

Name \_\_\_\_\_

Section \_\_\_\_\_

Rec. Instr. \_\_\_\_\_

CALCULUS 1  
Exam I  
February 17, 2005

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Below you will find 10 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, **show all work**. No books or notes are allowed.

**Problem 1.** Find the constants  $a$  and  $b$ , such that the function

$$f(x) = \begin{cases} x^2 - 1, & \text{if } x \leq 0 \\ ax + b, & \text{if } 0 < x \leq 1 \\ \frac{x^2 - 1}{x - 1}, & \text{if } x > 1 \end{cases}$$

is continuous on the entire real line.

**Problem 2.** Find the limit:  $\lim_{x \rightarrow 0} \frac{\sin(2x^2)}{x^2 + x}$ .

**Problem 3.** Find the limit:  $\lim_{x \rightarrow 3} \frac{\sqrt{2x+3} - 3}{x^2 - 9}$ .

**Problem 4.** Find the vertical asymptotes of the function  $f(x) = \frac{x^2 - 3x + 2}{x^3 - x}$ .

**Problem 5.** Describe the  $x$ -values where the function

$$f(x) = \begin{cases} -x, & \text{if } x \leq 0 \\ x^2, & \text{if } 0 < x < 1 \\ x - 1, & \text{if } x \geq 1 \end{cases}$$

is differentiable. If there are any points where  $f(x)$  is **not** differentiable, explain why.

**Problem 6.** Find the derivative of the function:  $f(x) = \frac{2\sqrt{x} - x}{x^2}$ . (DO NOT SIMPLIFY.)

**Problem 7.** Find the derivative of the function:  $f(x) = \sqrt[3]{x}(1 + \sin x)$ . (DO NOT SIMPLIFY.)

**Problem 8.** Find the derivative of the function:  $f(x) = \frac{\cos x}{x^2}$ . (DO NOT SIMPLIFY.)

**Problem 9.** Find the equation of the tangent line to the graph of  $y = 5\sqrt{x} + \frac{1}{\sqrt{x}}$ , at the point  $(1, 6)$ .

**Problem 10.** Find the limit:  $\lim_{x \rightarrow -\infty} \frac{2x - 1}{\sqrt{x^2 + 2x + 2}}$ .