MATH 1300: CALCULUS 1

November 9, 2005

3rd MIDTERM TEST

YOUR NAME:

- ◯ **001** A. Pence ..... (8am)
- ◯ **002** A. Spina ..... (8am)
- ◯ **003** I. Becker ..... (8am)
- ◯ **004** E. Frugoni ..... (8am)
- ◯ **005** T. Seguin ..... (9am)
- ◯ **006** I. Mishev ..... (9am)
- ◯ **007** J. Johanson ..... (9am)
- ◯ **008** J. Sanders ..... (9am)
- ◯ **009** J. Nibert ..... (9am)
- ◯ **010** J. Wiscons ..... (10am)
- ◯ **012** V. Wong ..... (11am)
- ◯ **013** E. Kim ..... (11am)
- ◯ **014** T. Schumacher ..... (12pm)
- ◯ **015** J. Clelland ..... (1pm)
- ◯ **016** J. Meadows ..... (2pm)
- ◯ **018** E. Angel ..... (4pm)
- ◯ **019** C. Seacrest ..... (4pm)

Show all your work.

Answers out of the blue and without any supporting work will receive no credit *even if they are right!*

Write clearly. **Box your final answers.**

No calculators allowed. **No cheat sheets allowed.**

After you get the test back, if you consider that something was incorrectly graded,
DO NOT WRITE ON YOUR TEST!
As clearly as possible write down your version of the story on a clean sheet of paper, attach it to your test, and give it back to your instructor for further consideration.

DO NOT WRITE ON THIS BOX!

problem	points	score
1	20 pts	
2	20 pts	
3	30 pts	
4	15 pts	
5	15 pts	
TOTAL	100 pts	

1: *(20 points)* Find $\frac{dy}{dx}$ for each of the following functions (some of which may be defined implicitly). IT IS NOT NECESSARY TO SIMPLIFY YOUR ANSWERS, AND DOING SO MAY LEAD TO A LOSS OF POINTS IF YOU DO IT INCORRECTLY.

(a) $y = (\ln(x))^2$

(b) $y = \sin^{-1}(3x^2)$

(c) $y = e^{x \sin x}$

(d) $xy + x^2 = y^2$

2: *(20 points)* Evaluate the following limits.

(a) $\lim_{x \to 2} \dfrac{1 - e^{(2-x)}}{x^2 - 5x + 6}$

(b) $\lim_{x \to +\infty} \dfrac{3x^{10} + 5x^8 - 4}{2x^{10} + 2000x^9 + 3x^6 + 1}$

(c) $\lim_{x \to 0} \dfrac{\sin^2 x}{x^2}$

(d) $\lim_{x \to 0^+} (x + 1)^{\frac{1}{x}}$

3: *(30 points)* If the function $f(x)$ and its first two derivatives, $f'(x)$ and $f''(x)$, are given by

$$f(x) = \frac{x^2}{x^2-1}, \qquad f'(x) = \frac{-2x}{(x^2-1)^2}, \qquad f''(x) = \frac{6x^2+2}{(x^2-1)^3},$$

complete the parts below:

(a) Find x and y intercepts for the graph of f.

(b) Find all vertical and horizontal asymptotes for the graph of f.

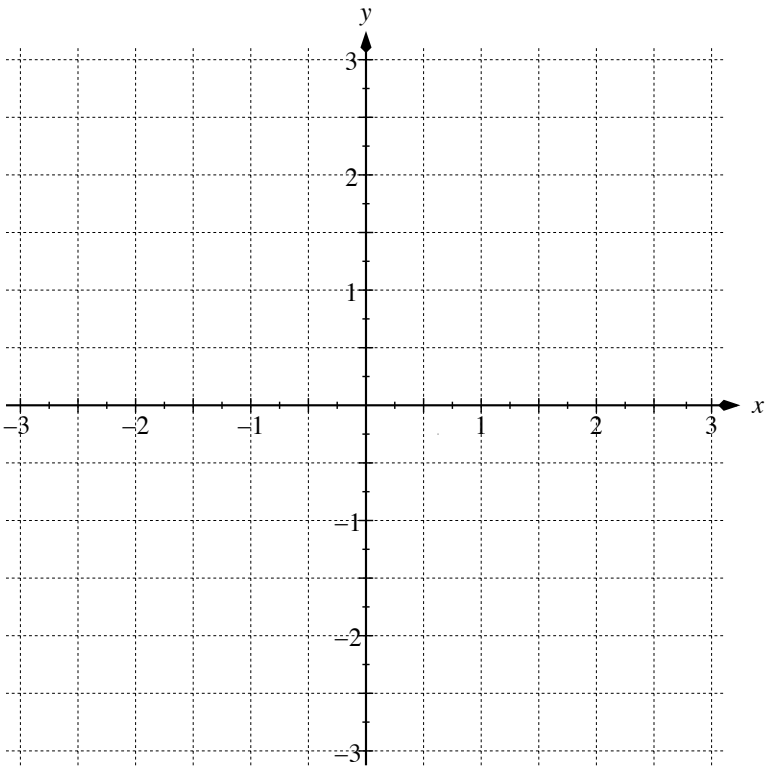
(c) Find and classify (local max, local min, or neither) all critical points of f.

(d) Find all intervals where f is increasing and decreasing.

(e) Find all inflection points of f.

(f) Find all intervals where f is concave up and concave down.

(g) Sketch the graph of f on the grid below, clearly indicating all features found above.



4: *(15 points)* A circular cylindrical metal container, open at the top, is to have a volume of 24π in^3. The cost of the material used for the bottom of the container is 15 cents per square inch, and the cost of the material used for the curved part is 5 cents per square inch. If there is no waste of material and thickness is negligible, find the dimensions of the cylinder that will minimize the cost. You may find the following formulas useful:

- Volume of a cylinder with radius r and height h: $V = \pi r^2 h$
- Area of the curved part of the cylinder: $A = 2\pi r h$.

5: *(15 points)* Suppose I drive from Boulder to Denver International Airport, a distance of 50 miles. I leave my house at 10:00 A.M. and arrive at the airport at 10:40 A.M. Use the Mean Value Theorem to prove that I exceeded the 65 m.p.h. speed limit at some point along the way. (Assume that I drive in such a way that my position function is differentiable.)