

MATH 123 PRACTICE MIDTERM 2

NAME (PRINTED):

DISCUSSION TIME:

Please *turn off all electronic devices*. You may use both sides of a 8.5×11 sheet of paper for notes while you take this exam. No calculators, no course notes, no books, no help from your neighbors. **Show all work**—the grading will be based on your work shown as well as the end result. Remember to put your name at the top of this page. Good luck.

Problem	Score (out of)
1	(10)
2	(10)
3	(10)
4	(10)
5	(10)
6	(10)
7	(10)
Total	(70)

1. (10 pts) Evaluate the following limit. Carefully justify your answer.

$$\lim_{n \rightarrow \infty} \frac{\sin(n)\ln(n)}{n}$$

2. (10 pts) Evaluate the following series

$$\sum_{n=0}^{\infty} \frac{3^{n-1} + 4^{n+1} + 1}{5^n}$$

3. (10 pts) Find all values of k for which the following series converges. Carefully justify your answer.

$$\sum_{n=1}^{\infty} \frac{n+1}{kn^3 + n^2 + n + 1}$$

4. (10 pts) Determine if the following series converges or diverges. Carefully justify your answer.

$$\sum_{n=1}^{\infty} \left(1 + \frac{1}{n}\right)^{\frac{1}{100}n^2}$$

5. Show that the following series converges conditionally. Carefully justify your answer.

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

6. (10 pts) Find the interval of convergence for the following power series.

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

7. (10 pts) Let $f(x) = \cos(x)\sin(x)$.

A) Find the cubic polynomial representing the first four terms of the Macluarin series for $f(x)$.

B) Use Taylor's formula to estimate the error in approximating $f(x)$ by the polynomial found in part A) on the interval on $[-\frac{\pi}{4}, \frac{\pi}{4}]$.