

**Write your name here:**

**Write your TA's name here:**

Math 109, Calculus II, spring term 2010, Prof. Andrew Salch.  
Midterm Exam 2.

- Make sure to write your name and your TA's name on the top of this page.
- **Show your work on all problems for full credit.** You may get partial credit if you solve part of a problem correctly.
- You may not use any of the following things on this test: a calculator, a computer, a cell phone, an Ipad, anything else with an LCD screen, notes, books, people (other than yourself), alcohol, tobacco, firearms, explosives, a calculator, other students' tests, anything that has headphones, Morse code, two calculators, three calculators, or anything else that you have a guilty or rebellious feeling about using on this test.
- Do not be worried if you cannot answer every problem on the test; I do not expect that you will be able to answer all of the problems in the 50 minutes allotted for the exam. Do as much as you can, and you will receive partial credit for problems which are partially complete. There will be a curve on this exam.

**For graders' use:**

Problem number	Your score	Maximum score
1		20
2		20
3		20
4		20
5		20
6		20
7		20
8		20
Total		160

**Problem 1.** Prove, using the definition of the limit of a sequence, that

$$\lim_{n \rightarrow \infty} \frac{1}{n} = 0.$$

**Problem 2.** Compute the integral

$$\int_{-1}^1 \frac{1}{\sqrt{|x|}} dx.$$

**Problem 3.** Use the integral test to show that

$$\sum_{n=1}^{\infty} \frac{1}{n^p}$$

converges if  $p > 1$ .

**Problem 4.** Compute

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

**Problem 5.** Let  $a_0, a_1, a_2, b_0, b_1, b_2$  be real numbers, with  $b_2$  nonzero. Prove that

$$\lim_{n \rightarrow \infty} \frac{a_2 n^2 + a_1 n + a_0}{b_2 n^2 + b_1 n + b_0} = \frac{a_2}{b_2}$$

using the Limit Laws.

**Problem 6.** Does the series

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

converge or diverge? Why?

**Problem 7.** Does the series

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

converge or diverge? Why?



**Problem 8.** Does the series

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

converge or diverge? Why?