_{n=0}^{\infty} (-1)^n \frac{n + 2^n}{n2^n}$$

2. (This question continues over the page) Determine the intervals of convergence of the following power series.

(a)

$$\sum_{n=0}^{\infty} \frac{x^n}{n!}$$

(b)

$$\sum_{n=0}^{\infty} \frac{n!(x-1)^n}{e^n}$$

(c)

$$\sum_{n=0}^{\infty} \frac{(x-2)^n}{3^n n^2}$$

3. (This question continues over the page) Consider the sequence with general n th term

$$a_n = (-1)^n \cdot 2n \left(\frac{1}{2}\right)^{2n+1}.$$

- (a) Show that the series

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

converges.

- (b) Determine a power series representation for the function

$$f(x) = -\frac{2x}{(1+x^2)^2}$$

and state its radius of convergence.

(c) Use your answer to determine the exact value of the series

$$\sum_{n=1}^{\infty} a_n.$$