NAME:_____ **Section:**_____

MATH 151(20-22), Dr. Z. , **First Midterm**, Mon., Oct. 13, 2008.

1. (12 points) Find $f'(1)$, if

$$f(x) = \frac{1}{x^2}$$

from the definition of the derivative [No Credit for other methods].

2. (12 points) Find $\frac{dy}{dx}$ by implicit differentiation if

$$x^2y + 2xy + xy^3 = 5 \quad .$$

3. (12 points [4 points each]) If the Law of Motion of a particle is $s(t) = t^3 - 3t^2 + 3t$, find

(a) The speed and direction (forward or backwards) at $t = 2$.

(b) The time(s) when it is at rest.

(c) The total distance travelled between $t = -1$ and $t = 1$.

4. (15 points ([5 pts each]) Find the derivative $f'(x)$ if:

(a) $f(x) = \frac{\cos x}{2x+1}$

(b) $f(x) = x \sin x \cos x$

(c) $f(x) = \frac{e^x}{1+3x}$

5. (13 points) Find an equation of the tangent line to the curve

$$y = x^3 + 2x + 1 \quad ,$$

at the point $(1, 4)$.

6. (12 points [3 pts each]) Find the limits

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

$$(b) \lim_{x \to 0} \frac{\sqrt{4 + x} - 2}{x}$$

$$(c) \quad \lim_{x \to \pi/2} \frac{1 - \cos x}{x}$$

$$(d) \quad \lim_{x \to 0} \frac{\sin 10x}{\sin 5x}$$

7. (12 points) Let

$$f(x) = \begin{cases} \sqrt{-2x}, & \text{if } x < 0; \\ 3 + 2x, & \text{if } 0 \leq x < 3; \\ (2x-3)^2, & \text{if } x \geq 3 \ . \end{cases}$$

(a) [1 pt. each] For each of the following limits, evaluate it, if it exists.

(i) $\lim_{x \to 0^+} f(x)$

(ii) $\lim_{x \to 0^-} f(x)$

(iii) $\lim_{x \to 0} f(x)$

(iv) $\lim_{x \to 3^+} f(x)$

(v) $\lim_{x \to 3^-} f(x)$

(vi) $\lim_{x \to 3} f(x)$.

(b) [6 pts] Where is f discontinuous? Explain! (no credit without explanation).

8. (12 points) Find the point on the curve

$$y = x^2 - 3x + 2$$

where the tangent line is parallel to the line $y = x + 4$. Then find the equation of that tangent line.