MATH 1210-90 Fall 2011
Third Midterm Exam

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LAST NAME ──────────────────

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INSTRUCTION: SHOW ALL OF YOUR WORK. MAKE SURE YOUR ANSWERS ARE CLEAR AND LEGIBLE. USE **SPECIFIED** METHOD TO SOLVE THE QUESTION. IT IS NOT NECESSARY TO SIMPLIFY YOUR FINAL ANSWERS.

PROBLEM 1   40   ──────

PROBLEM 2   20   ──────

PROBLEM 3   20   ──────

PROBLEM 4   20   ──────

TOTAL   100   ──────

PROBLEM 1

(40 pt) Analyze the funtion.

$$y = f(x) = \frac{x}{1 + x^2}.$$

(1) Domain and range.

(2) Symmetry.

(3) x- and y-intercepts.

(4) Find the first derivative of f.

(5) Find the second derivative of f.

(6) Find the critical points, if any.

(7) Find the inflection points, if any.

(8) Find the intervals where f is increasing, and the intervals f is decreasing.

(9) Find the intervals where f is concave up, and the intervals f is concave down.

(10) Find the asymptotes.

Sketch the graph of f.

PROBLEM 2

(20 pt) Find the dimension of the right circular cylinder of greatest volume that can be inscribed in a give right circular cone.

Hint: Let a be the altitude and b be the radius of the base of the given cone. Find out the altitude, radius, and volume, respectively, of an inscribed cylinder.

PROBLEM 3

(20 pt) Use Newton's method to find an approximation solution to the equation

$$x^3 + x = -3$$

as follows. Let $x_1 = -1$ be the initial approximation. What is the second approximation x_2?

PROBLEM 4

(20 pt) Consider the differential equation:

$$\frac{du}{dt} = -u^2(t^3 - t).$$

Find the particular solution of the above differential equation that satisfies the condition $u = 4$ at $t = 0$.