READ THE FOLLOWING INSTRUCTIONS.

- Do not open your exam until told to do so.
- No calculators, cell phones or any other electronic devices can be used on this exam.
- Clear your desk of everything except pens, pencils and erasers.
- If you need scratch paper, use the back of the previous page.
- Without fully opening the exam, check that you have pages 1 through 8.
- Fill in your name, etc. on this first page.
- **Show all your work.** Write your answers clearly! Include enough steps for the grader to be able to follow your work. Don’t skip limits or equal signs, etc. Include words to clarify your reasoning.
- Do first all of the problems you know how to do immediately. Do not spend too much time on any particular problem. Return to difficult problems later.
- If you have any questions please raise your hand and a proctor will come to you.
- There is no talking allowed during the exam.
- You will be given exactly 90 minutes for this exam.
- This is a practice exam. The actual exam may differ significantly from this practice exam because there are many varieties of problems that can test each concept.

I have read and understand the above instructions: __________________________

**SIGNATURE**
Multiple Choice. Circle the best answer. No work needed. No partial credit available.

1. (5 points) Evaluate the series: \( \sum_{n=1}^{\infty} (-1)^{n+1}(0.1)^n \)
   
   A. 0
   B. \( \infty \)
   C. \( \frac{1}{11} \)
   D. \( -\frac{10}{11} \)
   E. None of the above.

2. (5 points) Does the series \( \sum_{n=1}^{\infty} \frac{\cos(2\pi n)}{n} \) converge or diverge?
   
   A. L. Comparison Test to show it is diverges
   B. D. Comparison Test to show it is converges
   C. Limit Comparison Test to show it is converges
   D. \( n^{th} \) Term Test to show it is diverges
   E. None of the above.

Extra Work Space.
3. Determine if the following statements are True or False.

(a) (3 points) ______________: We can apply the comparison tests to a series with some negative terms.

(b) (3 points) ______________: For a given series \( \sum_{n=1}^{\infty} a_n \) unless \( \lim_{x \to +\infty} a_n = 0 \) the series diverges.

(c) (3 points) ______________: The Ratio Test can be used to determine whether \( \sum_{n=1}^{\infty} \frac{1}{n^4} \) converges.

(d) (3 points) ______________: If \( a_n \leq b_n \) and \( \sum_{n=1}^{\infty} a_n \) diverges, then \( \sum_{n=1}^{\infty} b_n \) also diverges.

(e) (3 points) ______________: If \( b_n \leq a_n \) and \( \sum_{n=1}^{\infty} a_n \) diverges, then \( \sum_{n=1}^{\infty} b_n \) also diverges.

4. (5 points) The length of the curve given by \( y = 6x^{3/2} \) for \( 0 \leq x \leq 2 \) is: ______________.

5. (5 points) Evaluate \( 1 - \frac{1}{2} + \frac{1}{4} - \cdots + (-1)^n \frac{1}{2^n} + \cdots = \) ____________

Extra Work Space.
6. Determine whether the series is convergent, or divergent. State which test you used and all necessary conditions to use the test.

(a) (5 points) \[ \sum_{n=1}^{\infty} \frac{n^2 + n + 5}{\left(\frac{n^2}{2}\right)} \]

(b) (5 points) \[ \sum_{n=1}^{\infty} \frac{(-1)^n}{n + 5^n} \]

(c) (6 points) \[ \sum_{n=1}^{\infty} \frac{n^2 + 1}{n^3 + n^2} \]

(d) (6 points) \[ \sum_{n=1}^{\infty} \frac{\ln n}{n} \]
7. Find the Maclaurin series for the following functions.
   (a) (8 points) $f(x) = \sin \left( \frac{2x}{3} \right)$

   (b) (8 points) $g(x) = e^{(\pi x)/2}$

8. Find the series’ radius and interval of convergence.
   (a) (6 points) $\sum_{n=1}^{\infty} n \frac{x^n}{n+5}$

   (b) (6 points) $\sum_{n=1}^{\infty} (2x)^n$

   (c) (6 points) $\sum_{n=1}^{\infty} \frac{(3x - 2)^n}{n}$
9. (6 points) Is the series \( \sum_{n=1}^{\infty} \left( \frac{-3n}{n^2+1} \right) \) convergent? Is it absolutely convergent? Justify.

10. (10 points) Find the Power series for: \( 1 - x^2 + x^4 - x^6 + x^8 - \ldots \)

11. (10 points) Find the first two nonzero terms of the Taylor series of

\[
f(x) = \frac{1}{x+2} \quad \text{at} \quad x = 2
\]
12. (8 points) Show that the series \( \sum_{n=1}^{\infty} \frac{(-1)^n(n + 6)!}{7^n n!7^n} \) is convergent by using the Ratio Test.

13. (8 points) Find a power series representation for the function and determine the interval of convergence.

\[
f(x) = \frac{5}{1 - 4x^2}
\]
Congratulations you are now done with the exam! Go back and check your solutions for accuracy and clarity. Make sure your final answers are BOXED.

When you are completely happy with your work please bring your exam to the front to be handed in. Please have your MSU student ID ready so that is can be checked.

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