Math 140, Jeffrey Adams

Test III, Apr 12, 2010

IMPORTANT INSTRUCTIONS

1. Write your name, section number, and TA's name on each answer sheet.

2. Number the sheets 1-4. Do all of the work for problem 1 ion sheet 1. You may use the back if necessary – write "see back of sheet". Similarly for problems 2-4. Each problem is worth 25 points.

3. For full credit you must show your work.

4. No calculators.

Question 1.

- (a) Suppose $f(x) = x^3 + x 2$. Find the value of x so that f'(x) has the value guaranteed by the mean value theorem on the interval [-3, 0].
- (b) Find all functions f(x) so that $f'(x) = x + e^{3x}$. Find one such function such that f(0) = 1.

Question 2.

(a) Evaluate
$$\lim_{x \to \infty} \frac{2x+1}{\sqrt{2x^2+1}}$$

(b) One ship is travelling east at 3 miles per hour, and passes a buoy at 3 PM. Another ship travelling south at 4 miles per hour, and at 3 PM it is 5 miles north of the buoy. At what time are the ships closest to each other?

Question 3.

- (a) Suppose a population doubles every 3 years, and the current population is 100,000. When will the population be 500,000?
- (b) Find the maxima and minima of the function $f(x) = x^3 3x$ on the interval [-2, 3].

Question 4. Consider the function $f(x) = \frac{1+x}{1-x}$.

- (a) Give the horizontal and vertical asymptotes, if any.
- (b) Indicate the region on which the function is increasing, and where it is decreasing.
- (c) Indicate where the function is concave up, and where it is concave down.
- (d) Sketch the function.