Math. 270-05
Fall, 2005
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Fourth Examination
Friday, November 11, 2005

Instructions: This exam should be done on your own paper. Your name should be on each sheet and on the back of the last sheet; the answers should appear written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly and explained. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 20 points. You may keep this exam sheet.

1. Find and classify all critical points of
$$f(x) = \frac{1}{3}x^3 - \frac{3}{2}x^2 + 2x.$$

2. Find the global maximum and global minimum of the function in problem 1, over the interval $x \in [-3, 3]$.

3. A farmer needs to fence in a pasture for his cattle, and decides to make a rectangular area. The cattle require 100,000 square feet of space. The cost for the fencing on the back of the pasture is \$5 per foot, the cost for the front is \$10 per foot, while the cost for each side is \$3 per foot. What should the dimensions of the pasture be to minimize the farmer's total cost?

4. A voltage V across a resistance R generates a current $I = V/R$. If a constant voltage of 12 volts is put across a resistance that is increasing at a rate of 0.5 ohms per second when the resistance is 2 ohms, at what rate is the current changing then?

5. Use L'Hopital's rule to compute the following limits.
$$\text{(a)} \lim_{x\to 0} \frac{\sin^2(x)}{x^2} \qquad \text{(b)} \lim_{x\to\infty} \frac{\ln(x)}{x} \qquad \text{(c)} \lim_{x\to\infty} \frac{x^2+3x+2}{x^2\ln(x)}$$