Math 140, Jeffrey Adams

Test II, October 15, 1999

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.

ANSWER ONLY ONE PROBLEM ON EACH PAGE

3. For full credit you must **show your work**.

4. No Calculators

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) let $f(x) = \frac{1}{x^2}$. Use the **definition** of the derivative to compute f'(1).

Question 3. (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 4. (20 points)

A car is driving on Pratt Street, approaching the intersection with Charles Street, at 50 MPH. A truck is on Charles Street and is approaching the intersection at 40 MPH. When the car is 3 miles from the intersection the truck is 4 miles from the intersection. At this instant, how fast is the distance between the two vehicles changing? (Pratt and Charles streets are straight and perpendicular to each other.)

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

Question 5. (20 points)

(a) Note that $e^2 = 7.389...$ Use the linear approximation to approximate $e^{2.1}$ to three decimal places.

(b) Use two steps of the Newton–Raphson method to find an approximate solution of $x^3 - 2x + \frac{1}{2} = 0$ near x = 1. Do not simplify your answer.

TA's: Gabriela Cohen Freue (0511/0521), Serge Bernard (0512/0522) David Spivak (0531), Richard Kollar (0532)