Review for Midterm Exam 2

Exam date: 16 Jul '12

Instructions. Here is a list of *some* of the things that you should know for the exam. Some are example problems that you should be able to work out. Others are terms or ideas that you should know. I won't ask you to write down any definitions or theorems word-for-word, but you should know what they say, what they mean, and how to use them.

1. Be able to take any derivative using power, product, quotient, and chain rules, *etc.* For example, these:

- $f(x) = e^{2x^2+3x}$

- $y = \dfrac{\ln x}{x+1}$

- $g(x) = \ln(2x^2 + 4x)$

- $f(x) = x^3 e^x$

- $y = \ln(x^2)$, two different ways

- $f(x) = \dfrac{(x+2)^2}{x^2 - 4}$

- $h(x) = \log_7(3x)$

- $y = 8^x$

2. Implicit differentiation. Find dy/dx for:

- $xy + \ln(y) = y^2$

- $x^2 + y^2 = 225$

- $e^{xy} = 3x + y$

3. Find an equation of the tangent line to $x^2 + y^2 = 100$ at the point $(8, -6)$.

4. Related rates.

- The ladder problem (notes)

- The boat problem (quiz, RE)

- The Boyle's Law problem (notes, RE)

5. L'Hôpital's rule.

- $\displaystyle \lim_{x \to \infty} \frac{x^2}{\ln x}$

- $\displaystyle \lim_{x \to 0^+} \frac{e^{1/x}}{\ln(x)}$

- $\displaystyle \lim_{x \to 1} \frac{1-x}{\ln(x)}$

6. Find the dimensions of a rectangle with perimeter 225 ft that has maximum area.

7. The picket/wire fence problem from class.

8. For each function, find: (a) domain, (b) intervals of inc/dec, (c) all local max/min (if any exist), (d) intervals of concavity, (e) all inflection points (if any exist), (f) all horizontal and vertical asymptotes (if any exist), (g) sketch the graph (you may need to find a few more points).

- $f(x) = \dfrac{x^2}{x+1}$

- $f(x) = x - \ln x$

- $f(x) = x^3 + 5x^2 + 3x + 1$

9. Find the absolute max and min of $y = x^4 + 3x^2 + 4$ on the interval $[-1, 3]$.