

**Exam 2, version A**  
**Math 171.501**  
**11/3/09**

*An unsupported answer  
is a wrong answer!*

*Do not use l'Hôpital's rule on this test.*

1. (15 pts.) Find  $\frac{dy}{dx}$  if:
  - (a)  $y = \sin^2(2x^3)$ .
  - (b)  $y = \frac{x}{\ln(2x+1)}$ .
  - (c)  $y = \arctan\left(\frac{1}{x}\right)$ .
2. (10 pts.) A ten foot ladder rests against a vertical wall. The bottom of the ladder is being pulled away from the wall at a rate of 2 feet per second. How rapidly is the top of the ladder going down at the instant that the top of the ladder is 8 feet from the floor?
3. (10 pts.) Use definition of derivative (i.e., evaluate a certain limit as  $h$  tends to zero) to find  $f'(x)$  if  $f(x) = \sqrt{4x}$ .
4. (5 pts.) Using logarithmic differentiation, find  $\frac{dy}{dx}$  if  $y = \frac{x^{(x+1)}(x^3+2x+4)^5}{\sqrt{x^2+6}}$ .
5. (10 pts.)
  - (a) Using implicit differentiation, find  $\frac{dy}{dx}$  if  $x^2 + xy + 2y^2 = 7$ .
  - (b) At what points on the curve  $x^2 + xy + 2y^2 = 7$  is the tangent line horizontal?
6. (5 pts.) In using Newton's method to find a root of  $f(x) = x^4 + x - 1$ , if  $x_0 = 0$ , what does  $x_2$  equal?

**More problems on back!**

7. (10 pts.) In 1990, the population of Maroon, TX, was 1500 people. In 2000, the population was 1800 people. Assume that the population is growing exponentially.
- What will the population be in the year 2010? (Leave your answer in terms of exponentials and/or logarithms)
  - When will the population reach 3000? (Leave your answer in terms of exponentials and/or logarithms)
8. (10 pts.) Find the linear and quadratic approximation to  $f(x) = \sqrt{x}$  at  $a = 4$ .
9. (10 pts.) At what point(s) of the parameterized curve  $x = t^2 + 1, y = 2t^3 - 3t$  is the tangent line parallel to the line  $y = \frac{3}{2}x$ ?
10. (15 pts.) Use the following values:

$f(1) = 3$	$f(2) = 5$	$g(1) = 4$	$g(2) = 1$
$f'(1) = 4$	$f'(2) = 6$	$g'(1) = -3$	$g'(2) = -5$

- If  $A(x) = f(g(x))$ , what is  $A'(2)$ ?
- If  $B(x) = \sqrt{f(x) + 2g(x)}$ , what is  $B'(1)$ ?
- If  $C(x) = g^{-1}(x)$ , what is  $C'(1)$ ?