NAME_____ID_____

MATHEMATICS 249   MIDTERM   November 7, 2006

SHOW ALL WORK. Marks for each problem are to the left of the problem number.
NO CALCULATORS PLEASE.

[5] 1. Find $\lim\limits_{x \to 5} \left(\dfrac{x^2 - 25}{\sqrt{9 - x} - 2} \right)$. (If it is possible to give the answer ∞ or $-\infty$, do so.)

[5] 2. Find $\lim\limits_{x \to -2+} \left(\dfrac{x^2 + x - 2}{(x + 2)^2} \right)$. (If it is possible to give the answer ∞ or $-\infty$, do so.)

[5] 3. Find $\dfrac{d}{dx}\left(\dfrac{\ln(2x-5)}{x^4}\right)$.

[5] 4. Find $\dfrac{d}{dx}\left(x^{-2/3}e^{\sin x}\right)$.

[5] 5. USE THE DEFINITION OF DERIVATIVE to find $\dfrac{d}{dx}\left(\dfrac{1}{x^2}\right)$.

[5] 6. Use implicit differentiation to find $\dfrac{dy}{dx}$ where $\quad 5y - 4\tan x = 3x^2 y^3$.

[10] 7. An object moves on the x axis so that its position at any time t is given by $x = t^3 + 3t^2 - 5$.

(a) Find the velocity and acceleration of the object.

(b) Find all times when the velocity is zero.

(c) Find the positions of the object when its velocity is zero.

(d) Find all times when the object is moving to the left.

[5] 8. Find the equation of the tangent line to the curve $y = \sqrt{17 - x^3}$ at the point on the curve where $x = 2$.

[5] 9. Find constants a and b so that the function $f(x) = \begin{cases} ax + b & \text{if } x \leq 1 \\ \dfrac{4}{3x - 1} & \text{if } x > 1 \end{cases}$ is both continuous and differentiable at $x = 1$.

[50]