MAC 2311 (Calculus I)
TEST 2, Friday November 13, 2009

Name: **PID:**

Remember that no documents or calculators are allowed during the exam. Be as precise as possible in your work; you shall show all your work to deserve the full mark assigned to any question. Do not cheat, otherwise I will be forced to give you a zero and report your act of cheating to the University Administration. Good Luck.

1. [20] Evaluate the following limits (Show all your work)

a) $\lim_{x \to 0} \frac{\sin(x)}{e^x - 1} =$

b) $\lim_{x \to +\infty} \cos\left(\ln(2+x) - \ln(3+2x)\right) =$

c) $\lim_{x \to 0} \frac{x^3}{x - \tan(x)} =$

d) $\lim_{x \to 0^+} (\sin(2x))^x =$

2. [8] Use an appropriate local linear approximation to estimate the value of $\sqrt[3]{26.46}$.

3. [8] A point P is moving along the curve $2y - x^3 = 2$. When P is at (2,5), y is increasing at the rate of 2 units/s. How fast is x changing?

4. [10] State the Mean-value theorem. Show that the function f defined by $f(x) = x^3 + x - 4, \quad x$ in $[-1, 2]$, satisfies all the requirements of the Mean Value Theorem. c) Find all numbers x_0 in $(-1, 2)$ such that $f'(x_0) = \frac{f(2)-f(-1)}{2-(-1)}$.

5. [20] Find the derivative of each of the following functions (Show all your work, and simplify your answers as much as possible; you will not get any credit by guessing the correct answer(s).)

a) $f(x) = \cos(e^x)$

b) $g(x) = e^{(x \sin x)}$

c) $h(x) = \tan^{-1}(x^2 - x)$

d) $k(x) = \sin^{-1}(\ln x)$

6. [14] The function $s(t) = t^3 - 6t^2 + 9t + 1, \quad t \geq 0$, describes the position of a particle moving along a straight line, where s is in feet and t is in seconds. a) Find the velocity and acceleration functions. b) At what times is the particle stopped? c) When is the particle speeding up? Slowing down? d) Give a schematic picture of the motion.

7. [20] Evaluate each indefinite integral. (Show all your work)

a) $\int \left(\frac{-2x^{13} + x^3 - \frac{7}{\sqrt[11]{x}} + 5}{x^4} \right) dx =$

b) $\int (x^6 + e^x)^{1113}(6x^5 + e^x)\, dx =$

c) $\int \cos x \cos(\sin x)\, dx =$

d) $\int \sec x(\tan x + \sec x)\, dx =$

Bonus. [6] $\int \frac{x^4+2x^2+3}{x^2+1}\, dx =$