Practice Midterm II
MAT 125, Spring 2008

Answer each question in the space provided and write full **solutions**, not just answers. Unless otherwise marked, **answers without justification will get little or no partial credit**. Cross out anything the grader should ignore and circle or box the final answer. Do **NOT** round answers.

No books, notes, or calculators!

1. Explain (without using a graphing calculator!) why the equation

$$x^5 - 3x + 1 = 0$$

must have a solution with $0 < x < 1$.

2. Compute the following limits. Distinguish between "limit is equal to ∞", "limit is equal to $-\infty$" and "the limit doesn't exist even allowing for infinite values":

(a) $\displaystyle \lim_{x \to \infty} \frac{x^3 + 2x + 1}{x^3 - 15x}$

(b) $\displaystyle \lim_{x \to 2-} \frac{x^2 - 2x - 3}{x^2 - 5x + 6}$

(c) $\displaystyle \lim_{x \to 3+} \frac{x^2 - 2x - 3}{x^2 - 5x + 6}$

(d) $\displaystyle \lim_{x \to \infty} \frac{1}{e^{(x^2)} + 1}$

3. Calculate derivatives of the following functions:

(a) $3(x + \sqrt{x})$

(b) $xe^x - 17x$

(c) $\frac{2x}{x+1}$

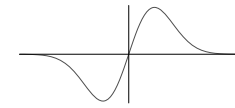(d) $\frac{1+\sqrt{x}}{1-\sqrt{x}}$

4. Let $f(x) = \left| 2 - \frac{1}{x} \right|$.

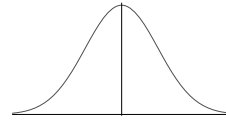(a) Sketch the graph of f and identify the asymptotes.

(b) Find all values of x for which f is not continuous.

(c) Find all values of x for which f is not differentiable (you do not have to calculate the derivative).
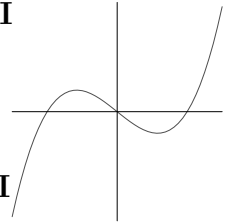
5. Match the graphs of functions **I**–**IV** below with the graphs of their derivatives **A**–**D**. (Justification is not required.)
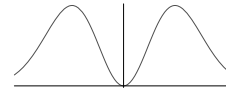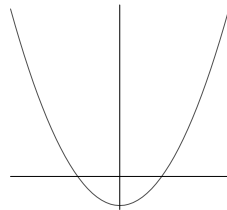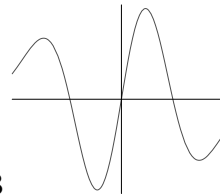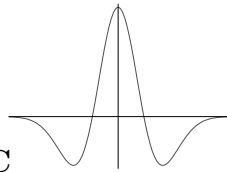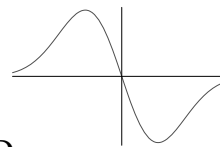
I

II

III

IV

A

B

C

D

6. Let $f(x) = x^3 - 3x^2 - 9x + 7$.

   (a) Calculate f'

   (b) Calculate f''

   (c) On which intervals does f increase? decrease?

   (d) On which intervals is f concave up?

7. Find all tangent lines to the graph of $f(x) = 1/x$ which have slope $m = -1/4$; write equations of each of these tangent lines.