

DEPARTMENT OF MATHEMATICS AND STATISTICS  
UNIVERSITY OF MASSACHUSETTS  
EXAM 2: MATH 131 Spring 2003  
30 April 2003

Your Name: \_\_\_\_\_

Your Instructor's Name: \_\_\_\_\_

This exam paper consists of 9 questions. The value of each question is as indicated. It has 8 pages, including this one.

On this exam, you may use a calculator, but no books or notes.

It is not sufficient to just write the answers. You must *explain* how you arrive at your answers.

This space reserved for marking the exam.

1. (15) \_\_\_\_\_

2. (10) \_\_\_\_\_

3. (10) \_\_\_\_\_

4. (10) \_\_\_\_\_

5. (10) \_\_\_\_\_

6. (10) \_\_\_\_\_

7. (10) \_\_\_\_\_

8. (10) \_\_\_\_\_

9. (15) \_\_\_\_\_

TOTAL (100)

(1) [15] For  $t \geq 0$ , the position  $s$  of a particle moving along a line is

$$s = \frac{1}{4}t^4 - t^3 + t^2 + 1,$$

where  $t$  is measured in seconds and  $s$  in feet.

- (a) Find the velocity at time  $t$ .
- (b) Find the acceleration at time  $t$ .
- (c) What is the velocity at three seconds?
- (d) When is the particle at rest?

(2) [10] Suppose that  $y^2 = x^4 - 2x^2$ . Compute  $\frac{dy}{dx}$ .

(3) [10] Compute the derivative of the function  $y = \frac{x}{\ln(\sin x)}$ .

- (4) [10] Suppose that  $(x + y)^2 = x$ .
- (a) Find  $y'$  by using implicit differentiation.
  - (b) Using implicit differentiation on your answer to part (a), compute  $y''$ , expressing it in terms of  $x$  and  $y$ .

(5) [10] Find the first three derivatives of the function  $y = e^{x^2}$ .

(6) [10] Use logarithmic differentiation to compute the derivative of the function  $y = x^{2x}$ .

- (7) [10] Use logarithmic differentiation to find the derivative of the following function. (No credit will be given for using only the chain, quotient, and product rules.)

$$y = \frac{e^x(5x^3 + 3x - 2)^3}{\sqrt[3]{x}}$$

- (8) [10] Let  $f(x) = \sqrt{x}$ . Use the linearization of this function at  $a = 4$  to find an estimate for  $\sqrt{3.5}$ .

- (9) [15] A car is moving west at 50 miles/hour. A man is riding a bike south at 15 miles/hour. The car and the bike are heading towards the same intersection of roads. At what rate are the bike and the car approaching each other when the car is 3 miles away from the intersection and the bike is 4 miles away from the intersection?