MATH 235 (SPRING 2014) QUIZ III

FRI APR, 11 2014

Name: **Name:**
Name: **Name:**

Attempt all problems. Box your answers.

(1) Find the derivative of the function $f(x) = \frac{1}{x}$ using the limit definition of the derivative.

(2) Differentiate the following function $f(x) = \sqrt{x \ln(2^x + 1)}$.

(3) Carefully sketch the graph of the function $f(x) = \frac{e^x}{x^2-1}$. Clearly label any critical points, inflection points, *etc.*. ($f''(x) = \frac{e^x(x^4-4x^3+4x^2+4x+3)}{(x^2-1)^3}$, the polynomial $x^4-4x^3+4x^2+4x+3$ has no real roots, so when you do a sign chart for $f''(x)$, you only include the points where $f''(x)$ does not exist.)

(4) Optimization problem: A farmer wants to build a rectangular ostrich pen along the side of a river (so only three sides of fence are needed). He only has 540 ft of fencing material. What are the dimensions of the pen, so that the pen has the largest possible area?

(5) Related rates: Elmer is holding an ice-cream cone on a hot summer day. The cone has a small hole at the bottom, and the ice-cream is melting and dripping through the hole at a rate of half a cubic inch per minute. The cone has a radius of two inches and height of 5 inches. How fast is the height of the ice-cream changing at the instant when the ice-cream in the cone is 3 inches? (The volume of a right circular cone is $V = \frac{1}{3}\pi r^2 h$.)

(6) State the mean value theorem for differentiable functions, then sketch a graph illustrating this theorem.