Calculus I Exam 3 Spring 1995 4/6/95

Each problem is worth 10 points. Be sure to show all work for full credit. Please circle all answers and keep your work as legible as possible. All answers must be reasonably simplified for full credit. All proceeds from this test go to the A.S.P.C.A.

1. Find the maximum and minimum values of the function $f(x) = x^4 - 4x^3 + 4x^2 - 3$ on the interval $[-1,4]$.

2. a) Find all inflection points of the function $f(x)$ from problem 1.

b) Find the point on the graph of $f(x)$ from problem 1 where the function is steepest.

3. Sketch a graph of a function given the following information, and label the axes clearly:

	$x<-2$	$-2<x<0$	$0<x<3$	$3<x$
$g'(x)$	+	+	-	+
$g''(x)$	+	-	-	+

4. Use Newton's Method to find $\sqrt[3]{2}$. Start with $x_0 = 4/3$, and find x_1 and x_2 (which happens to be accurate to four decimal places).

5. If a company has a cost function $C(q) = .4q^2 + 10$ and marginal revenue function $R'(q) = 5$, how many units should they sell to maximize their profit?

6. A small country exports gizmos for sale in the United States. The annual gizmo sales have followed the function $G(t) = 20 - .5t - 10t^{-1}$, where t is in years since 1992 and G(t) is measured in thousands of gizmos. Find the year in which the country's gizmo production will peak (after which the nation's economy will decline sharply, throwing the population into squalor and despair).

for $7 each
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7. A movie theater is currently selling an average of 40 tickets per show. The manager estimates that for every dollar they increase the price of a ticket, they will sell 5 fewer tickets. Since the theater owner is a capitalist pig who cares much more about making money than about making people happy, he wants to bring in as much revenue as possible. At what level should he set the ticket prices to bring in the maximum revenue?

8. Find the value of b for which $f(x) = xe^{-bx}$ has its maximum value when $x = 2$.

9. Farmer Brown has decided to raise Tasmanian Devils. He's heard that the little critters are feisty, so he plans to build a special lot for them. The lot will be a large rectangle divided into three equal rectangles as shown at right. If Farmer Brown has 1000 feet of fence on hand to build the whole lot, what dimensions should he make it to maximize the area of the whole enclosure?

10. Buffy, a Calc I student, is trying to use Newton's Method to solve the equation $x - 2\sqrt{x} = 6$. She has decided to use $f(x) = x - 2\sqrt{x}$. She first tries $x_0 = 1$, but has trouble with this and tries $x_0 = 0$ instead. Again she has trouble, so in desperation she tries $x_0 = .5$, but again is confused by the results. Explain the things she's doing wrong (there may be several) in clear language Buffy can understand, and give her a good idea of how to proceed. The graph at right (from Buffy's graphing calculator) might be helpful.

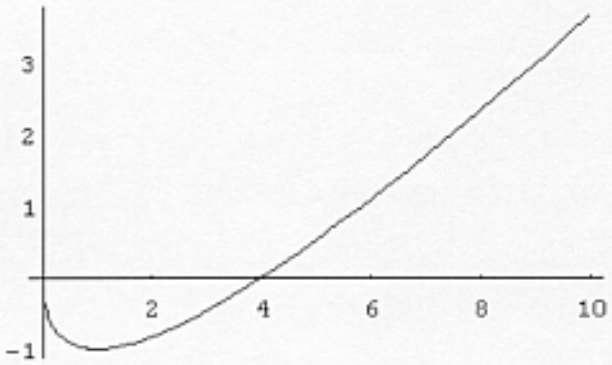

Figure 2 $f(x) = x - 2\sqrt{x}$

Extra Credit (5 points possible):
Farmer Brown has decided maybe 3 seperate pens won't be enough. If he divides the overall rectangle into n small rectangles (like before, but with more vertical lines dividing it into sub-pens) what are the best dimensions for the overall rectangle?