Do not write in the boxes immediately below.

Question:	1	2	3	4	5	Total
Points:	23	36	14	14	13	100
Score:						

MATH 2250 Exam 1

February 10, 2009

Name:_____

1. (23 points) Let $f(x) = 5x + 3\sqrt{x}$. Using the **definition of derivative**, find the derivative of $f(x)$.

   Note: Finding the derivative by using the shortcuts introduced in Section 3.2 is worth 0 points.

2. (36 points) Compute each of the following limits. If a limit does not exist, write DNE, and briefly explain why it does not exist.

(a) $\lim_{x\to\infty} \dfrac{\sin x}{x}$

(b) $\lim_{x\to 0^-} \dfrac{4|x| + x}{5x - 2|x|}$

(c) $\lim_{x\to\infty} \dfrac{9x^3 + 3x^2 + 2009}{x^4 - 3x}$

(d) $\lim_{x\to 4} \dfrac{x^2 + 2}{(x-1)(x-4)}$

(e) $\lim_{x\to 0} \dfrac{\sin x}{3x\cos x}$ (Hint: $\dfrac{\sin x}{3x\cos x} = \dfrac{\sin x}{x} \cdot \dfrac{1}{3\cos x}$)

(f) $\lim_{x\to 3^+} \dfrac{x^2-1}{(x-3)(x-5)}$

3. (14 points) Consider the function

$$f(x) = \begin{cases} x^3 - 5x, & \text{if } x < -2 \\ -3x + 1, & \text{if } -2 \le x < 1 \\ x^5 - 4x + 1, & \text{if } 1 \le x \end{cases}$$

Parts (a) and (b) below both pertain to this function.

(a) Circle the first true statement:

1. $f(x)$ is not defined at $x = -2$.
2. $\lim_{x\to -2} f(x)$ does not exist.
3. $\lim_{x\to -2} f(x) \neq f(-2)$.
4. $f(x)$ is continuous at $x = -2$.

(b) Circle the first true statement:

1. $f(x)$ is not defined at $x = 1$.
2. $\lim_{x\to 1} f(x)$ does not exist.
3. $\lim_{x\to 1} f(x) \neq f(1)$.
4. $f(x)$ is continuous at $x = 1$.

4. (14 points) Consider $f(x) = \dfrac{2x^2 - 2x - 12}{x^2 - 7x + 12}$.

   (a) Compute $\lim_{x \to 3} f(x)$. If the limit does not exist, write DNE, and briefly explain why it does not exist.

   (b) Find all vertical and horizontal asymptotes of $f(x)$.

Answer

Vertical asymptotes:

Horizontal asymptotes:

5. (13 points) Suppose that a function $f(x)$ has derivative $f'(x) = 2/(x + 4)$, and suppose also that $f(2) = 5$. Find an equation for the tangent line to the graph of $f(x)$ at $x = 2$.