

EXAM 3
Math 131
November 20, 2002

Name _____

You must show all your work. Partial credit will be given.

1. Find the limit of each of the following problems. (7 pts each)

(a) $\lim_{x \rightarrow 0} \frac{\sin(x)}{x^{\frac{1}{3}}}$.

(b) $\lim_{x \rightarrow 0} \frac{\sin(x) - x}{x^3}$.

2. Which of the two functions $100x^3 + 39$ or $e^{.2x}$ dominates as $x \rightarrow \infty$? (8 pts)

3. What is the local linearization of $f(x) = \ln(x^2 + 1)$ near $x = 1$? (8 pts)

4. Classify all the critical points of the equation x^2e^{-x} . (12 pts)

5. Find all the relative maxima/minima AND inflection points of $x^5 - 5x^3 + 21$. (12 pts)

6. The number, N , of people who have heard a rumor spread by mass media at time, t is given by

$$N(t) = a(1 - e^{-kt}).$$

There are 200,000 people in the population who hear the rumor eventually. If 10% of them heard it the first day, find a and k , assuming t is measured in days. (8 pts)

7. Find the global max/min for $\ln(1 + x^2)$ on the interval $-1 \leq x \leq 3$. (10 pts)

8. A square bottomed box with no top has a volume of 150 square feet. Find the dimensions for this box which will minimize the surface area of the box. (9 pts)

9. Show that the derivative of $\sinh(x)$ is $\cosh(x)$. (6 pts)

10. Find the derivative of $t^3 \cosh(e^{t^2})$ (8 pts)

11. Show that if f is differentiable on $(0, 1)$ and $f(0) < f(1)$, then there is a number c , with $0 < c < 1$, such that $f'(c) > 0$. (5 pts)