Name: __Key_____ _____ / 25

There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. **Show all work for full credit.**

1. **[12 points]** Find the derivative of each function below. Show your work and **use correct derivative notation.** Use parentheses when needed. You do not need to simplify your answers.

   a. $f(x) = (1 - x^4)^6$

   $$f'(x) = 6(1 - x^4)^5 \cdot (-4x^3)$$

   b. $g(x) = \sqrt{3x + \sin(4x)}$

   $$g'(x) = \frac{1}{2}(3x + \sin(4x))^{-\frac{1}{2}} \cdot (3 + \cos(4x) \cdot 4)$$

   c. $h(x) = (\cos(5 - x))^5$

   $$h'(x) = 5(\cos(5-x))^4 \cdot (-\sin(5-x) \cdot (-1))$$

   d. $f(\theta) = \dfrac{\csc(\theta^3) + \theta^3}{3\theta}$

   $$f'(\theta) = \frac{(-\csc(\theta^3)\cot(\theta^3) \cdot 3\theta^2 + 3\theta^2) \cdot 3\theta - (\csc(\theta^3) + \theta^3) \cdot 3}{(3\theta)^2}$$

2. [8 points] Find $f'''(x)$ for $f(x) = \tan x$.

$f'(x) = \sec^2 x$

$f''(x) = 2\sec x (\sec x \tan x) = 2\sec^2 x \tan x$

$f'''(x) = 2\left[(2\sec^2 x \tan x)\tan x + \sec^2 x (\sec^2 x)\right] = 4\sec^2 x \tan^2 x + 2\sec^4 x$

3. [6 points] Determine all x-values on the interval $[0, 2\pi]$ where the graph of $f(x) = \cot(x) + 2x$ has a horizontal tangent.

$f'(x) = -\csc^2 x + 2$

Set $f'(x)$ equal to 0: $-\csc^2 x + 2 = 0 \Rightarrow \csc^2 x = 2 \Rightarrow \csc x = \pm\sqrt{2}$

$\Rightarrow \sin x = \pm\frac{\sqrt{2}}{2} \Rightarrow x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$