Name: _____ _____ **/ 25**

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

1. [15 points] Find the derivatives of each of the following. You do not need to simplify your answer.

a. $h(\theta) = e^2 \sec(\theta) + \csc(\theta)$

b. $y = \sin(5x^2)$

c. $f(x) = \dfrac{\tan(x)}{x + 4\cos(x)}$

d. $f(q) = q^3 e^{6q+5}$

e. $k(t) = (\sqrt[4]{t} - 7t + 3)^4$

2. [4 points] Find an x-value such that the function $f(x) = 2x - \sin(4x)$ has a horizontal tangent line. (You do not have to find *every* value. Simply find one.)

3. [6 points] In a certain experiment involving bacteria, the number N of bacteria in a culture after t days is modeled by the function

$$N(t) = 800\left(1 + \frac{3}{(t^2+1)^2}\right).$$

a. How many bacteria are in the culture at the beginning of the experiment?

b. Compute $N'(t)$. (You do not need to simplify, but you may if you choose.)

c. After one day, is the number of bacteria in the culture **increasing** or **decreasing**, and how do you know? (Justify your answer; an answer with no justification will receive no credit.)