

## MATH 2300-004: Practice Final

Name:

**Directions:** There are seven (well, really nine) questions on this practice test. Complete all questions, and show all work to receive full credit.

On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work.

**Signature:**

1. Given the function defined as  $F(x) = \int_0^{x^2} \sinh(\cosh(x)) dx$ , find  $F(0)$ ,  $F'(0)$ , and  $F''(0)$ .

2. Find each integral.

(a)  $\int e^x \cos(x) dx$

(b)  $\int x\sqrt{x^2 - 1} dx$

3. Consider the spiral  $r = \frac{1}{\theta}$ , and define  $a_n$  to be the arclength of the spiral over the interval  $n$  to  $n + 1$ . Show that the sequence  $a_n$  is strictly decreasing. Does the sequence converge?

4. Consider the conic section represented by

$$4x^2 + y^2 + 8x - 10y + 13 = 0$$

Sketch the conic section and label all important characteristics (i.e. foci, vertices, directrix, asymptotes, etc.).

5. Suppose a 32 lb mass is suspended on a spring whose spring constant is  $k = \frac{1}{8} \frac{\text{lb}}{\text{ft}}$ . If the block is pulled 2 ft below its equilibrium position and released, find an equation for the motion of the mass. State the frequency, period, and amplitude of the motion.

6. Find the radius and interval of convergence for the series

$$\sum_{k=1}^{\infty} \frac{(x-2)^k}{2^{2k} \sqrt{k}}$$

7. Determine if the following series converge, and state any convergence tests you may use.

$$\sum_{k=1}^{\infty} \frac{\sinh(k)}{\cosh^2(k)}$$

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