Math 251: Quiz 5 Oct 5, 2019

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

$$h'(\theta) = e^2 \sec \theta + \tan \theta - \csc^2 \theta$$

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

$$\frac{dy}{dx} = \left(-\sin(5x^2)\right)(10x)$$

c.
$$f(x) = \frac{\tan(x)}{x - 3\sin(x)}$$

$$f'(x) = (x-3sinx)(sec^2x)-(tanx)(1-3cosx)$$

(x-3sinx)²

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

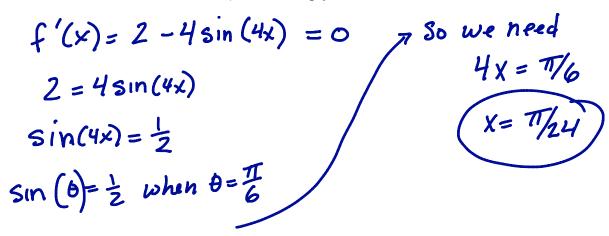
$$f'(q) = 3q^2(e^{5q+6})(5) + q^3(e^{5q+6})(5)$$

e.
$$k(t) = (\sqrt[5]{t} - 7t + 3)^5 = (t^{1/5} - 7t + 3)^5$$

$$K'(t) = 5(t^{1/5}-7t+3)(t-t^{1/5}-7)$$

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2. [4 points] Find an *x*-value such that the function $f(x) = 2x + \cos(4x)$ 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

$$N(t) = 900 \left(1 + \frac{3}{(t^2 + 1)^2}\right) = 900 \left(1 + 3(\xi^2 + 1)^2\right)$$

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

beginning means
$$t=0$$
.
 $N(0) = 900(1+3) = 900.4 = 3600$ bacteria

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

$$N'(t) = 900(0 + 3(-2)(t^{2}+1)(2t)) = \frac{-12(900)t}{(t^{2}+1)^{3}}$$

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.)