Loyola University Chicago
Math 161, Fall 2010

Midterm 2

Name (print): _____ **Signature:** _____

Please do not start working until instructed to do so.

You have 75 minutes.

You must show your work to receive full credit.

No calculators.

You may use one double-sided 8.5 by 11 sheet of handwritten (by you) notes.

Problem 1. _____

Problem 2. _____

Problem 3. _____

Problem 4. _____

Problem 5. _____

Total. _____

Problem 1. *(20 points)* Find the following limits and integrals. Put a box around your final answer.

a. *(4 points)* $\lim_{x\to 1} \dfrac{x^7-1}{x^3-1}$

b. *(4 points)* $\lim_{x\to\infty} (e^x + x)^{\frac{1}{x}}$

c. *(4 points)* $\lim_{x\to 0} \dfrac{t\sin t}{1-\cos t}$

d. *(4 points)* $\displaystyle\int \sqrt{x} - \frac{5}{x^3}\,dx$

e. *(4 points)* $\displaystyle\int \frac{e^{3x}-4x}{11}\,dx$

Problem 2. *(10 points)* Use Newton's method to approximate the solution to $x^4 + x = 3$. Pick the initial approximation x_0 reasonably. Then find x_1 and x_2. You do not need to simplify x_2.

Problem 3. *(10 points)* When a circular plate of metal is heated in an oven, its radius increases at the rate of 0.01 cm/min. At what rate is the plate's area increasing when the radius is 50 cm?

Problem 4. *(10 points)* Let $f(x) = xe^{-x^2}$.

a. Determine all horizontal and all vertical asymptotes of the curve $y = f(x)$.

b. Find all critical points of f.

c. Find the intervals on which f is increasing and the intervals on which f is decreasing.

d. Find all values x where $f''(x) = 0$.

Problem 5. *(10 points)* A load must be suspended 6 meters below a high ceiling using cables attached to two supports that are 2 meters apart (see figure). How far below the ceiling (labeled x) should the cables be joined to minimize the total length of cable used? What is the minimum amount of cable needed? (Leave your answers in **exact** form and make sure to justify your minimum in some way.)