

Name:

Math 1441 Practice Midterm 3

You have 75 minutes to finish the exam. This exam contains 7 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Print your name on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may *not* use your books, notes, or any calculator on this exam.

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.
- **Mysterious or unsupported answers will not receive full credit.** A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.

Do not write in the table to the right.

Problem	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
Total:	50	

1. (10 points) Use the **Closed Interval Method** to find the absolute maximum and minimum of

$$f(x) = \frac{x}{x^2 + 1} \quad \text{on } [0, 2].$$

Indicate the x -values at which they occur.

2. (10 points) Use the **Second Derivative Test** to classify each critical point of f as a local maximum, a local minimum, or neither.

$$f(x) = x \ln x, \quad x > 0$$

3. Let $f(x) = \frac{x}{x^2+1}$, where $-\infty < x < \infty$.

(a) (2 points) Find the intervals on which f is increasing or decreasing.

(b) (3 points) Find the intervals of concavity and the inflection points.

Hint: You may use $f''(x) = \frac{2x(x^2-3)}{(x^2+1)^3}$.

(c) (1 point) Find the horizontal asymptote of f .

(d) (4 points) Sketch the graph of f .

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4. (10 points) A rectangular storage container with an open top is to have a volume of 20 m^3 . The length of its base is twice the width. Material for the base costs \$5 per square meter. Material for the sides costs \$9 per square meter. Find the cost of materials for the cheapest such container. Indicate the corresponding dimensions.

5. A particle is moving along a straight line with the given data:

$$a(t) = 30(t^4 - 2t^3 + t), \quad s(0) = 0, \quad s(1) = 0.$$

(a) (8 points) Find the position function $s(t)$.

(b) (2 points) Find the velocity of the particle at $t = 0$.