MATH 251 Calculus I Fall 2003
Practice First Midterm Name: _____

1. Evaluate the following limits.

   (a) $\lim\limits_{x \to -2} \frac{x^2-4}{x+2}$

   (b) $\lim\limits_{x \to 0} \frac{\sqrt{x+1}-\sqrt{1-x}}{x}$

   (c) $\lim\limits_{x \to 0} \frac{\tan x}{x}$

   (d) $\lim\limits_{t \to 3} \frac{t^3-9t}{t^2-9}$

   (e) $\lim\limits_{\theta \to 0} \frac{\sin^2 \theta}{\theta}$

   (f) $\lim\limits_{h \to 2} \frac{\frac{1}{h}-\frac{1}{h-2}}{h-2}$

   (g) $\lim\limits_{x \to 2} \frac{x^2-4}{3x^2-2x-8}$

   (h) $\lim\limits_{x \to \infty} \frac{\sqrt{17x^4-1}}{x^2+x}$

   (i) $\lim\limits_{x \to -\infty} \frac{\sqrt{17x^4-1}}{x^2+x}$

   (j) $\lim\limits_{x \to 0} x^3 \cos \frac{1}{x}$

2. Compute the derivative of the function $f(x) = \sin 2x$ using the definition of the derivative.

3. Differentiate:

   (a) $f(x) = (2-x)^4(3+x)^7$

   (b) $f(x) = \left(\frac{x+2}{x-2}\right)^{17}$

   (c) $f(x) = \left(\frac{x}{1+x^2}\right)^{\frac{7}{5}}$

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

   (e) $f(x) = \frac{\sec x}{1+\sec x}$

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

   (g) $f(x) = (\sqrt{x}+1)(\sqrt{x}-1)$

   (h) $f(x) = \frac{5-4x^2+x^5}{x^3-1}$

   (i) $f(x) = (3x^2 + 4x + 1)(\cos x - \sin x)$

   (j) $f(x) = [\sin(\cos x)]^2$

   (k) $f(x) = \sin(\cos(x^2))$

   (l) $f(x) = \sin[(\cos x)^2]$

4. Find all point on the graph of the function $f(x) = \frac{1}{\sqrt{(9-x^2)}}$ where the tangent line is either horizontal or vertical. What is the domain of this function? where is it continuous? Where is it differentiable?

5. Find an equation of the tangent line to $y = e^x \sin x$ at the point $(0, 0)$.

6. The height $y(t)$ (in feet at time t seconds) of a ball thrown vertically upwards is given by $y(t) = -16t^2 + 128t + 25$. Find the velocity of the ball at time $t = 1$. Find the velocity of the ball when it hits the ground (you do not have to simplify your answer).