Math 112z, Fall 2019 Practice Midterm 2

Name: _

Student ID Number: _

- There are 6 pages of questions. Make sure your exam contains all these questions.
- This is a closed book, closed note, no calculator exam. You must show your work on all problems. The correct answer with no supporting work may result in no credit.
- Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.
- If you need more room, use the backs of the pages and indicate clearly that you have done so.
- Raise your hand if you have a question.
- Remember the **Honor Code**. Avoid suspicion of cheating by keeping your eyes on your paper and clearly showing your work on each problem!
- The problems are not ordered according to their difficulties, so please take a look at all problems and do not waste too much time on one problem. Budget your time wisely.
- You have 75 minutes to complete the exam.

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GOOD LUCK!

1. (15 pts) Find all solutions of the equation

$$(x^2+1)y' = xy$$

$$xy' - y = x\ln x, \quad y(1) = 2.$$

Note x > 0 in this problem.

3. (20 pts) Newton's law of cooling states that the temperature of an object changes at a rate proportional to the difference between its temperature and the surrounding temperature. Let T(t) be the temperature of the object and T_s be the surrounding temperature. We get

$$\frac{dT}{dt} = k(T - T_s)$$

where k is a constant. Suppose that the temperature of the object is 200° F in the beginning and 1 minute later, it has cooled down to 190° F in a room at 70° F. Find the time when the temperature of the object becomes 150° F.

- 4. (15 pts) Determine whether the sequence converges or diverges. If it converges, find the limit.
 - (a) $a_n = (1+2/n)^n$.

(b) $a_n = 2^{-n} \cos(n\pi)$.

5. (15 pts) Determine whether the series converges or diverges. If it converges, find the sum.

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

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

(c)
$$\sum_{n=1}^{\infty} \ln(1+1/n)$$

- 6. (20 pts) The following two problems are independent of each other.
 - (a) Find constant c such that

$$\sum_{n=0}^{\infty} e^{cn} = 10.$$

(b) Consider the sequence $a_n = \frac{3^n}{n!}$. Determine whether it converges or diverges. (Note: the original problem was for $a_n = \frac{(-3)^n}{n!}$.)