

Name: _____

Student ID: _____

Section: _____

Instructor: _____

Math 113 (Calculus 2)

Exam 4

4–8 April 2008

Instructions:

1. Work on scratch paper will not be graded.
 2. For question 1 and questions 10 through 15, show all your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer. Please write neatly.
 3. Questions 2 through 9 are short answer. Fill in the blank with the appropriate answer. You do not need to show your work.
 4. Should you have need for more space than is allotted to answer a question, use the back of the page the problem is on and indicate this fact.
 5. Simplify your answers. Expressions such as $\ln(1)$, e^0 , $\sin(\pi/2)$, etc. must be simplified for full credit.
 6. Calculators are not allowed.
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For Instructor use only.

#	Possible	Earned		#	Possible	Earned
1a	5			6	5	
1b	5			7	5	
1c	5			8	5	
1d	5			9	5	
1e	5			10	5	
1f	5			11	5	
2	5			12	5	
3	5			13	5	
4	5			14	5	
5	5			15	5	
				Total	100	

Unless indicated, each problem is worth 5%.

1. (30% Show your work.) Determine whether each series converges absolutely, converges conditionally, or fails to converge. State and justify your conclusion next to the series.

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

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

(c)
$$\sum_{k=1}^{\infty} \frac{(-1)^k k}{k^2 + 1}$$

(d)
$$\sum_{n=1}^{\infty} \frac{\sqrt[3]{n^2 + 1}}{n^2}$$

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

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

Questions 2 through 9 are short answer. Fill in the blank with the appropriate answer. You do not need to show your work.

2. If $f(x) = x^3 \sin x$, find the 100th derivative evaluated at zero; i.e., find $f^{(100)}(0)$.

3. Evaluate the sum. $1 + \frac{1}{2 \cdot 1!} + \frac{1}{2^2 \cdot 2!} + \frac{1}{2^3 \cdot 3!} + \frac{1}{2^4 \cdot 4!} + \cdots = \sum_{k=0}^{\infty} \frac{1}{2^k \cdot k!}$

4. Find the radius of convergence. $\sum_{n=1}^{\infty} \frac{x^{3n}}{n8^n}$

5. Find the coefficient of x^5 in the Maclaurin series for $e^x \cos(2x)$.

6. Find the the first three non-zero terms of Taylor series for $\cos 2x$ about $x = \pi/6$.

7. Find the Taylor series for $p(x) = x^3 + x^2 + x + 1$ about $x = 1$; i.e., write $p(x)$ as a polynomial in $x - 1$.

8. Find the Maclaurin series for $\frac{2}{2-x}$. _____

9. Use the Alternating Series Estimation Theorem to estimate the error in computing $\cos x$ by using $\cos x \approx 1 - \frac{x^2}{2} + \frac{x^4}{24}$ for $-1 \leq x \leq 1$.

|error| < _____

Problems 10-15. Show your work for full credit.

10. Find the sum $\sum_{k=1}^{\infty} \frac{1}{k^2 + k}$

11. Evaluate the sum. $x + 2x^2 + 3x^3 + 4x^4 + \dots = \sum_{n=1}^{\infty} nx^n$

12. Evaluate the following limit: $\lim_{x \rightarrow 0} \frac{24 - 12x^2 + x^4 - 24 \cos x}{x^6}$

13. Find the the first four non-zero terms of a power series expansion for the function $\frac{1}{\sqrt{1-x^2}}$ expanded about $x = 0$.

14. Find the interval of convergence. $\sum_{n=1}^{\infty} \frac{(2x-1)^n}{n^2 2^n}$

15. Show the Ratio Test gives no information if the limiting ratio equals 1; i.e., give examples of two series whose limiting ratios are both 1 so that one converges and the other diverges.