

**Math 140, Jeffrey Adams**

Test II, October 9, 1998

**IMPORTANT INSTRUCTIONS**

1. Write your name, section number, and TA's name on each answer sheet.
  2. Number the sheets 1-5. Do all of the work for problem 1 on sheet 1. You may use the back if necessary – write “*see back of sheet*”. Similarly for problems 2-5.
  3. For full credit you must **show your work**.
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Question 1. (20 points) Do not simplify your answers.

- (a) If  $f(x) = \frac{x \cos(2x)}{e^{3x}}$ , compute  $f'(x)$  and  $f'(0)$ .
- (b) If  $f(x) = \ln(\cos(x))$ , compute  $f''(x)$ .

Question 2. (20 points) Consider the equation  $\cos(x - y) = x$ .

- (a) Use implicit differentiation to find  $\frac{dy}{dx}$ .
- (b) Find  $\frac{dy}{dx}$  at  $x = 0, y = \pi/2$ .
- (c) Find the equation of the line tangent to the graph of the equation at the point  $(0, \pi/2)$ .

Question 3. (20 points)

Suppose a Ferris wheel, of radius 100 feet, is revolving at a rate of 3 radians per minute. Consider a point  $P$  on the edge of the Ferris wheel. When  $P$  is 50 higher than the center of the circle and going up, how fast is its height increasing?

Make sure you define all the relevant variables, possibly with the aid of a picture, and write down the equation(s) relating them.

Question 4. (20 points)

- (a) Note that  $\ln(20) = 2.9957322735 \dots$ . Find the linear approximation of  $\ln(20.01)$ .
- (b) In fact  $\ln(20.01) = 2.9962321486 \dots$ . What is the error in your approximation in (a)? Give your answer to 10 digits.

Question 5. (20 points)

Use two steps of the Newton–Raphson method to find an approximate solution of  $\ln(x) = x - 3$  near  $x = 4$ .